ĐẠI HỌC QUỐC GIA
THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC QUỐC TẾ

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

CHƯƠNG TRÌNH ĐÀO TẠO KHÓA 2024 – NGÀNH CÔNG NGHỆ THÔNG TIN TRÌNH ĐỘ ĐẠI HỌC

(Kèm theo Quyết định số: 776 /QĐ-ĐHQT ngày 11 tháng 7 năm 2024 của Hiệu trưởng trường Đại học Quốc tế)

1. Thông tin chung

- Tên ngành đào tạo:
+ Tiếng Việt: Công nghệ Thông Tin (CNTT)
+ Tiếng Anh: Information Technology
- Mã ngành đào tạo: 7480201
- Trình độ đào tạo: Bậc Đại học, trình độ kỹ sư
- Loại hình đào tạo: Chính quy
- Thời gian đào tạo: 4,5 năm
- Tên văn bằng sau khi tốt nghiệp:
+ Tiếng Việt: Kỹ sư Công Nghệ Thông Tin
+ Tiếng Anh: Bachelor of Engineering in Information Technology
- Nơi đào tạo: Trường Đại Học Quốc Tế (ĐHQT) - ĐH Quốc Gia Tp. Hồ Chí Minh

2. Thông tin tuyển sinh và kế hoạch đào tạo

a. Đối tượng tuyển sinh

Mọi công dân nước Cộng Hòa Xã Hội Chủ Nghĩa Việt Nam đủ điều kiện dự thi kỳ thi tuyển sinh quốc gia theo quy chế tuyển sinh đại học, cao đẳng hệ chính quy của Bộ Giáo dục và Đào tạo ban hành; dự thi đủ số môn quy định và đạt điểm trúng tuyển do trường Đại học Quốc Tế, Đại học Quốc Gia TP HCM quy định.

Các công dân nước ngoài hoặc công dân nước Cộng Hòa Xã Hội Chủ Nghĩa Việt Nam đang theo học các chương trình quốc tế được xét tuyển theo quy định của trường Đại học Quốc Tế, Đại học Quốc Gia TP HCM

b. Hình thức tuyển sinh

Theo các phương thức tuyển sinh đang thực hiện tại Trường ĐHQT hiện nay.

c. Tổ hợp môn xét tuyển: A (Toán, Lý, Hoá), A1(Toán, Lý, Anh)

3. Mục tiêu đào tạo

a. Mục tiêu chung: đào tạo kỹ sư CNTT có kiến thức cơ bản vững vàng, nắm vững các công nghệ tiên tiến trong lĩnh vực CNTT, trong môi trường học tập hiện đại. Kỹ sư CNTT tốt nghiệp có kỹ năng về CNTT chuyên nghiệp, có khả năng anh ngữ tốt trong môi trường làm việc, học tập và nghiên cứu quốc tế, có kỹ năng làm việc nhóm và trình bày hiệu quả. Chương trình đào tạo tuân thủ theo các quy định của Bộ GDĐT, ĐHQG TP.HCM và các chuẩn mực quốc tế.

Bảng 1. Sự phù hợp của mục tiêu đào tạo với Tầm nhìn, sứ mạng và Mục tiêu giáo dục của Luật giáo dục đại học.

Mục tiêu đào tạo của CTĐT	**Tầm nhìn**	**Sứ mạng (tô đậm những nội hàm mà mục tiêu thể hiện hoặc gắn kết)**	**Luật giáo dục (tô đậm những nội hàm mà mục tiêu thể hiện hoặc gắn kết)**
Ngành IT tại Khoa CNTT đào tạo kỹ sư CNTT có kiến thức cơ bản vững vàng, nắm vững các công nghệ tiên tiến trong lĩnh vực CNTT, trong môi trường học tập hiện đại. Kỹ sư CNTT tốt nghiệp có kỹ năng về CNTT chuyên nghiệp, có khả năng anh ngữ tốt trong môi trường làm việc, học tập và nghiên cứu quốc tế, có kỹ năng làm việc nhóm và trình bày hiệu quả. Chương trình đào tạo tuân thủ theo các quy định của Bộ GDĐT, ĐHQG TP.HCM và các chuẩn mực quốc tế	Khoa CNTT là một trong các khoa của Trường Đại học Quốc tế, ĐHQG-TP.HCM. Do đó, tầm nhìn của Khoa phụ thuộc và tầm nhìn của Trường (**Trường ĐHQT là trường đại học nghiên cứu thuộc tốp đầu tại châu Á; là cơ sở giáo dục quốc tế, tự chủ, sáng tạo; là nơi vun đắp và phát triển nguồn nhân lực chất lượng cao cho thị trường lao động trong nước và quốc tế**.)	**Đào tạo chất lượng cao đa ngành – đa lĩnh vực cho bậc đại học và sau đại học. Tất cả các CTĐT được đánh giá theo tiêu chuẩn trong nước và quốc tế AUN.** **Nâng cao nghiên cứu cơ bản và nghiên cứu ứng dụng để đáp ứng được nhu cầu của doanh nghiệp, địa phương, xã hội và tiêu chuẩn quốc tế.** Đảm nhận vai trò tiên phong tại Việt Nam bằng cách thực hành quản lý xuất sắc, truyền cảm hứng và hỗ trợ các thành viên của ĐHQG TP.HCM trong việc phát triển toàn diện	**Mục tiêu giáo dục nhằm phát triển toàn diện con người Việt Nam có đạo đức, tri thức, văn hóa**, sức khỏe, thẩm mỹ và nghề nghiệp; có phẩm chất, năng lực và ý thức công dân; có lòng yêu nước, tinh thần dân tộc, trung thành với lý tưởng độc lập dân tộc và chủ nghĩa xã hội; phát huy tiềm năng, **khả năng sáng tạo của mỗi cá nhân**; nâng cao dân trí, phát triển nguồn nhân lực, bồi dưỡng nhân tài, đáp ứng yêu cầu của sự nghiệp xây dựng, bảo vệ Tổ quốc và hội nhập quốc tế (Điều 2)

b. Mục tiêu cụ thể (Program Objectives - POs): Kỹ sư CNTT sau khi tốt nghiệp tại ĐHQT có kiến thức, kỹ năng và năng lực như sau:

Kiến thức:

(**PO1**) Kiến thức và lập luận ngành

- kiến thức cơ bản vững chắc về máy tính, hệ thống máy tính, mạng máy tính và ứng dụng CNTT, bao gồm các khía cạnh lý thuyết và ứng dụng.

- kiến thức chuyên ngành sâu, rộng về máy tính, hệ thống máy tính, mạng máy tính và ứng dụng công nghệ thông tin; có kỹ năng phân tích và giải quyết vấn đề; thiết kế, phát triển và tích hợp hệ thống thông tin cho các ứng dụng kỹ thuật liên quan đến máy tính, hệ thống mạng máy tính và các ứng dụng và hệ thống dựa trên mạng máy tính; khả năng giải quyết các vấn đề kỹ thuật, xã hội, chính trị và kinh tế liên ngành.

Kỹ năng:

(**PO2**) Kỹ năng và phẩm chất cá nhân

- kiến thức về hội nhập và khởi nghiệp; có ý thức bảo vệ môi trường, thiết kế và vận hành hệ thống thân thiện với môi trường.

(**PO3**) Kỹ năng làm việc nhóm và giao tiếp

- các kỹ năng mềm cần thiết và giải quyết vấn đề; có khả năng làm việc theo nhóm, kỹ năng lãnh đạo và quản lý; có khả năng giao tiếp và làm việc chuyên nghiệp bằng tiếng Anh (ở mức độ thành thạo).

- có ý thức về chuyên môn, đạo đức nghề nghiệp và tinh thần trách nhiệm đối với bản thân và xã hội; có phẩm chất chính trị tốt, sống và làm việc tuân thủ pháp luật của nhà nước Việt Nam.

Tự chủ và trách nhiệm:

(**PO4**) Năng lực thực hành nghề nghiệp

- khả năng tự học và nghiên cứu hoặc tham gia các khóa bồi dưỡng để nắm bắt công nghệ mới.

- có đủ năng lực học tiếp các chương trình cao hơn trong và ngoài nước.

4. Chuẩn đầu ra của chương trình đào tạo (Program Learning Outcomes –PLOs)

Cách tuyên bố mục tiêu theo hướng dẫn tại Điều 5, Chương II, Thông tư 17/2021/TT-BGDĐT). Thầy/Cô trình bày CĐR rõ ràng, đo được theo cấp độ tư duy và được sắp xếp theo các khối: kiến thức, kỹ năng, mức tự chủ và trách nhiệm theo Khung trình độ Quốc gia Việt Nam.

Danh sách 6 CĐR được xem xét trong chương trình đào tạo gồm:

Kiến thức:

(**PLO1**) khả năng áp dụng kiến thức, kỹ thuật, kỹ năng và các công cụ hiện đại của toán học, khoa học, kỹ thuật và công nghệ để giải quyết các vấn đề kỹ thuật thuộc chuyên ngành;

(**PLO2**) khả năng thiết kế các hệ thống, thành phần hoặc quy trình đáp ứng các nhu cầu cụ thể cho các vấn đề kỹ thuật trong chuyên ngành;

Kỹ năng:

(**PLO3**) khả năng giao tiếp bằng văn bản, lời nói và đồ họa trong các môi trường kỹ thuật và phi kỹ thuật; và khả năng tìm kiếm và sử dụng tài liệu kỹ thuật phù hợp;

(**PLO4**) khả năng phân tích và diễn giải các kết quả để cải tiến quy trình;

Mức tự chủ và trách nhiệm:

(**PLO5**) khả năng hoạt động hiệu quả với tư cách là thành viên cũng như lãnh đạo trong các nhóm kỹ thuật;

(**PLO6**) khả năng tiến hành kiểm tra, đo đạt, và thử nghiệm hệ thống.

5. Ma trận giữa mục tiêu đào tạo và chuẩn đầu ra

CĐR sẽ gắn kết với mục tiêu cụ thể đã được xác định ở Mục 3.

Bảng 2. Mối quan hệ giữa CĐR của CTĐT và mục tiêu đào tạo

	Mục tiêu giáo dục của chương trình	**PO1**	**PO2**	**PO3**	**PO4**
Kiến thức	**PLO 1**	X			
	PLO 2	X			X
Kỹ năng	**PLO 3**			X	
	PLO 4		X		X
Mức tự chủ và trách nhiệm	**PLO 5**			X	
	PLO 6	X			X

6. Quy trình đào tạo, điều kiện tốt nghiệp

- Căn cứ Quyết định số 1342/QĐ-ĐHQG ngày 30 tháng 9 năm 2022 của Giám đốc Đại học Quốc gia Thành phố Hồ Chí Minh về việc ban hành Quy chế đào tạo trình độ đại học.

- Căn cứ Quyết định số 719/QĐ-ĐHQT ngày 06 tháng 12 năm 2021 của Hiệu trưởng trường Đại học Quốc tế về việc ban hành Quy chế đào tạo trình độ đại học theo hệ thống tín chỉ tại trường Đại học Quốc tế.

7. Thang điểm (theo thang điểm chính thức của trường)

Trường quy định thang điểm đánh giá kết quả học tập của người học (Quy chế đào tạo trình độ đại học theo hệ thống tín chỉ tại trường Đại học Quốc tế)

Bảng 3: Thang điểm

Xếp loại	**Thang điểm 100**	**Điểm chữ**	**Thang điểm 4**
Xuất sắc	Từ 90 đến 100	A+	4,0
Giỏi	Từ 80 đến cận 90	A	3,5
Khá	Từ 70 đến cận 80	B+	3,0

Trung bình khá	Từ 60 đến cận 70	B	2,5
Trung bình	Từ 50 đến cận 60	C	2,0
Yếu	Từ 40 đến cận 50	D+	1,5
Kém	Từ 30 đến cận 40	D	1,0
	Dưới 30	F	0,0

Quy chế đào tạo theo học chế tín chỉ trên cơ sở các quyết định, nghị định hướng dẫn của Bộ GĐDT, ĐHQG TPHCM và ĐHQT:

- Văn bản hợp nhất số 17/VBHN-BGDĐT ngày 15/5/2014 của Bộ Giáo dục và Đào tạo về Văn bản hợp nhất Quyết định số 43/2007/QĐ-BGDĐT ngày 15/08/2007 và Thông tư số 57/2012/TT-BGDĐT ngày 27/12/2012 về việc ban hành quy chế đào tạo đại học và cao đẳng hệ chính quy theo hệ thống tín chỉ

- Văn bản hướng dẫn của ĐHQG-HCM (Công văn số 85/ĐHQG-ĐH ngày 15/01/2020 của Giám Đốc ĐHQG TPHCM về việc rà soát cập nhật chương trình đào tạo các ngành đào tạo chuyên sâu đặc thù trình độ đại học tại ĐHQG-HCM năm 2020)

- Quy chế đào tạo theo học chế tín chỉ - bậc đại học do Hiệu Trưởng Trường Đại học Quốc Tế, Đại học Quốc Gia TP HCM ban hành.

8. Khối lượng kiến thức toàn khoá

Ngành Công nghệ Thông Tin có 2 chuyên ngành: **kỹ sư Kỹ Thuật Mạng (150 tín chỉ) và kỹ sư Kỹ Thuật máy tính (150 tín chỉ)**. Phân bổ kiến thức cho 02 chuyên ngành như sau (không bao gồm giáo dục thể chất và giáo dục quốc phòng):

TT	Các khối kiến thức	Số tín chỉ	%	Số tín chỉ	%
		Kỹ Thuật Mạng		**Kỹ Thuật Máy Tính**	
1	Khối kiến thức giáo dục đại cương	45	30.0	45	30.0
2	Khối kiến thức cơ sở ngành	35	23.3	35	23.3
3	Kiến thức chuyên ngành (tính cả khối kiến thức tự chọn)	44	29.3	44	29.3
4	Kiến thức bổ trợ	6	4.0	6	4.0
5	Thực tập, khóa luận/luận văn tốt nghiệp	20	13.33	20	13.3
	Tổng cộng	**150**	**100**	**150**	**100**

9. Nội dung chương trình đào tạo

9.1. Chuyên ngành Kỹ Thuật Mạng

STT	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
I	**Kiến thức giáo dục đại cương**				**45**	**44**	**1**	
I.1	***Các môn lý luận chính trị***				**11**	**11**	**0**	
1	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0	
2	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0	
3	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0	
4	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0	
5	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0	
I.2	***Khoa học xã hội - Nhân văn - Nghệ thuật***				***3***	***3***	***0***	
6	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0	
I.3	***Ngoại ngữ***				***8***	***8***	***0***	
7	EN008IU	Tiếng Anh chuyên ngành 1 (kỹ năng nghe)	Academic English 1 (listening skill)	Bắt buộc	2	2	0	
8	EN007IU	Tiếng Anh chuyên ngành 1 (kỹ năng viết)	Academic English 1 (writing skill)	Bắt buộc	2	2	0	

9	EN012IU	Tiếng Anh chuyên ngành 2 (kỹ năng nói)	Academic English 2 (speaking skill)	Bắt buộc	2	2	0	
10	EN011IU	Tiếng Anh chuyên ngành 2 (kỹ năng viết)	Academic English 2 (writing skill)	Bắt buộc	2	2	0	
I.4	***Toán - Khoa học tự nhiên - Môi trường***				***23***	***22***	***1***	
11	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0	
12	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0	
13	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0	
14	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0	
15	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0	
16	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0	
17	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0	
18	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý
II	**Kiến thức cơ sở ngành**				**35**	**27**	**8**	
19	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0	
20	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT
21	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0	

22	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT
23	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT
24	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT
25	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT
26	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT
27	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT
28	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT
III	**Kiến thức chuyên ngành**				**44**	**33**	**11**	
III.1	***Kiến thức bắt buộc***				***32***	***24***	***8***	
29	IT096IU	Lập trình Mạng	Net-Centric Programming	Bắt buộc	4	3	1	Phòng TN. CNTT
30	IT094IU	Quản lý hệ thống thông tin	Information System Management	Bắt buộc	4	3	1	Phòng TN. CNTT
31	IT093IU	Phát triển ứng dụng Web	Web Application Development	Bắt buộc	4	3	1	Phòng TN. CNTT
32	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	Bắt Buộc	4	3	1	Phòng TN. CNTT

33	IT125IU	Quản trị hệ thống mạng	System and Network Administration	Bắt Buộc	4	3	1	Phòng TN. CNTT
34	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	Bắt Buộc	4	3	1	Phòng TN. CNTT
35	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT
36	IT159IU	Trí thông minh nhân tạo	Artificial Intelligent	Bắt Buộc	4	3	1	
III.2	***Kiến thức ngành tự chọn (sinh viên chọn tối thiểu 16 tín chỉ trong nhóm môn học sau)***				***12***	***9***	***3***	
37		Tự chọn 1	Elective 1	Tự chọn	4	3	1	
38		Tự chọn 2	Elective 2	Tự chọn	4	3	1	
39		Tự chọn 3	Elective 3	Tự chọn	4	3	1	
IV	**Kiến thức bổ trợ**				**6**	**6**	**0**	
40	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt Buộc	3	3	0	
41	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0	
V	**Thực tập, khóa luận/luận văn tốt nghiệp**				**20**	**0**	**20**	
42	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7	
43	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3	
44	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10	
	Tổng số (tín chỉ)				**150**	**110**	**40**	

Các môn tự chọn của kỹ thuật mạng

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
1	IT163IU	Tối ưu hóa và ứng dụng	Optimization and Applications	4	3	1	Phòng TN.CNTT
2	IT024IU	Đồ hoạ Máy tính	Computer Graphics	4	3	1	Phòng TN. CNTT
3	IT056IU	Quản lý dự án CNTT	IT Project Management	4	3	1	Phòng TN. CNTT
4	IT068IU	Các nguyên lý mạch điện 1	Principles of Electrical Engineering I	3	3	0	Phòng TN. CNTT
5	IT074IU	Linh kiện điện tử	Electronics Devices	3	3	0	
6	IT076IU	Công nghệ Phần mềm	Software Engineering	4	3	1	Phòng TN. CNTT
7	IT090IU	Phân tích và thiết kế hướng đối tượng	Object-Oriented Analysis and Design	4	3	1	Phòng TN. CNTT
8	IT092IU	Nguyên lý của Ngôn ngữ lập trình	Principles of Programming Languages	4	3	1	Phòng TN. CNTT
9	IT098IU	Thực hành các nguyên lý mạch điện 1	Principles of Electrical Engineering I Laboratory	1	0	1	Phòng TN. CNTT
10	IT101IU	Thực hành linh kiện điện tử	Electronics Devices Laboratory	1	0	1	Phòng TN. CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
11	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	4	3	1	Phòng TN. CNTT
12	IT105IU	Thiết kế hệ thống số	Digital System Design	3	3	0	
13	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	1	0	1	Phòng TN. CNTT
14	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	3	3	0	Phòng TN. CNTT
15	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	1		1	Phòng TN. CNTT
16	IT114IU	Kiến trúc phần mềm	Software Architecture	4	3	1	Phòng TN. CNTT
17	IT115IU	Hệ thống nhúng	Embedded Systems	3	3	0	Phòng TN. CNTT
18	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	1	0	1	
19	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	3	3	0	
20	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	1	0	1	Phòng TN. CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
21	IT130IU	Xử lý ảnh Kỹ thuật số	Digital Image Processing	4	3	1	Phòng TN. CNTT
22	IT160IU	Khai thác dữ liệu	Data Mining	4	3	1	Phòng TN.CNTT
23	IT133IU	Phát triển ứng dụng di động	Mobile Application Development	4	3	1	Phòng TN. CNTT
24	IT138IU	Trực quan hóa dữ liệu	Data Science and Data Visualization	4	3	1	Phòng TN.CNTT
25	IT140IU	Khái niệm cơ bản về bảo mật dữ liệu	Fundamental Concepts of Data Security	4	3	1	Phòng TN.CNTT
26	IT144IU	Phân Tích Quy Trình Nghiệp Vụ	Business Process Analysis	4	3	1	Phòng TN.CNTT
27	IT145IU	Hệ Thống Hỗ Trợ Quyết Định	Decision Support Systems	4	3	1	Phòng TN.CNTT
28	IT164IU	Điện Toán Đám Mây	Cloud Computing	4	3	1	Phòng TN.CNTT
29	IT150IU	Chuỗi khối	Blockchain	4	3	1	Phòng TN. CNTT
30	IT156IU	Phát triển và vận hành liên tục	Development & Operation (DevOps)	4	3	1	Phòng TN. CNTT
31	IT157IU	Học sâu	Deep Learning	4	3	1	Phòng TN. CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
32	IT158IU	Thiết kế và đánh giá giao diện	UI Design and Evaluation	4	3	1	Phòng TN. CNTT
33	IT166IU	Kiểm tra chất lượng phần mềm	Software Quality Verification and Validation	4	3	1	Phòng TN. CNTT
34	IT167IU	Phát triển ứng dụng game	Game Application Development	4	3	1	Phòng TN. CNTT
35	PE008IU	Tư Duy Phản Biện	Critical Thinking	3	3	0	Phòng TN.CNTT
36	IT131IU	Mô hình Toán cho Tin học	Theoretical Models in Computing	4	3	1	Phòng TN. CNTT
37		Tự chọn tự do	Free elective	4	3	1	

9.2. Chuyên ngành Kỹ thuật Máy tính

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
I	**Kiến thức giáo dục đại cương**				**45**	**44**	**1**	
I.1	***Các môn lý luận chính trị***				***11***	***11***	***0***	
1	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0	

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
2	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0	
3	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0	
4	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0	
5	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0	
I.2	***Khoa học xã hội - Nhân văn - Nghệ thuật***				***3***	***3***	***0***	
6	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0	
I.3	***Ngoại ngữ***				*8*	*8*	*0*	
7	EN008IU	Tiếng Anh chuyên ngành 1 (kỹ năng nghe)	Academic English 1 (listening skill)	Bắt buộc	2	2	0	
8	EN007IU	Tiếng Anh chuyên ngành 1 (kỹ năng viết)	Academic English 1 (writing skill)	Bắt buộc	2	2	0	
9	EN012IU	Tiếng Anh chuyên ngành 2 (kỹ năng nói)	Academic English 2 (speaking skill)	Bắt buộc	2	2	0	

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
10	EN011IU	Tiếng Anh chuyên ngành 2 (kỹ năng viết)	Academic English 2 (writing skill)	Bắt buộc	2	2	0	
I.4	***Toán - Khoa học tự nhiên - Môi trường***				***23***	***22***	***1***	
11	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0	
12	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0	
13	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0	
14	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0	
15	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0	
16	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0	
17	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0	
18	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý
II	**Khối kiến thức cơ sở ngành**				**35**	**27**	**8**	
19	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0	

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
20	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT
21	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0	
22	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT
23	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT
24	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT
25	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT
26	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT
27	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT
28	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT
III	**Kiến thức chuyên ngành**				**44**	**33**	**11**	
III. 1	***Kiến thức bắt buộc***				***36***	***27***	***9***	

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
29	IT068IU	Các nguyên lý mạch điện 1	Principles of Electrical Engineering I	Bắt buộc	3	3	0	
30	IT098IU	Thực hành các nguyên lý mạch điện 1	Principles of Electrical Engineering I Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT
31	IT074IU	Linh kiện điện tử	Electronics Devices	Bắt buộc	3	3	0	
32	IT101IU	Thực hành linh kiện điện tử	Electronics Devices Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT
33	IT105IU	Thiết kế hệ thống số	Digital System Design	Bắt buộc	3	3	0	
34	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT
35	IT115IU	Hệ thống nhúng	Embedded Systems	Bắt buộc	3	3	0	
36	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT
37	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	Bắt buộc	3	3	0	
38	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
39	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	Bắt buộc	3	3	0	Phòng TN. CNTT
40	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	Bắt buộc	1		1	Phòng TN. CNTT
41	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	Bắt buộc	4	3	1	Phòng TN. CNTT
42	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT
43	IT159IU	Trí thông minh nhân tạo	Artificial Intelligence	Bắt Buộc	4	3	1	
III. 2	***Kiến thức ngành tự chọn (sinh viên chọn tối thiểu 8 tín chỉ trong nhóm môn học sau)***				***8***	***6***	***2***	
44		Tự chọn 1	Elective 1	Tự chọn	4	3	1	
45		Tự chọn 2	Elective 2	Tự chọn	4	3	1	
IV	**Kiến thức bổ trợ**				**6**	**6**	**0**	
47	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt Buộc	3	3	0	
46	IT120IU	Khởi nghiệp	Entrepreneurs hip	Bắt buộc	3	3	0	
V	**Thực tập, khóa luận/luận văn tốt nghiệp**				**20**	**0**	**20**	

Stt	Mã môn học	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng thí nghiệm (TN)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm	
47	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7	
48	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3	
49	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10	
	Tổng số (tín chỉ)				**150**	**110**	**40**	

CÁC MÔN TỰ CHỌN CỦA KỸ THUẬT MÁY TÍNH

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng Thí nghiệm
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
1	IT163IU	Tối ưu hóa và ứng dụng	Optimization and Applications	4	3	1	Phòng TN.CNTT
2	IT024IU	Đồ hoạ Máy tính	Computer Graphics	4	3	1	Phòng TN. CNTT
3	IT056IU	Quản lý dự án CNTT	IT Project Management	4	3	1	Phòng TN. CNTT
4	IT076IU	Công nghệ Phần mềm	Software Engineering	4	3	1	Phòng TN. CNTT
5	IT090IU	Phân tích và thiết kế hướng đối tượng	Object-Oriented Analysis and Design	4	3	1	Phòng TN. CNTT
6	IT092IU	Nguyên lý của Ngôn ngữ lập trình	Principles of Programming Languages	4	3	1	Phòng TN. CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng Thí nghiệm
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
7	IT093IU	Phát triển ứng dụng Web	Web Application Development	4	3	1	Phòng TN.CNTT
8	IT094IU	Quản lý hệ thống thông tin	Information System Management	4	3	1	Phòng TN. CNTT
9	IT096IU	Lập trình Mạng	Net-Centric Programming	4	3	1	Phòng TN. CNTT
10	IT114IU	Kiến trúc phần mềm	Software Architecture	4	3	1	Phòng TN. CNTT
11	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	4	3	1	Phòng TN. CNTT
12	IT125IU	Quản trị hệ thống mạng	System and Network Administration	4	3	1	Phòng TN. CNTT
13	IT160IU	Khai thác dữ liệu	Data Mining	4	3	1	Phòng TN.CNTT
14	IT133IU	Phát triển ứng dụng di động	Mobile Application Development	4	3	1	Phòng TN. CNTT
15	IT138IU	Trực quan hóa dữ liệu	Data Science and Visualization	4	3	1	Phòng TN. CNTT
16	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	4	3	1	Phòng TN. CNTT
17	IT140IU	Khái niệm cơ bản về bảo mật dữ liệu	Fundamental Concepts of Data Security	4	3	1	Phòng TN.CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng Thí nghiệm
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
18	IT144IU	Phân Tích Quy Trình Nghiệp Vụ	Business Process Analysis	4	3	1	Phòng TN.CNTT
19	IT145IU	Hệ Thống Hỗ Trợ Quyết Định	Decision Support Systems	4	3	1	Phòng TN.CNTT
20	IT147IU	Điện Toán Đám Mây Di Động	Mobile Cloud Computing	4	3	1	Phòng TN.CNTT
21	IT150IU	Chuỗi khối	Blockchain	4	3	1	Phòng TN. CNTT
22	IT156IU	Phát triển và vận hành liên tục	Development & Operation (DevOps)	4	3	1	Phòng TN. CNTT
23	IT157IU	Học sâu	Deep Learning	4	3	1	Phòng TN. CNTT
24	IT158IU	Thiết kế và đánh giá giao diện	UI Design and Evaluation	4	3	1	Phòng TN. CNTT
25	IT131IU	Mô hình Toán cho Tin học	Theoretical Models in Computing	4	3	1	Phòng TN. CNTT
26	IT165IU	Công nghệ và Triển khai bảo mật	Security Technology and Implementation	4	3	1	Phòng TN. CNTT
27	IT166IU	Kiểm tra chất lượng phần mềm	Software Quality Verification and Validation	4	3	1	Phòng TN. CNTT
28	IT167IU	Phát triển ứng dụng game	Game Application Development	4	3	1	Phòng TN. CNTT

STT	Mã môn học	Tên môn học (MH)		Tín chỉ			Phòng Thí nghiệm
		Tiếng Việt	Tiếng Anh	Tổng cộng	Lý thuyết	Thực hành	
29	PE008IU	Tư Duy Phản Biện	Critical Thinking	3	3	0	Phòng TN.CNTT
30		Tự chọn tự do	Free elective	4	3	1	

10. Dự kiến kế hoạch giảng dạy (phân bổ các môn học theo từng học kỳ)

Tùy vào trình độ tiếng Anh của người học đạt trình độ AE1, IE2, IE1 và IE0, kế hoạch giảng dạy các môn học được cụ thể tương ứng được trình bày trong các Bảng 6, Bảng 7, Bảng 8 và Bảng 9.

10.1. Trình độ AE1 chuyên ngành Kỹ Thuật Mạng

Bảng 6. Kế hoạch giảng dạy đối với người học đạt trình độ AE1 chuyên ngành Kỹ Thuật Mạng

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	P.TN	Không
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
II (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn TQ EN008IU + EN007IU Academic English 1 (listening + writing skills)
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	Tổng				**17**	**15**	**2**		
	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
III (20 tín chỉ)	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn TQ MA001IU Calculus 1
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		
IV (17 tín chỉ)	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT093IU	Phát triển ứng dụng Web	Web Application Development	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT079IU (3,1) Principles of Database Management và IT069IU (3,1) Object-Oriented Programming
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	Tổng				**17**	**14**	**3**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
V (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture, IT013IU Algorithms and Data Structures
	IT096IU	Lập trình mạng	Net-Centric Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT125IU	Quản trị hệ thống mạng	System & Network Administration	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		

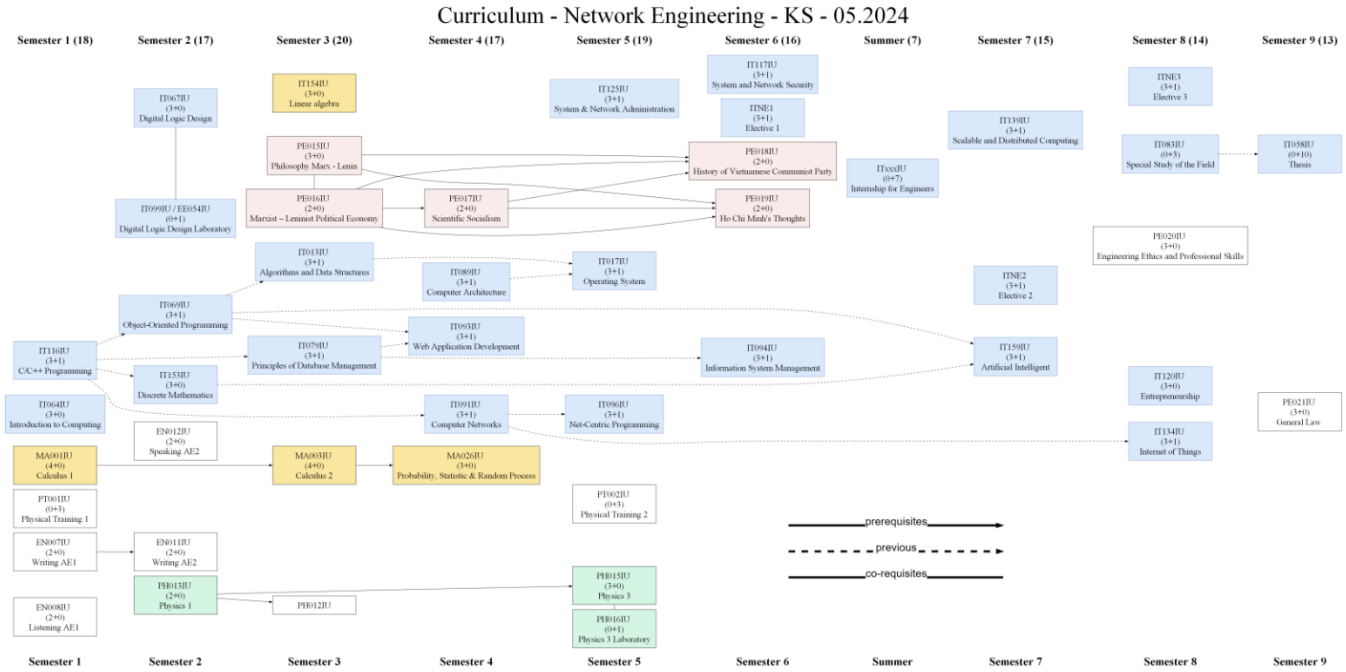
Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
VI (16 tín chỉ)		Môn tự chọn 1	Elective 1	Tự chọn	4	3	1	Phòng TN. CNTT	
	IT094IU	Quản lý Hệ thống thông tin	Information System Management	Bắt buộc	4	3	1	Phòng TN. CNTT	
	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	Bắt buộc	4	3	1	Phòng TN. CNTT	
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn TQ PE017IU Scientific Socialism
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
Hè năm 3	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (15 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	Tổng				**15**	**12**	**3**		
VIII (14 tín chỉ)	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không
		Môn tự chọn 3	Elective 3	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng Thí nghiệm (P.TN)	Môn tiên quyết (TQ)/ học trước (HT)/ song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	Tổng				**14**	**9**	**5**		
IX (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn TQ IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

Ghi chú: *Tổng số tín chỉ 156 bao gồm cả 06 tín chỉ giáo dục thể chất.*

Hình sau đây thể hiện mối quan hệ giữa các môn học trong chương trình Kỹ sư Kỹ thuật Mạng.


Curriculum - Network Engineering - KS - 05.2024
Semester 1 (18)
Semester 2 (17)
Semester 3 (20)
Semester 4 (17)
Semester 5 (19)
Semester 6 (16)
Summer (7)
Semester 7 (15)
Semester 8 (14)
Semester 9 (13)
IT067IU (3+0) Digital Logic Design
IT154IU (3+0) Linear algebra
IT125IU (3+1) System & Network Administration
IT117IU (3+1) System and Network Security
ITNE1 (3+1) Elective 1
ITNE3 (3+1) Elective 3
IT139IU (3+1) Scalable and Distributed Computing
IT083IU (0+3) Special Study of the Field
IT058IU (0+10) Thesis
PE015IU (3+0) Philosophy Marx - Lenin
PE018IU (2+0) History of Vietnamese Communist Party
ITxxxIU (0+7) Internship for Engineers
PE016IU (2+0) Marxist – Leninist Political Economy
PE017IU (2+0) Scientific Socialism
PE019IU (2+0) Ho Chi Minh's Thoughts
IT099IU / EE054IU (0+1) Digital Logic Design Laboratory
PE020IU (3+0) Engineering Ethics and Professional Skills
IT013IU (3+1) Algorithms and Data Structures
IT089IU (3+1) Computer Architecture
IT017IU (3+1) Operating System
ITNE2 (3+1) Elective 2
IT069IU (3+1) Object-Oriented Programming
IT093IU (3+1) Web Application Development
IT116IU (3+1) C/C++ Programming
IT079IU (3+1) Principles of Database Management
IT094IU (3+1) Information System Management
IT159IU (3+1) Artificial Intelligent
IT153IU (3+0) Discrete Mathematics
IT120IU (3+0) Entrepreneurship
IT064IU (3+0) Introduction to Computing
IT091IU (3+1) Computer Networks
IT096IU (3+1) Net-Centric Programming
PE021IU (3+0) General Law
EN012IU (2+0) Speaking AE2
IT134IU (3+1) Internet of Things
MA001IU (4+0) Calculus 1
MA003IU (4+0) Calculus 2
MA026IU (3+0) Probability, Statistic & Random Process
PT001IU (0+3) Physical Training 1
PT002IU (0+3) Physical Training 2
prerequisites
previous
co-requisites
EN007IU (2+0) Writing AE1
EN011IU (2+0) Writing AE2
PH013IU (2+0) Physics 1
PH015IU (3+0) Physics 3
EN008IU (2+0) Listening AE1
PH012IU
PH016IU (0+1) Physics 3 Laboratory
Semester 1
Semester 2
Semester 3
Semester 4
Semester 5
Semester 6
Summer
Semester 7
Semester 8
Semester 9

10.2. Trình độ AE1 chuyên ngành Kỹ Thuật Máy Tính

Bảng 7. Kế hoạch giảng dạy đối với người học đạt trình độ AE1 chuyên ngành Kỹ Thuật Máy Tính

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
II (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn HT EN008IU + EN007IU Academic English 1 (listening + writing skills)
	Tổng				**17**	**15**	**2**		
III (20 tín chỉ)	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn HT MA001IU Calculus 1

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT068IU	Nguyên lý mạch điện 1	Principle of Electrical Engineering I	Bắt buộc	3	3	0		Môn SH Principle of Electrical Engineering I Laboratory
	IT098IU	Thực hành nguyên lý mạch điện 1	Principle of Electrical Engineering I Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Principle of Electrical Engineering I
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
IV (17 tín chỉ)	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT074IU	Linh kiện điện tử	Electronic Devices	Bắt buộc	3	3	0		Môn HT IT068IU Principle of Electrical Engineering I; Môn SH IT074IU Electronic Devices
	IT101IU	Thực hành linh kiện điện tử	Electronic Devices Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH IT074IU Electronic Devices

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	Tổng				**17**	**14**	**3**		
V (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture; IT013IU Algorithms and Data Structures
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Micro-processing Systems Laboratory
	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Micro-processing Systems
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
VI (16 tín chỉ)		Môn tự chọn 1	Elective 1		4	3	1		Không
	IT105IU	Thiết kế hệ thống số	Digital System Design	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Digital System Design Laboratory
	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Digital System Design
	IT115IU	Hệ thống nhúng	Embedded Systems	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT128IU Micro-processing Systems; Môn SH Embedded Systems Laboratory
	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	Bắt buộc	1	0	1		Môn SH Embedded Systems

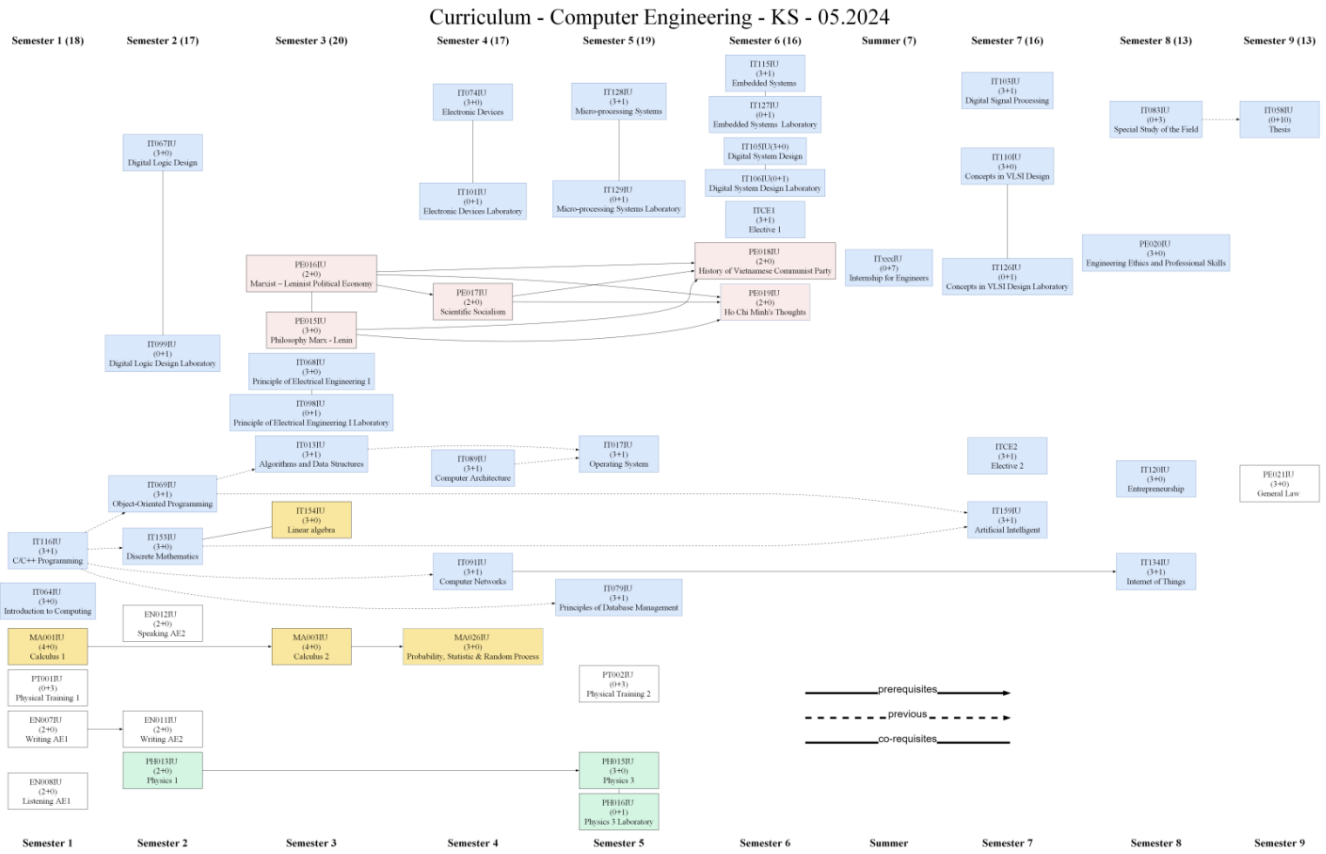
Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
Hè năm 3	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (16 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT067IU Digital Logic Design; Môn SH IT126IU Concepts in VLSI Design Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	Bắt buộc	1		1	Phòng TN. CNTT	Môn SH IT110IU Concepts in VLSI Design
	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	Tổng				**16**	**12**	**4**		
VIII (13 tín chỉ)	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**13**	**9**	**4**		
IX (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn HT IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

Ghi chú: *Tổng số tín chỉ 156 bao gồm cả 06 tín chỉ giáo dục thể chất.*

Hình sau đây thể hiện mối quan hệ giữa các môn học trong chương trình Kỹ sư Kỹ thuật Máy tính.



10.3. Trình độ IE2 chuyên ngành Kỹ Thuật Mạng

Bảng 8. Kế hoạch giảng dạy đối với người học đạt trình độ IE2 chuyên ngành Kỹ Thuật Mạng

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (17 tín chỉ)	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**17**	**17**	**0**		Không tính vào TC
II (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
III (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn TQ EN008IU + EN007IU Academic English 1 (listening + writing skills)

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	Tổng				**17**	**15**	**2**		
IV (20	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không

Học kỳ tín chỉ)	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn TQ MA001IU Calculus 1
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		
V (17 tín chỉ)	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT093IU	Phát triển ứng dụng Web	Web Application Development	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT079IU (3,1) Principles of Database Management và IT069IU (3,1) Object-Oriented Programming
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	Tổng				**17**	**14**	**3**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
VI (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture, IT013IU Algorithms and Data Structures
	IT096IU	Lập trình mạng	Net-Centric Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT125IU	Quản trị hệ thống mạng	System & Network Administration	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
Hè năm 3	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (16 tín chỉ)		Môn tự chọn 1	Elective 1	Tự chọn	4	3	1	Phòng TN. CNTT	
	IT094IU	Quản lý Hệ thống thông tin	Information System Management	Bắt buộc	4	3	1	Phòng TN. CNTT	
	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	Bắt buộc	4	3	1	Phòng TN. CNTT	

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn TQ PE017IU Scientific Socialism
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
VIII (15 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	Tổng				**15**	**12**	**3**		
IX (14 tín chỉ)	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không
		Môn tự chọn 3	Elective 3	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**14**	**9**	**5**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
X (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn TQ IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

10.4. Trình độ IE2 chuyên ngành Kỹ Thuật Máy Tính

Bảng 9. Kế hoạch giảng dạy đối với người học đạt trình độ IE2 chuyên ngành Kỹ Thuật Máy Tính

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (17 tín chỉ)	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**17**	**17**	**0**		Không tính vào TC
II (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
III (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn HT EN008IU + EN007IU Academic English 1 (listening + writing skills)
	Tổng				**17**	**15**	**2**		
IV (20 tín chỉ)	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn HT MA001IU Calculus 1

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT068IU	Nguyên lý mạch điện 1	Principle of Electrical Engineering I	Bắt buộc	3	3	0		Môn SH Principle of Electrical Engineering I Laboratory
	IT098IU	Thực hành nguyên lý mạch điện 1	Principle of Electrical Engineering I Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Principle of Electrical Engineering I
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
V (17 tín chỉ)	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT074IU	Linh kiện điện tử	Electronic Devices	Bắt buộc	3	3	0		Môn HT IT068IU Principle of Electrical Engineering I; Môn SH IT074IU Electronic Devices
	IT101IU	Thực hành linh kiện điện tử	Electronic Devices Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH IT074IU Electronic Devices

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	Tổng				**17**	**14**	**3**		
VI (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture; IT013IU Algorithms and Data Structures

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Micro-processing Systems Laboratory
	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Micro-processing Systems
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
Hè năm 3	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (16 tín chỉ)		Môn tự chọn 1	Elective 1		4	3	1		Không
	IT105IU	Thiết kế hệ thống số	Digital System Design	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Digital System Design Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Digital System Design
	IT115IU	Hệ thống nhúng	Embedded Systems	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT128IU Micro-processing Systems; Môn SH Embedded Systems Laboratory
	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	Bắt buộc	1	0	1		Môn SH Embedded Systems
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	Tổng				**16**	**13**	**3**		
VII (16 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT067IU Digital Logic Design; Môn SH IT126IU Concepts in VLSI Design Laboratory
	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	Bắt buộc	1		1	Phòng TN. CNTT	Môn SH IT110IU Concepts in VLSI Design
	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	Tổng				**16**	**12**	**4**		
VIII (13 tín chỉ)	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**13**	**9**	**4**		
IX (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn HT IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

10.5. Trình độ IE1 chuyên ngành Kỹ Thuật Mạng

Bảng 10. Kế hoạch giảng dạy đối với người học đạt trình độ IE1 chuyên ngành Kỹ Thuật Mạng

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (34 tín chỉ)	ENTP01	Tiếng Anh tăng cường 1	Intensive English 1	Bắt buộc	17	17	0		
	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**34**	**34**	**0**		Không tính vào TC
II (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
III (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn TQ EN008IU + EN007IU Academic English 1 (listening + writing skills)
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	Tổng				**17**	**15**	**2**		
IV (20 tín chỉ)	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn TQ MA001IU Calculus 1
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		
V (17 tín chỉ)	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT093IU	Phát triển ứng dụng Web	Web Application Development	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT079IU (3,1) Principles of Database Management và IT069IU (3,1) Object-Oriented Programming
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	Tổng				**17**	**14**	**3**		
VI (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture, IT013IU Algorithms and Data Structures

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT096IU	Lập trình mạng	Net-Centric Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT125IU	Quản trị hệ thống mạng	System & Network Administration	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
Hè năm 3	I174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (16 tín chỉ)		Môn tự chọn 1	Elective 1	Tự chọn	4	3	1	Phòng TN. CNTT	

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT094IU	Quản lý Hệ thống thông tin	Information System Management	Bắt buộc	4	3	1	Phòng TN. CNTT	
	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	Bắt buộc	4	3	1	Phòng TN. CNTT	
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn TQ PE017IU Scientific Socialism
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
VIII (15 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	Tổng				**15**	**12**	**3**		
IX (14 tín chỉ)	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không
		Môn tự chọn 3	Elective 3	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**14**	**9**	**5**		
X (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn TQ IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

10.6. Trình độ IE1 chuyên ngành Kỹ Thuật Máy Tính

Bảng 11. Kế hoạch giảng dạy đối với người học đạt trình độ IE1 chuyên ngành Kỹ Thuật Máy Tính

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (34 tín chỉ)	ENTP01	Tiếng Anh tăng cường 1	Intensive English 1	Bắt buộc	17	17	0		
	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**34**	**34**	**0**		Không tính vào TC
II (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
III (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn HT EN008IU + EN007IU Academic English 1 (listening + writing skills)
	Tổng				**17**	**15**	**2**		
IV (20	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không

Học kỳ tín chỉ)	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn HT MA001IU Calculus 1
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT068IU	Nguyên lý mạch điện 1	Principle of Electrical Engineering I	Bắt buộc	3	3	0		Môn SH Principle of Electrical Engineering I Laboratory
	IT098IU	Thực hành nguyên lý mạch điện 1	Principle of Electrical Engineering I Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Principle of Electrical Engineering I
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	Tổng				**20**	**18**	**2**		
V (17 tín chỉ)	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT074IU	Linh kiện điện tử	Electronic Devices	Bắt buộc	3	3	0		Môn HT IT068IU Principle of Electrical Engineering I; Môn SH IT074IU Electronic Devices

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT101IU	Thực hành linh kiện điện tử	Electronic Devices Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH IT074IU Electronic Devices
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	Tổng				**17**	**14**	**3**		
VI (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture; IT013IU Algorithms and Data Structures

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Micro-processing Systems Laboratory
	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Micro-processing Systems
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
Hè năm 3	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	ITxxxIU	7	0	7		Không
	Tổng				**7**	**0**	**7**		
VII (16 tín chỉ)		Môn tự chọn 1	Elective 1		4	3	1		Không
	IT105IU	Thiết kế hệ thống số	Digital System Design	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Digital System Design Laboratory
	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Digital System Design

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT115IU	Hệ thống nhúng	Embedded Systems	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT128IU Micro-processing Systems; Môn SH Embedded Systems Laboratory
	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	Bắt buộc	1	0	1		Môn SH Embedded Systems
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
VII (16		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không

Học kỳ tín chỉ)	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT067IU Digital Logic Design; Môn SH IT126IU Concepts in VLSI Design Laboratory
	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	Bắt buộc	1		1	Phòng TN. CNTT	Môn SH IT110IU Concepts in VLSI Design
	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	Tổng				**16**	**12**	**4**		
VIII (13	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không

Học kỳ tín chỉ)	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**13**	**9**	**4**		
IX (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn HT IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

10.7. Trình độ IE0 chuyên ngành Kỹ Thuật Mạng

Bảng 12. Kế hoạch giảng dạy đối với người học đạt trình độ IE0 chuyên ngành Kỹ Thuật Mạng

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (34 tín chỉ)	ENTP00	Tiếng Anh tăng cường 0	Intensive English 0	Bắt buộc	17	17	0		
	ENTP01	Tiếng Anh tăng cường 1	Intensive English 1	Bắt buộc	17	17	0		
	Tổng				**34**	**34**	**0**		Không tính vào TC
II (17 tín chỉ)	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**17**	**17**	**0**		Không tính vào TC
III (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
IV (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn TQ EN008IU + EN007IU Academic English 1 (listening + writing skills)
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	Tổng				**17**	**15**	**2**		
V (20 tín chỉ)	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn TQ MA001IU Calculus 1
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		
VI (17 tín chỉ)	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT093IU	Phát triển ứng dụng Web	Web Application Development	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT079IU (3,1) Principles of Database Management và IT069IU (3,1) Object-Oriented Programming

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	Tổng				**17**	**14**	**3**		
VII (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture, IT013IU Algorithms and Data Structures
	IT096IU	Lập trình mạng	Net-Centric Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT125IU	Quản trị hệ thống mạng	System & Network Administration	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
VIII (16 tín chỉ)		Môn tự chọn 1	Elective 1	Tự chọn	4	3	1	Phòng TN. CNTT	
	IT094IU	Quản lý Hệ thống thông tin	Information System Management	Bắt buộc	4	3	1	Phòng TN. CNTT	
	IT117IU	Bảo mật hệ thống và mạng	System and Network Security	Bắt buộc	4	3	1	Phòng TN. CNTT	
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn TQ PE017IU Scientific Socialism

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn TQ PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
Hè năm 4	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
IX (15 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	IT139IU	Tính toán phân tán	Scalable and Distributed Computing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	Tổng				**15**	**12**	**3**		
	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
X (14 tín chỉ)		Môn tự chọn 3	Elective 3	Tự chọn	4	3	1	Phòng TN. CNTT	Không
	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**14**	**9**	**5**		
XI (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn TQ IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

10.8. Trình độ IE0 chuyên ngành Kỹ Thuật Máy tính

Bảng 13. Kế hoạch giảng dạy đối với người học đạt trình độ IE0 chuyên ngành Kỹ Thuật Máy tính

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
I (34 tín chỉ)	ENTP00	Tiếng Anh tăng cường 0	Intensive English 0	Bắt buộc	17	17	0		
	ENTP01	Tiếng Anh tăng cường 1	Intensive English 1	Bắt buộc	17	17	0		
	Tổng				**34**	**34**	**0**		Không tính vào TC
II (17 tín chỉ)	ENTP02	Tiếng Anh tăng cường 2	Intensive English 2	Bắt buộc	17	17	0		
	Tổng				**17**	**17**	**0**		Không tính vào TC
III (18 tín chỉ)	MA001IU	Toán 1	Calculus 1	Bắt buộc	4	4	0		Không
	EN008IU + EN007IU	Tiếng Anh chuyên ngành 1 (nghe + viết)	Academic English 1 (listening + writing skills)	Bắt buộc	4	4	0		Không
	IT064IU	Nhập môn Tin học	Introduction to Computing	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT116IU	Lập trình C/C++	C/C++ Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	PT001IU	Giáo dục thể chất 1	Physical Training 1	Bắt buộc	3	0	3		Không
	Tổng				**18**	**14**	**4**		
IV (17 tín chỉ)	IT153IU	Toán rời rạc	Discrete Mathematics	Bắt buộc	3	3	0		Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	PH013IU	Vật lý 1	Physics 1	Bắt buộc	2	2	0		Không
	IT067IU	Thiết kế logic số	Digital Logic Design	Bắt buộc	3	3	0		Môn SH IT099IU / EE054IU Digital Logic Design Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT099IU	Thực hành Thiết kế logic số	Digital Logic Design Laboratory	Bắt buộc	1	0	1	Phòng TN. ĐTVT	Môn SH IT067IU Digital Logic Design
	IT069IU	Lập trình hướng đối tượng	Object-Oriented Programming	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học HT IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	EN012IU + EN011IU	Tiếng Anh chuyên ngành 2 (nói + viết)	Academic English 2 (speaking + writing skills)	Bắt buộc	4	4	0		Môn HT EN008IU + EN007IU Academic English 1 (listening + writing skills)
	Tổng				**17**	**15**	**2**		
	IT154IU	Đại số tuyến tính	Linear algebra	Bắt buộc	3	3	0		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
V (20 tín chỉ)	MA003IU	Toán 2	Calculus 2	Bắt buộc	4	4	0		Môn HT MA001IU Calculus 1
	IT013IU	Cấu trúc dữ liệu và giải thuật	Algorithms and Data Structures	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT069IU Object-Oriented Programming
	IT068IU	Nguyên lý mạch điện 1	Principle of Electrical Engineering I	Bắt buộc	3	3	0		Môn SH Principle of Electrical Engineering I Laboratory
	IT098IU	Thực hành nguyên lý mạch điện 1	Principle of Electrical Engineering I Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Principle of Electrical Engineering I
	PE015IU	Triết học Mác-Lênin	Philosophy Marx - Lenin	Bắt buộc	3	3	0		Không
	PE016IU	Kinh tế chính trị Mác-Lênin	Marxist – Leninist Political Economy	Bắt buộc	2	2	0		Môn SH PE015IU Philosophy Marx - Lenin
	Tổng				**20**	**18**	**2**		

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
VI (17 tín chỉ)	IT091IU	Mạng máy tính	Computer Networks	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1) Fundamentals of Programming
	IT089IU	Cấu trúc máy tính	Computer Architecture	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT074IU	Linh kiện điện tử	Electronic Devices	Bắt buộc	3	3	0		Môn HT IT068IU Principle of Electrical Engineering I; Môn SH IT074IU Electronic Devices
	IT101IU	Thực hành linh kiện điện tử	Electronic Devices Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH IT074IU Electronic Devices

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PE017IU	Chủ nghĩa xã hội khoa học	Scientific Socialism	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin
	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	Probability, Statistic & Random Process	Bắt buộc	3	3	0		Không
	Tổng				**17**	**14**	**3**		
VII (19 tín chỉ)	IT017IU	Hệ điều hành	Operating System	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn HT IT089IU Computer Architecture; IT013IU Algorithms and Data Structures
	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	Principles of Database Management	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT116IU (3,1) C/C++ Programming hoặc IT149IU (3,1)

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
									Fundamentals of Programming
	IT128IU	Hệ thống vi xử lý	Micro-processing Systems	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Micro-processing Systems Laboratory
	IT129IU	Thực hành hệ thống vi xử lý	Micro-processing Systems Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Micro-processing Systems
	PT002IU	Giáo dục thể chất 2	Physical Training 2	Bắt buộc	3	0	3		Không
	PH015IU	Vật lý 3	Physics 3	Bắt buộc	3	3	0		Môn TQ Physics 1; Môn SH Physics 3 Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	PH016IU	Thực hành Vật lý 3	Physics 3 Laboratory	Bắt buộc	1	0	1	Phòng TN. Vật lý	Môn SH PH015IU Physics 3
	Tổng				**19**	**12**	**7**		
VIII (16 tín chỉ)		Môn tự chọn 1	Elective 1		4	3	1		Không
	IT105IU	Thiết kế hệ thống số	Digital System Design	Bắt buộc	3	3	0		Môn HT IT067IU Digital Logic Design; Môn SH Digital System Design Laboratory
	IT106IU	Thực hành thiết kế hệ thống số	Digital System Design Laboratory	Bắt buộc	1	0	1	Phòng TN. CNTT	Môn SH Digital System Design
	IT115IU	Hệ thống nhúng	Embedded Systems	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT128IU Micro-processing Systems; Môn SH Embedded Systems Laboratory

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT127IU	Thực hành hệ thống nhúng	Embedded Systems Laboratory	Bắt buộc	1	0	1		Môn SH Embedded Systems
	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam	History of Vietnamese Communist Party	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	PE019IU	Tư tưởng Hồ Chí Minh	Ho Chi Minh's Thoughts	Bắt buộc	2	2	0		Môn HT PE015IU, PE016IU, PE017IU
	Tổng				**16**	**13**	**3**		
Hè năm 4	IT174IU	Thực tập công nghiệp cho kỹ sư	Internship for engineers	Bắt buộc	7	0	7		Không
	Tổng				**7**	**0**	**7**		
IX (16 tín chỉ)		Môn tự chọn 2	Elective 2	Tự chọn	4	3	1	Phòng TN. CNTT	Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
	IT110IU	Khái niệm thiết kế VLSI	Concepts in VLSI Design	Bắt buộc	3	3	0	Phòng TN. CNTT	Môn HT IT067IU Digital Logic Design; Môn SH IT126IU Concepts in VLSI Design Laboratory
	IT126IU	Thực hành khái niệm thiết kế VLSI	Concepts in VLSI Design Laboratory	Bắt buộc	1		1	Phòng TN. CNTT	Môn SH IT110IU Concepts in VLSI Design
	IT103IU	Xử lý tín hiệu số	Digital Signal Processing	Bắt buộc	4	3	1	Phòng TN. CNTT	Không
	IT159IU	Trí thông minh nhân tạo	Artificial intelligence	Bắt buộc	4	3	1	Phòng TN. CNTT	Môn học học trước IT069IU (3,1) Object-Oriented Programming
	Tổng				**16**	**12**	**4**		
	IT083IU	Thực tập tốt nghiệp	Special Study of the Field	Bắt buộc	3	0	3		Không

Học kỳ	Mã MH	Tên môn học (MH)		Loại MH (bắt buộc /tự chọn)	Tín chỉ			Phòng TN	Chi chú / Môn tiên quyết (TQ)/Môn học trước (HT)/Môn song hành (SH)
		Tiếng Việt	Tiếng Anh		Tổng cộng	Lý thuyết	Thực hành/ Thí nghiệm		
X (13 tín chỉ)	IT134IU	Internet vạn vật	Internet of Things	Bắt Buộc	4	3	1	Phòng TN. CNTT	Môn HT IT091I Computer Networks
	IT120IU	Khởi nghiệp	Entrepreneurship	Bắt buộc	3	3	0		Không
	PE020IU	Đạo đức và kỹ năng nghề nghiệp	Engineering Ethics and Professional Skills	Bắt buộc	3	3	0		Không
	Tổng				**13**	**9**	**4**		
XI (13 tín chỉ)	IT058IU	Luận văn tốt nghiệp	Thesis	Bắt buộc	10	0	10		Môn HT IT083IU Special Study of the Field
	PE021IU	Pháp luật đại cương	General Law	Bắt Buộc	3	3	0		Không
	Tổng				**13**	**3**	**10**		
	TỔNG CỘNG				**156**	**110**	**46**		

11. Ma trận các môn học và chuẩn đầu ra (kỹ năng)

Mức độ đóng góp của các môn học vào chuẩn đầu ra của CTĐT ngành Công nghệ Thông tin được trình bày như Bảng 14.

Bảng 14. Đóng góp của các môn học vào CĐR của CTĐT chuyên ngành Kỹ thuật Mạng

STT	Mã môn học	Tên môn học (MH)	Chuẩn đầu ra (ABET)					
		Tiếng Việt	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
I	**Kiến thức giáo dục đại cương**							
I.1	***Các môn lý luận chính trị***							
1	PE015IU	Triết học Mác-Lênin				xx		
2	PE016IU	Kinh tế chính trị Mác-Lênin				xx		
3	PE017IU	Chủ nghĩa xã hội khoa học				xx		
4	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam				x		
5	PE019IU	Tư tưởng Hồ Chí Minh				xx		
I.2	***Khoa học xã hội - Nhân văn - Nghệ thuật***							
6	PE021IU	Pháp luật đại cương				xx	x	
I.3	***Ngoại ngữ***							
7	EN008IU	Tiếng Anh chuyên ngành 1 (kỹ năng nghe)			xxx			
8	EN007IU	Tiếng Anh chuyên ngành 1 (kỹ năng viết)			xxx			
9	EN012IU	Tiếng Anh chuyên ngành 2 (kỹ năng nói)			xxx			
10	EN011IU	Tiếng Anh chuyên ngành 2 (kỹ năng viết)			xxx			
I.4	***Toán - Khoa học tự nhiên - Môi trường***							
11	MA001IU	Toán 1	xx		x			
12	MA003IU	Toán 2	xx		x			
13	IT154IU	Đại số tuyến tính	xx					
14	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	xx	x				
15	IT153IU	Toán rời rạc	x	x				
16	PH013IU	Vật lý 1	x					
17	PH015IU	Vật lý 3	x					
18	PH016IU	Thực hành Vật lý 3	x					
II	**Khối kiến thức cơ sở ngành**							
19	IT064IU	Nhập môn Tin học	x			x	x	

STT	Mã môn học	Tên môn học (MH)	Chuẩn đầu ra (ABET)					
		Tiếng Việt	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
20	IT116IU	Lập trình C/C++	x	xxx			x	
21	IT067IU	Thiết kế logic số	x	x				x
22	IT099IU	Thực hành Thiết kế logic số	x	x				x
23	IT069IU	Lập trình hướng đối tượng	xx	xxx				x
24	IT013IU	Cấu trúc dữ liệu và giải thuật	xxx	xx				x
25	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	xxx	xxx			xx	
26	IT089IU	Kiến trúc máy tính	x	x				x
27	IT091IU	Mạng máy tính	xx	xxx			x	
28	IT017IU	Hệ điều hành	x	x				
III	**Kiến thức chuyên ngành**							
29	IT094IU	Quản lý hệ thống thông tin	x				xx	x
30	IT093IU	Phát triển ứng dụng Web	x	x			x	x
31	IT096IU	Lập trình Mạng	x	xxx				x
32	IT117IU	Bảo mật hệ thống và mạng	x	x	x	x		
33	IT125IU	Quản trị hệ thống mạng	xxx		x	xxx		
34	IT139IU	Tính toán phân tán	x	x				x
35	IT134IU	Internet vạn vật		xxx			xx	x
36	IT159IU	Trí thông minh nhân tạo	x	x				x
IV	**Kiến thức tự chọn**							
37		Tự chọn 1						
38		Tự chọn 2						
39		Tự chọn 3						
V	**Kiến thức bổ trợ**							
40	IT120IU	Khởi nghiệp	x			x		
41	PE020IU	Đạo đức và kỹ năng nghề nghiệp				xx		
VI	**Nghiên cứu, thực tập và luận văn tốt nghiệp**							
42	IT174IU	Thực tập công nghiệp cho kỹ sư				x		x
43	IT083IU	Thực tập tốt nghiệp	xxx	xx				x
44	IT058IU	Luận văn tốt nghiệp	xxx	xxx				x

Bảng 14. Đóng góp của các môn học vào CĐR của CTĐT chuyên ngành Kỹ thuật Máy tính

STT	Mã môn học	Tên môn học (MH)	Chuẩn đầu ra (ABET)					
		Tiếng Việt	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
I	**Kiến thức giáo dục đại cương**							
I.1	***Các môn lý luận chính trị***							
1	PE015IU	Triết học Mác-Lênin				xx		
2	PE016IU	Kinh tế chính trị Mác-Lênin				xx		
3	PE017IU	Chủ nghĩa xã hội khoa học				xx		
4	PE018IU	Lịch sử Đảng Cộng Sản Việt Nam				x		
5	PE019IU	Tư tưởng Hồ Chí Minh				xx		
I.2	***Khoa học xã hội - Nhân văn - Nghệ thuật***							
6	PE021IU	Pháp luật đại cương				xx	x	
1.3	***Ngoại ngữ***							
7	EN008IU	Tiếng Anh chuyên ngành 1 (kỹ năng nghe)			xxx			
8	EN007IU	Tiếng Anh chuyên ngành 1 (kỹ năng viết)			xxx			
9	EN012IU	Tiếng Anh chuyên ngành 2 (kỹ năng nói)			xxx			
10	EN011IU	Tiếng Anh chuyên ngành 2 (kỹ năng viết)			xxx			
I.4	***Toán - Khoa học tự nhiên - Môi trường***							
11	MA001IU	Toán 1	xx		x			
12	MA003IU	Toán 2	xx		x			
13	IT154IU	Đại số tuyến tính	xx					
14	MA026IU	Xác suất, thống kê và quá trình ngẫu nhiên	xx	x				
15	IT153IU	Toán rời rạc	x	x				
16	PH013IU	Vật lý 1	x					
17	PH015IU	Vật lý 3	x					
18	PH016IU	Thực hành Vật lý 3	x					
II	**Khối kiến thức cơ sở ngành**							
19	IT064IU	Nhập môn Tin học	x			x	x	
20	IT116IU	Lập trình C/C++	x	xxx			x	
21	IT067IU	Thiết kế logic số	x	x				x
22	IT099IU	Thực hành Thiết kế logic số	x	x				x
23	IT069IU	Lập trình hướng đối tượng	xx	xxx				x

STT	Mã môn học	Tên môn học (MH)	Chuẩn đầu ra (ABET)					
		Tiếng Việt	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
24	IT013IU	Cấu trúc dữ liệu và giải thuật	xxx	xx				x
25	IT079IU	Nguyên lý Quản trị Cơ sở dữ liệu	xxx	xxx			xx	
26	IT089IU	Kiến trúc máy tính	x	x				x
27	IT091IU	Mạng máy tính	xx	xxx			x	
28	IT017IU	Hệ điều hành	x	x				
III	**Kiến thức chuyên ngành**							
29	IT068IU	Các nguyên lý mạch điện 1	x	x				x
30	IT098IU	Thực hành các nguyên lý mạch điện 1	x	x				x
31	IT074IU	Linh kiện điện tử	x	x				x
32	IT101IU	Thực hành linh kiện điện tử	x	x				x
33	IT105IU	Thiết kế hệ thống số	x	x				x
34	IT106IU	Thực hành thiết kế hệ thống số	x	x				x
35	IT128IU	Hệ thống vi xử lý	x	x	x			x
36	IT129IU	Thực hành hệ thống vi xử lý	x	x	x			x
37	IT110IU	Khái niệm thiết kế VLSI	x	x	x			x
38	IT126IU	Thực hành khái niệm thiết kế VLSI	x	x	x			x
39	IT115IU	Hệ thống nhúng		x				x
40	IT127IU	Thực hành hệ thống nhúng		x				x
41	IT103IU	Xử lý tín hiệu số	x	x				x
42	IT134IU	Internet vạn vật		xxx			xx	x
43	IT159IU	Trí thông minh nhân tạo	x	x				x
IV	**Kiến thức tự chọn**							
44		Tự chọn 1						
45		Tự chọn 2						
V	**Kiến thức bổ trợ**							
46	IT120IU	Khởi nghiệp	x			x		
47	PE020IU	Đạo đức và kỹ năng nghề nghiệp				xx		
VI	**Nghiên cứu, thực tập và luận văn tốt nghiệp**							
48	IT174IU	Thực tập công nghiệp cho kỹ sư				x		x
49	IT083IU	Thực tập tốt nghiệp	xxx	xx				x
50	IT058IU	Luận văn tốt nghiệp	xxx	xxx				x

12. Mô tả vắn tắt nội dung và khối lượng các môn học (số thứ tự của môn học tương ứng với số thứ tự của môn học trong nội dung chương trình đào tạo)

12.1 **PE015IU - Triết học Mác-Lênin (Philosophy Marx - Lenin)**

Số tín chỉ : 3 (3LT + 0TH)

Môn học tiên quyết: không

Mô tả môn học:

Môn học trang bị cho sinh viên những kiến thức cơ bản về triết học Mác-Lênin.

12.2 **PE016IU - Kinh tế chính trị Mác-Lênin (Marxist – Leninist Political Economy)**

Số tín chỉ : 2 (2LT + 0TH)

Môn học song hành: Triết học Mác-Lênin

Mô tả môn học:

Nội dung chương trình gồm 6 chương: Trong đó chương 1 bàn về đối tượng, phương pháp nghiên cứu và chức năng của Kinh tế chính trị Mác-Lênin. Từ chương 2 đến chương 6 trình bày nội dung cốt lõi của Kinh tế chính trị Mác-Lênin theo mục tiêu của môn học. Cụ thể các vấn đề như: Hàng hóa, thị trường và vai trò của các chủ thể trong nền kinh tế thị trường; Sản xuất giá trị thặng dư trong nền kinh tế thị trường; Cạnh tranh và độc quyền trong nền kinh tế thị trường; Kinh tế thị trường định hướng xã hội chủ nghĩa và các quan hệ lợi ích kinh tế ở Việt Nam; Công nghiệp hóa, hiện đại hóa và hội nhập kinh tế quốc tế ở Việt Nam.

12.3 **PE017IU - Chủ nghĩa xã hội khoa học (Scientific Socialism)**

Số tín chỉ : 2 (2LT + 0TH)

Môn học trước: Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin

Mô tả môn học:

Môn học trang bị cho sinh viên những kiến thức cơ bản về chủ nghĩa xã hội khoa học.

12.4 **PE018IU - Lịch sử Đảng Cộng Sản Việt Nam (History of Vietnamese Communist Party)**

Số tín chỉ : 2 (2LT + 0TH)

Môn học trước: Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin, Chủ nghĩa xã hội khoa học.

Mô tả môn học:

Môn học trang bị cho sinh viên những kiến thức cơ bản về lịch sử Đảng Cộng Sản Việt Nam.

12.5 **PE019IU - Tư tưởng Hồ Chí Minh (Ho Chi Minh's Thoughts)**

Số tín chỉ : 2 (2LT + 0TH)

Môn học trước: Triết học Mác-Lênin, Kinh tế chính trị Mác-Lênin, Chủ nghĩa xã hội khoa học.

Mô tả môn học:

Môn học trang bị cho sinh viên những kiến thức cơ bản về: đối tượng, phương pháp nghiên cứu và ý nghĩa học tập môn tư tưởng Hồ Chí Minh; về cơ sở, quá trình hình thành và phát triển tư tưởng Hồ Chí Minh; về độc lập dân tộc và đoàn kết quốc tế; về văn hóa, đạo đức, con người.

12.6 **MA001IU - Toán 1 (Calculus 1)**

Số tín chỉ : 4 (4LT + 0TH)

Môn học tiên quyết: Không

Mô tả môn học:

Nội dung chính: Hàm số, Giới hạn, Tính liên tục, Đạo hàm, Đạo hàm cho các hàm cơ bản, Qui tắc tính đạo hàm, Ứng dụng của đạo hàm, Quy tắc L'hospital, Tối ưu, Phương pháp Newton, Tích phân, Tích phân xác định, Các định lý cơ bản của giải tích, kỹ thuật tính tích phân.

12.7 **MA003IU - Toán 2 (Calculus 2)**

Số tín chỉ : 4 (4LT + 0TH)

Môn học tiên quyết: Toán 1

Mô tả môn học:

Dãy và chuỗi; Kiểm tra sự hội tụ; Chuỗi mủ; Chuỗi Taylor và Maclaurin; Hệ tọa độ Cartesian; Đường thẳng, Mặt và Mặt phẳng; Đạo hàm và tích phân của hàm Véctơ; Chiều dài đường cong; Mặt phẳng tham số; Mặt tiếp xúc; Véctơ Gradient; Cực trị; Nhân tử Lagrange; Tích phân bội: tích phân hai lớp, tích phân ba lớp, những kỹ thuật tính tích phân; Trường Véctơ, tích phân đường, tích phân mặt.

Số tín chỉ : 4 (3LT + 1TH)

Môn học tiên quyết: Toán 1, Toán 2

Mô tả môn học: Phương trình vi phân cấp một, phương trình vi phân cấp hai, hệ số không xác định, phương sai của tham số, phương trình vi phân tuyến tính cấp cao, nghiệm chuỗi của phương trình vi phân tuyến tính cấp hai với hệ số không là hằng, hệ phương trình tuyến tính cấp một, cơ bản về phương trình đạo hàm riêng và phương pháp tách biến, phương pháp số.

12.8 **MA026IU - Xác suất, thống kê và quá trình ngẫu nhiên (Probability, Statistic & Random Process)**

Số tín chỉ : 3 (3LT + 0TH)

Môn học tiên quyết: Toán 1, Toán 2

Mô tả môn học: Môn học trình bày lý thuyết xác suất theo quan điểm độ đo. Nội dung chính bao gồm kiến thức về các biến cố (độc lập, có điều kiện,…), các biến ngẫu nhiên, phân phối, kỳ vọng, phương sai và các định lý giới hạn quan trọng trong xác suất (định lý giới hạn trung tâm, luật số lớn, …).

12.9 **PH013IU - Vật lý 1 (Physics 1)**

Số tín chỉ : 2 (2LT + 0TH)

Môn học tiên quyết: Không

Mô tả môn học:

Khảo sát động học, động lực học, năng lượng học của chuyển động của chất điểm và của vật rắn. Khảo sát động lực học lưu chất, tính chất của khí lí tưởng, và các nguyên lí nhiệt động lực học.

12.10 **PH015IU & PH016IU - Vật lý 3 (Physics 3 + Physics 3 Laboratory)**

Số tín chỉ : 4 (3LT + 1TH)

Môn học tiên quyết: Vật lý 1

Mô tả môn học:

Môn học cung cấp cho sinh viên những kiến thức cơ bản về điện và từ.

12.11 **PE020IU - Đạo đức và kỹ năng nghề nghiệp (Engineering Ethics and Professional Skills)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học tiên quyết: không

Mô tả môn học: Môn học thiết kế để giới thiệu cho sinh viên kỹ thuật về khái niệm, lý thuyết và thực hành về đạo đức kỹ thuật. Môn học giúp sinh viên khám phá ra mối quan hệ giữa đạo đức và kỹ thuật cũng như việc áp dụng lý thuyết đạo đức cổ điển và ra quyết định cho các vấn đề kỹ thuật trong quá trình học thuật cũng như trong nghề nghiệp. Học tập và hiểu đạo đức nghề nghiệp cũng là một phần trong sự phát triển của sinh viên với tư cách là một kỹ sư. Sinh viên phải có khả năng mở rộng hiểu biết và tư duy cởi mở. Điều quan trọng là sinh viên phải học cách chia sẻ ý tưởng kể cả khi có sự bất đồng, do đó hoạt động thực hành nhóm sẽ được chú trọng trong môn học này.

12.12 **EN007IU & EN008IU - Tiếng anh chuyên ngành 1 (Academic English 1)**

Số tín chỉ : 4 (4LT + 0TH)

Môn học tiên quyết: không

Mô tả môn học:

Môn học nhằm nâng cao kỹ năng viết trình độ tiền nâng cao (pre-advanced). Chương trình tập trung vào việc xây dựng bài luận dựa trên các kỹ năng viết như: làm dàn bài, viết câu luận đề, kết nối và sắp xếp trình tự các đoạn, dung từ và cụm từ nối để tạo sự mạch lạc cho bài văn. Các thể loại bao gồm: miêu tả người, đồ vật, qui trình, trình bày ý kiến, so sánh và đối chiếu, nguyên nhân – kết quả, vấn đề - giải pháp, nghị luận. Những kỹ năng nghe tiếng Anh học thuật, ghi chú, và thảo luận sẽ giúp sinh viên làm quen với những khó khăn trong việc học tiếng Anh ở đại học. Sinh viên sẽ học các kỹ năng cần thiết cho sinh viên đại học quốc tế, bao gồm: nghe bài giảng chủ động, ghi chú hiệu quả, tham gia thảo luận tự tin. Cùng với các kỹ năng nghe, sinh viên cũng sẽ trau giồi thêm vốn từ vựng học thuật.

12.13 **EN011IU & EN012IU - Tiếng anh chuyên ngành 2 (Academic English 2)**

Số tín chỉ : 4 (4LT + 0TH)

Môn học tiên quyết: Tiếng anh chuyên ngành 1

Mô tả môn học:

Khóa học nhằm cung cấp một cách tổng quát cấu trúc của một bài viết báo cáo nghiên cứu, từng bước giúp sinh viên hoàn tất một bài viết cụ thể trong lĩnh vực của mình. Nội dung của khóa học bao gồm: các thành phần của bài báo cáo, kỹ năng chọn và giới hạn đề tài, viết câu luận đề, làm dàn bài, tìm và dẫn chứng tài liệu, ghi chú, viết mở bài, nội dung chính và kết luận, viết và sửa chữa bản nháp. Sinh viên sẽ thực hành trên các đề tài liên quan đến môn học của mình. Môn học cung cấp cho sinh viên các chiến lược thiết thực sử dụng trong việc thuyết trình. Ngòai ra sinh viên được giúp đỡ hình thành kỹ năng lắng nghe, nhận xét và nêu ý kiến phản hồi đối với các bài thuyết trình khác trong lớp.

12.14 **IT064IU - Nhập môn Tin học (Introduction to computing)**

Số tín chỉ: 3 (3 LT+0TH)

Môn học tiên quyết: Không

Mô tả môn học:

Môn học giới thiệu những khái niệm cơ bản, những mô hình và xu hướng trong ngành công nghiệp Công nghệ thông tin. Ngoài ra, sinh viên được giới thiệu về các chuyên ngành, về cơ cấu các môn học trong mỗi chuyên ngành, ý nghĩa của các môn học, các nghề nghiệp liên quan đến mỗi chuyên ngành, định hướng nghề nghiệp cho sinh viên.

12.15 **IT116IU - Lập trình C/C++ (C/C++ Programming)**

Số tín chỉ: 4 (3 LT+1TH)

Môn học tiên quyết: Không

Mô tả môn học:

Môn học giúp phát triển những giải thuật và giới thiệu những nguyên tắc trong lập trình dùng C và C++. Các chủ đề bao gồm: giới thiệu máy tính và điện toán, phát triển chương trình, cú pháp ngôn ngữ lập trình C/C++ và các phương pháp số căn bản cho kỹ sư. Môi trường Unix và một số tiện ích cũng được giới thiệu trong môn học này.

12.16 **IT153IU - Toán rời rạc (Discrete Mathematics)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Toán 1, Toán 2, Lập trình C/C++

Mô tả môn học: Môn học giúp sinh viên phát triển khả năng tư duy, suy nghĩ và diễn giải dựa trên toán học, logic, ứng dụng khả năng này để phân tích, xử lý và giải quyết các đối tượng rời rạc trong thực tế. Đây là khóa học hướng ứng dụng dựa trên việc nghiên cứu các sự kiện xảy ra là nhỏ hay rời rạc phân đoạn trong khoa học, kinh tế, công nghiệp…. Sinh viên sẽ được giới thiệu các công cụ toán học về toán rời rạc như: lý thuyết tổ hợp; lý thuyết quan hệ (quan hệ tương đương, quan hệ sắp xếp); bài toán đếm (giới thiệu về bài toán và phần mở rộng về hệ thức truy hồi); bài toán tồn tại; bài toán liệt kê; lý thuyết đại số Boole; lý thuyết đồ thị và cây. Các ứng dụng thực tế sẽ được giới thiệu trong suốt khóa học.

12.17 **IT067IU & IT099IU - Thiết kế logic số và thực hành (Digital Logic Design + Digital Logic Design Laboratory)**

Số tín chỉ: 4 (3 LT+1TH)

Môn học tiên quyết: không

Môn học tương đương: EE053IU & EE054IU

Mô tả môn học:

Môn học cung cấp cho sinh viên các kiến thức về số nhị phân, đại số Boolean, bìa Karnaugh, mạch tổ hợp, mạch tổ hợp MSI, logis tuần tự, thiết kế máy trạng thái đồng bộ, mạch MSI tuần tự.

12.18 **IT069IU - Lập trình hướng đối tượng (Object Oriented Programming)**

Số tín chỉ: 4 (3 LT+1TH)

Môn học học trước: Lập trình C/C++ hoặc Lập trình cơ bản

Mô tả môn học:

Lập trình và các cấu trúc dữ liệu cơ bản dùng ngôn ngữ Java. Các cấu trúc điều khiển cơ bản như vòng lặp, mảng, đệ qui và con trỏ. Thiết kế hướng đối tương: lớp, thừa kế, overload và đa hình. Cấu trúc dữ liệu trừu tượng: danh sách, danh sách liên kết, chồng và hàng. Giới thiệu về phân tích giải thuật, dùng ký hiệu O, các phương pháp tìm kiếm và sắp xếp.

12.19 **IT013IU - Cấu trúc dữ liệu và giải thuật (Algorithms and Data Strutures)**

Số tín chỉ: 4 (3 LT+1TH)

Môn học trước: Lập trình hướng đối tượng

Mô tả môn học:

Tìm hiểu những đặc điểm quan trọng của cấu trúc dữ liệu và giải thuật. Cách sử dụng những cấu trúc này để hỗ trợ thiết kế giải thuật. Giới thiệu về các kỹ thuật tìm kiếm, sắp xếp và băm.

12.20 **IT079IU - Nguyên lý Quản trị Cơ sở dữ liệu (Principle of Database Management).**

Số tín chỉ: 4 (3 LT+1TH)

Môn học trước: Lập trình C/C++ hoặc Lập trình cơ bản

Mô tả môn học:

Môn học nhằm cung cấp cho người học kiến thức tổng quan về: kiến trúc Cơ sở dữ liệu (CSDL), phương pháp quản trị CSDL; các mô hình dữ liệu phân cấp, mô hình dữ liệu mạng và mô hình dữ liệu quan hệ; phương pháp thiết kế mô hình thực thể kết hợp và mô hình cơ sở dữ liệu quan hệ; các phụ thuộc hàm cho dữ liệu và cách chuẩn hóa dữ liệu, các ràng buộc toàn vẹn dữ liệu và bảo mật dữ liệu; các cơ chế quản lý giao tác cho hệ quản trị CSDL đa người dùng; ngoài ra môn học còn giới thiệu một số hệ quản trị CSDL thông dụng như SQL Server và một số hệ quản trị CSDL thương mại khác.

12.21 IT089IU - Cấu trúc máy tính (Computer Architecture)

Số tín chỉ: 4 (3 LT+1TH)

Môn học học trước: Thiết kế logic số

Mô tả môn học: Lịch sử và các nguyên lý của cấu trúc máy tính, cấu tạo máy tính, hợp ngữ và mã máy tính, số học của máy tính, thiết kế ALU, hiệu năng của máy tính, đường dẫn dữ liệu và điều khiển, pipelining, cấu trúc phân tầng của bộ nhớ, thiết bị xuất nhập, và các bộ xử lý di động cũng như đa lõi.

12.22 IT091IU - Mạng Máy Tính (Computer Networks)

Số tín chỉ: 4 (3 LT+1TH)

Môn học học trước: Lập trình C/C++

Môn học trước: Lập trình hướng đối tượng

Mô tả môn học: Giới thiệu về mạng, cấu trúc OSI, chuyển mạch gói, mạng nội bộ, Ethernet, mạng không dây, và các giao thức mạng.

12.23 IT096IU - Lập trình mạng (Net-Centric Programming)

Số tín chỉ: 4 (3LT+1TH)

Môn học học trước: Mạng máy tính, Lập trình C/C++

Mô tả môn học: Môn học cung cấp các kiến thức cơ sở và nâng cao về các kỹ thuật lập trình mạng TCP/IP và UDP. Giúp sinh viên có khả năng xây dựng định dạng dữ liệu để thiết kế các giao thức truyền dữ liệu trên mạng. Hướng dẫn sinh viên lập trình được các ứng dụng có kết nối mạng Client/Server độc lập sử dụng ở mức socket và một số giao thức mạng cấp ứng dụng phổ biến như HTTP, FTP, DNS, Email… Môn học cũng cung cấp cho sinh viên các kỹ năng phát triển phần mềm trên các công cụ và môi trường trực quan như PyCharm, Visual Studio…

12.24 IT094IU - Quản lý Hệ thống thông tin (Information System Management)

Số tín chỉ: 4 (3 LT+1TH)

Môn học trước: Nguyên lý Quản Trị Cơ sở dữ liệu

Mô tả môn học: Môn học hướng tới việc mô tả cách mà một hệ thống thông tin được sử dụng bởi các doanh nghiệp và sự ảnh hưởng của nó đến hoạt động của doanh nghiệp. Cùng với việc trình bày và tìm hiểu về công nghệ trong hệ thống thông tin, các vấn đề cơ bản là làm cách nào để các công nghệ được dùng giải quyết các vấn đề của doanh nghiệp và các cơ hội khai thác chúng. Nội dung cụ thể gồm các vấn đề liên quan đến tổ chức, quản lý, mạng doanh nghiệp; hạ tầng công nghệ thông tin doanh nghiệp; các hệ thống hỗ trợ quản lý và tổ chức cho doanh nghiệp số; xây dựng và quản lý hệ thống thông tin

12.25 IT017IU - Hệ điều hành (Operating System)

Số tín chỉ: 4 (3 LT+1TH)

Môn học học trước: Cấu trúc dữ liệu và giải thuật, Kiến trúc máy tính, Lập trình C/C++

Mô tả môn học: Môn học trang bị cho sinh viên khả năng định nghĩa và giải thích các nguyên lý của hệ điều hành. Hiểu về kiến trúc của một hệ điều hành. Khả năng lập trình để giao tiếp với các chức năng và dịch vụ hệ thống

12.26 **IT093IU - Phát triển ứng dụng Web (Web Application Development)**

Số tín chỉ: 4 (3 LT+1TH)

Môn học học trước: Lập trình hướng đối tượng, Nguyên lý Quản Trị Cơ sở dữ liệu

Mô tả môn học: Sử dụng các kiến thức và kỹ năng để phát triển ứng dụng Web dựa trên các tiện ích, công nghệ và môi trường phát triển của Java như HTML, Java Server Page, Java Bean, MVC Model. Ngoài ra còn mở rộng thêm các kiến thức liên quan đến kiến trúc của Java như Ajax và Struts. Môn học này làm nền tảng để sinh viên thực hiện các đề án môn học cũng như luận văn tốt nghiệp theo hướng Web.

12.27 **IT117IU - Bảo mật hệ thống và mạng (System and Network Security)**

Số tín chỉ: 4 (3LT+1TH)

Môn học học trước: Mạng máy tính

Mô tả môn học: Môn học này giới thiệu cho sinh viên các hệ thống mật mã (mã hóa đối xứng và khóa công khai), lý thuyết thông tin cơ bản, xác thực và ủy quyền, bảo mật cơ sở dữ liệu, phần mềm độc hại, tấn công từ chối dịch vụ, hệ thống phát hiện và ngăn chặn xâm nhập, tường lửa, tấn công tràn bộ đệm và bảo mật phần mềm, các tiêu chuẩn giao thức và bảo mật Internet, ứng dụng xác thực Internet và bảo mật không dây.

12.28 **IT134IU - Internet vạn vật (Internet of Things)**

Số tín chỉ: 4 (3LT+1TH)

Môn học học trước: Mạng máy tính

Mô tả môn học:

Môn học giải thích về kiến trúc, thành phần của mạng Internet vạn vật. Sinh viên sẽ được học về các kỹ thuật truyền thông khác nhau, từ tầm gần đến tầm xa như là Bluetooth, Zigbee, Wifi, LoRa, NB-IoT,... Ngoài ra, các kỹ thuật lưu trữ, tổ chức và phân tích dữ liệu còn được học trong môn học này. Sau đó, sinh viên sẽ được học các khái niệm, nguyên lý cơ bản và cấu tạo cơ bản của các hệ thống IoT cho các ứng dụng công nghiệp như y tế, sản xuất, nông nghiệp, v.v..

12.29 **IT074IU – Linh kiện điện tử (Electronics Devices)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Nguyên lý mạch điện 1

Môn học song hành: Thực hành linh kiện điện tử

Môn tương đương: EE090IU

Mô tả môn học: Môn học này cung cấp cho sinh viên kiến thức cơ bản về các thiết bị bán dẫn và mạch vi điện tử, đặc tính của kết nối P-N, điốt Zener và mạch điốt tương tự. Lý thuyết hoạt động của MOSFET và BJT, phân cực và phân tích transistor ở trung tần.

12.30 **IT101IU – Thực hành linh kiện điện tử (Electronics Devices Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Nguyên lý mạch điện 2

Môn học song hành: Linh kiện điện tử

Môn tương đương: EE091IU

Mô tả môn học: Môn học được thiết kế để cung cấp sinh viên kiến thức về các mạch điện tử sử dụng các linh kiện bán dẫn bao gồm: Diod, MOSFE và BJT nhấn mạnh yếu tố thực nghiệm kết hợp mô phỏng máy tính.

12.31 **IT068IU – Nguyên lý mạch điện 1 (Principles of Electrical Engineering I)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Toán 1

Môn học song hành: Thực hành nguyên lý mạch điện 1

Môn tương đương: EE051IU

Mô tả môn học: Môn học được thiết kế để cung cấp sinh viên các kiến thức về các thành phần mạch điện; nguồn độc lập; nguồn phụ thuộc; phân tích mạch một chiều và xoay chiều trạng thái ổn định; lý thuyết mạng điện; khuếch đại thuật toán; tính toán công suất.

12.32 **IT098IU – Thực hành Nguyên lý mạch điện 1 (Principles of Electrical Engineering I Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Toán 1

Môn học song hành: Nguyên lý mạch điện 1

Môn tương đương: EE052IU

Mô tả môn học: Môn học được thiết kế để cung cấp sinh viên các kiến thức về các bài thực hành thí nghiệm về sử dụng thiết bị thí nghiệm: máy đo điện áp, dòng điện, trở kháng, tần số, dạng sóng. Nguyên lí cơ bản về thiết kế và mô hình hóa mạch điện.

12.33 **IT105IU – Thiết kế hệ thống số (Digital System Design)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Thiết kế logic số

Môn học song hành: Thực hành thiết kế hệ thống số

Môn tương đương: EE063IU

Mô tả môn học: Môn học này giới thiệu phương pháp và kỹ thuật để thiết kế hệ thống kỹ thuật số. Các chủ đề bao gồm các khái niệm cơ bản, phân tích và thiết kế hệ thống với các ngôn ngữ mô tả phần cứng (HDL). Khóa học cung cấp cái nhìn sâu sắc về thiết kế các mạch tuần tự không đồng bộ và các hệ thống đồng bộ phức tạp. Quá trình thiết kế được giới thiệu bởi các khái niệm, tài liệu và mô phỏng.

12.34 **IT106IU – Thực hành thiết kế hệ thống số (Digital System Design Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Thiết kế logic số

Môn học song hành: Thiết kế hệ thống số

Môn tương đương: EE117IU

Mô tả môn học: Môn học này này giúp sinh viên hiểu rõ hơn về các kỹ thuật để thiết kế hệ thống kỹ thuật số. Môn học bao gồm các chủ đề phần mềm và phần cứng: Giới thiệu về phần mềm Maxplus II, Bộ đếm, Giới thiệu về VHDL trong Maxplus II, Đồng hồ kỹ thuật số.

12.35 **IT128IU – Hệ thống vi xử lý (Micro-processing Systems)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Thiết kế logic số

Môn học song hành: Thực hành hệ thống vi xử lý

Môn tương đương: EE083IU

Mô tả môn học: Môn học trang bị cho sinh viên những kiến thức cơ bản về: lập trình bằng ngôn ngữ máy và hợp ngữ, kiến trúc và tập lệnh của các hệ vi xử lý, các ứng dụng về thiết kế dùng bộ vi xử lý

12.36 **IT129IU – Thực hành hệ thống vi xử lý (Micro-processing Systems Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Thiết kế logic số

Môn học song hành: Hệ thống vi xử lý

Môn tương đương: EE084IU

Mô tả môn học: Sinh viên sẽ thực hành với các chủ đề sau: ngôn ngữ máy và hợp ngữ, kiến trúc và bộ hướng dẫn; ngăn xếp, chương trình con, I / O và ngắt; nguyên tắc giao thoa ngoại vi; thiết kế với bộ vi xử lý, và các ứng dụng của hệ thống vi xử lý cho một số vấn đề thực tế.

12.37 **IT115IU – Hệ thống nhúng (Embedded Systems)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Thiết kế logic số, Hệ thống vi xử lý

Môn học song hành: Thực hành Hệ thống nhúng

Môn tương đương: EE104IU

Mô tả môn học: Môn học cung cấp cho sinh viên kiến thức về thiết kế các Hệ thống nhúng, cả từ góc độ phần cứng và phần mềm. Trọng tâm chính là xử lý thời gian thực cho các hệ thống xử lý tín hiệu và truyền thông. Các dự án lập trình bằng ngôn ngữ cấp cao như C / C ++ sẽ là một thành phần thiết yếu của khóa học, cũng như thiết kế phần cứng với các công cụ thiết kế hiện đại.

12.38 **IT127IU – Thực hành Hệ thống nhúng (Embedded Systems Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Thiết kế logic số, Hệ thống vi xử lý

Môn học song hành: Hệ thống nhúng

Môn tương đương: EE118IU

Mô tả môn học: Môn học được thiết kế để cung cấp sinh viên các kiến thức về thực hành thí nghiệm thiết kế các Hệ thống nhúng cả về phần cứng và phần mềm. Bao gồm các giao tiếp ngoại vi, các giao thức bus, giao tiếp bộ nhớ ngoài, hệ điều hành Hệ thống nhúng, bộ lập lịch và xử lý ngắt thời gian thực, kết nối mạng hệ thống nhúng.

12.39 **IT110IU – Khái niệm thiết kế VLSI (Concepts in VLSI Design)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Thiết kế logic số, Điện tử kỹ thuật số

Môn học song hành: Thực hành Khái niệm thiết kế VLSI

Môn tương đương: EE066IU

Mô tả môn học: Môn học này cung cấp một giới thiệu về thiết kế chip VLSI kỹ thuật số dựa trên công nghệ CMOS và bao gồm logic xung nhịp động, phân tích thời gian MOSFET và quy tắc thiết kế bố trí. Môn học phát triển việc sử dụng các công cụ phần mềm thiết kế hỗ trợ máy tính cũng như hiểu biết về kiểm tra mạch cơ bản.

12.40 **IT126IU – Thực hành Khái niệm thiết kế VLSI (Concepts in VLSI Design Laboratory)**

Số tín chỉ: 1 (0LT + 1TH)

Môn học học trước: Thiết kế logic số, Điện tử kỹ thuật số

Môn học song hành: Khái niệm thiết kế VLSI

Môn tương đương: EE121IU

Mô tả môn học: Môn học này cung cấp giới thiệu về thiết kế chip VLSI kỹ thuật số dựa trên việc sử dụng các công cụ Khái niệm thiết kế VLSI để thiết kế chip vi xử lý MIPS. Môn học này sử dụng phương pháp học tập, nhấn mạnh vào kinh nghiệm thiết kế thực tế và mô phỏng máy tính.

12.41 **IT103IU – Xử lý tín hiệu số (Digital Signal Processing)**

Số tín chỉ: 3 (3LT + 0TH)

Môn học học trước: Tín hiệu và hệ thống

Môn học song hành: Thực hành xử lý tín hiệu số

Môn tương đương: EE092IU

Mô tả môn học: Môn học này giới thiệu về các nguyên tắc cơ bản, phương pháp và ứng dụng xử lý tín hiệu số, nhấn mạnh các khía cạnh thuật toán, tính toán và lập trình của nó. Nội dung cụ thể bao gồm: chuyển đổi từ analog sang kỹ thuật số, các khái niệm về hệ thống tuyến tính thời gian rời rạc, lọc, phân tích quang phổ của tín hiệu thời gian rời rạc và thiết kế bộ lọc.

12.42 **IT125IU - Quản trị hệ thống mạng (System and Network Administration)**

Số tín chỉ: 4 (3LT+1TH)

Môn học học trước: Mạng máy tính

Mô tả môn học: Môn học này giới thiệu các công nghệ mạng mới, bao gồm các cấu trúc liên kết mạng, các khái niệm triển khai giao thức và kỹ thuật quản lý. Giải thích các yếu tố và công nghệ khác nhau được sử dụng trong mạng doanh nghiệp và cách chúng liên quan với nhau. Tập trung vào các khái niệm và nguyên tắc cơ bản. Cung cấp một nền tảng kỹ thuật vững chắc để điều hướng quản lý mạng một cách thành công và áp dụng các khái niệm trên cho các tình huống cụ thể.

12.43 **IT120IU - Khởi nghiệp (Entrepreneurship)**

Số tín chỉ: 3 (3LT)

Môn học học trước: không

Mô tả môn học: Môn học cung cấp kiến thức về khởi tạo doanh nghiệp, tư duy sáng tạo để đưa ra sản phẩm, dịch vụ mới có liên quan đến công nghệ. Vai trò của doanh nghiệp trẻ trong nền kinh tế và cách quản lý doanh nghiệp để khơi nguồn ý tưởng sáng tạo trong nhóm làm việc. Xây dựng và biến ý tưởng kinh doanh thành hiện thực.

12.44 **ITxxxIU - Thực tập Công nghiệp cho kỹ sư (Internship for Engineers)**

Số tín chỉ: 7 (0 LT+7TH)

Điều kiện tiên quyết: sinh viên năm 3 trở lên

Mô tả môn học: Môn học nhằm tạo điều kiện cho sinh viên có cơ hội tiếp xúc với môi trường thực tế, nhằm để giải quyết những vấn đề thực tiễn trong sản xuất, cuộc sống hàng ngày. Nội dung chủ yếu bao gồm: xây dựng và quản trị hệ thống thông tin bằng web hoặc ứng dụng; tin học hóa các công tác văn phòng, công việc hang ngày; thiết kế, cài đặt vận hành mạng máy tính cho các doanh nghiệp, tổ chức. Tìm hiểu và ứng dụng các công nghệ mới.

12.45 **IT083IU- Thực tập tốt nghiệp (Special Study of the Field)**

Số tín chỉ: 3 (0 LT+3TH)

Điều kiện tiên quyết: đủ số tín chỉ theo quy định

Mô tả môn học: Môn học nhằm hướng dẫn sinh viên đến việc tìm hiểu phương pháp giải quyết một vấn đề tổng hợp thực tế. Nội dung hướng dẫn chủ yếu bao gồm: phương pháp tiếp cận vấn đề, các bước trong quá trình tìm hiểu vấn đề, các phương pháp tìm hiểu những giải pháp, các bước hoạch định, đề xuất giải pháp cho vấn đề

12.46 **IT058IU - Luận văn tốt nghiệp (Thesis)**

Số tín chỉ: 10 (0LT+10TH)

Điều kiện tiên quyết: Thực tập tốt nghiệp

Mô tả môn học: Đây là các đề tài có tính thực tiễn hoặc có tính khoa học cao, được thiết kế để bảo đảm sinh viên nắm và vận dụng được những kiến thức đã học trong chương trình. Sinh viên sẽ làm việc theo nhóm để thu thập yêu cầu, thiết kế, cài đặt và cung cấp giải pháp cho các vấn đề thực tế. Sinh viên có thể sử dụng mô hình thích hợp, phải tự quản lý

chính đề án đố, theo các kỹ thuật quản lý đề án đã học. Kết quả của luận văn có thể là sản phẩm theo yêu cầu và các tài liệu liên quan.

12.47 **IT139IU - Tính toán phân tán (Scalable and Distributed Computing)**

Mã MH: IT139IU

Số tín chỉ: 4 (3,1)

Môn học trước: Không

Mô tả vắn tắt nội dung: Khóa học này trình bày lý thuyết, thiết kế, hiện thực, và phân tích các hệ thống phân bố. Thông qua các bài giảng lớp học, phòng thí nghiệm, dự án và bài tập, sinh viên có thể học các nguyên tắc cơ bản của hệ thống phân bố, mô hình hệ thống, gọi thủ tục từ xa, các đối tượng phân bố, hỗ trợ hệ điều hành, bảo mật trong các hệ thống phân bố, các hệ thống tập tin phân bố, đồng thời, giao dịch và đồng bộ hóa, sao chép. Khóa học cũng bao gồm các chủ đề nâng cao liên quan đến công nghệ xử lý dữ liệu phân bố và đám mây: phân vùng dữ liệu, sơ đồ lưu trữ, xử lý luồng, và các thuật toán song song. Các giờ thực hành của khóa học cho phép khai thác Internet và các dịch vụ điện toán đám mây hiện đại chạy trên nhiều trung tâm dữ liệu được phân bố theo địa lý: Google, Yahoo, Facebook, iTunes, Amazon, eBay, Bing, v.v ...

12.48 **IT154IU - Đại số tuyến tính (Linear algebra)**

Mã MH: IT154IU

Số tín chỉ: 3 (3,0)

Môn học trước: Toán 1

Mô tả vắn tắt nội dung: Đại số tuyến tính cung cấp một khuôn khổ toán học để tổ chức thông tin và sau đó sử dụng thông tin đó để giải quyết các vấn đề, đặc biệt là các vấn đề phân tích dữ liệu. Đại số tuyến tính rất cần thiết để hiểu và tạo ra các thuật toán học máy, đặc biệt là mạng thần kinh và các mô hình học sâu.

Khóa học này sẽ cung cấp cho sinh viên kiến thức đại số tuyến tính cần thiết cho học máy và mô hình mạng thần kinh. Học sinh sẽ tìm hiểu tổng quan về ma trận cơ bản và đại số vector như được áp dụng cho các hệ thống tuyến tính. Sau đó, họ sẽ học cách thao tác ma trận để có được kiến thức hữu ích từ dữ liệu, định lượng mức độ học tập và tối ưu hóa tốc độ học tập trong không gian vector và chuyển đổi tuyến tính để khám phá dữ liệu. Các bài học và bài tập thực hành sẽ trang bị cho sinh viên nền tảng toán học cần thiết để xây dựng và đào tạo các mạng thần kinh đơn giản trong các ứng dụng khai thác dữ liệu.

12.49 **PE021IU - Pháp luật đại cương**

Mã MH: PE021IU

Số tín chỉ: 3 (3,0)

Môn học trước: Không

Mô tả vắn tắt nội dung:

12.50 **IT159IU - Trí thông minh nhân tạo (Artificial intelligence)**

Số tín chỉ : 4 (3LT + 1TH)

Môn học trước: Đại số tuyến tính , Lập trình hướng đối tượng

Mô tả môn học: Môn học nhằm cung cấp một cách tiếp cận kỹ thuật vào các khái niệm cơ bản trong lĩnh vực trí tuệ nhân tạo. Nội dung cụ thể bao gồm: lịch sử trí tuệ nhân tạo, các tác tử, các phương pháp tìm kiếm (tìm kiếm trên không gian trạng thái, tìm kiếm có thông tin và tìm kiếm không có thông tin, tìm kiếm thỏa mãn ràng buộc hoặc tìm kiếm cho trò chơi), biểu diễn tri thức (biểu diễn tri thức cụ thể bằng logic, hệ thống lập luận bằng logic), hoạch định, và ngôn ngữ Lisp. Môn học này thích hợp cho sinh viên nào muốn có một kiến thức cơ bản vững chắc về trí tuệ nhân tạo hoặc chuẩn bị cho những phát triển sâu hơn trong lĩnh vực Trí tuệ nhân tạo.

12.51 **IT155IU – Tối ưu hóa và ứng dụng (Optimization and Applications, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình C/C++**,** Lập trình hướng đối tượng

Mô tả môn học: Tối ưu hóa, đặc biệt là tối ưu hóa lồi, được ứng dụng trong nhiều lĩnh vực như khoa học dữ liệu, khoa học máy tính, kinh tế, kỹ thuật, hậu cần, v.v.. Môn học giới thiệu các mô hình tối ưu hóa của nhiều ứng dụng khác nhau trong học máy, phân bổ nguồn lực, v.v.. Lý thuyết nền tảng của các thuật toán lặp giải các bài toán như gradient descent, mini-batch stochastic gradient descent, subgradient method, proximal gradient descent, v.v. được giảng dạy. Môn học cũng bao gồm lập trình tuyến tính (LP). Một số ứng dụng LP như luồng tối đa – cắt tối thiểu, vận chuyển, đường đi ngắn nhất,… được đề cập.

12.52 **IT024IU - Đồ hoạ máy tính (Computer Graphics, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình C/C++**,** Lập trình hướng đối tượng

Mô tả môn học:

Triển khai các giải thuật và ngôn ngữ cho việc tương tác trong đồ hoạ máy tính. Các khái niệm về hệ trục toạ độ trong không gian 2 chiều, 3 chiều, không gian véc tơ đường cong, bề mặt được sinh ra từ việc thiết kế, bố trí xây dựng các đối tượng đồ hoạ. Ngoài ra còn phát triển các mô hình kết hợp camera để tạo ảnh và xử lý ảnh.

12.53 **IT056IU - Quản trị Dự án Công nghệ thông tin (IT Project Management, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình hướng đối tượng

Mô tả môn học:

Soạn đề cương kế hoạch dự án. Phỏng vấn và chuẩn bị yêu cầu khách hàng. Ước tính chi phí, thời gian, nhân lực để hoàn tất dự án. Quản lý công đoạn thiết kế và lập trìng hệ thống. Kiểm soát chất lượng: thử nghiệm phần mềm, kiểm soát yêu cầu khách hàng.

12.54 **IT076IU - Công nghệ phần mềm (Software Engineering)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình hướng đối tượng

Mô tả môn học:

Môn học giới thiệu quy trình công nghệ phần mềm. Khảo sát hoạt động doanh nghiệp. Thảo luận với khách hàng về yêu cầu. Chọn công nghệ thiết kế. Phân tích hệ thống theo hướng đối tượng. Thiết kế và lập trình dự án.

12.55 **IT090IU- Phân tích và thiết kế hướng đối tượng (Object Oriented Analysis and Design)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình hướng đối tượng

Mô tả môn học:

Mô hình hóa hệ thống. Các khái niệm về phân tích và thiết kế hệ thống. Chu kỳ phát triển sản phẩm. Quy trình hợp nhất và những công đoạn thực hiện như: lấy yêu cầu, phân tích, thiết kế, hiện thực và kiểm thử. Nội dung nâng cao bao gồm cơ sở dữ liệu hướng đối tượng, mẫu thiết kế, lập trình Extreme.

12.56 **IT092IU - Nguyên lý Ngôn ngữ lập trình (Principle of Programming Languages)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Môn học nhằm làm cho người học quen thuộc với một số khái niệm cơ bản của các ngôn ngữ lập trình, từ đó nâng cao khả năng tiếp thu các ngôn ngữ lập trình khác. Các kiểu ngôn ngữ lập trình khác nhau (chẳng hạn như ngôn ngữ lập trình luận lý, ngôn ngữ lập trình chức năng, ngôn ngữ lập trình thủ tục, ngôn ngữ lập trình hướng đối tượng) cũng được so sánh và các phương pháp cài đặt cũng được tìm hiểu và thảo luận.

12.57 **IT114IU – Kiến trúc phần mềm (Software Architecture, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: không.

Mô tả môn học:

Cung cấp cho sinh viên sự hiểu biết thấu đáo về các phương pháp và kỹ thuật khác nhau trong phân tích, thiết kế và triển khai hệ thống thông tin bằng cách sử dụng UML.

12.58 **IT160IU – Khai thác Dữ liệu (Data Mining, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: Lập trình hướng đối tượng

Mô tả môn học:

Môn học này giới thiệu cho sinh viên các nguyên lý, thuật toán khai phá dữ liệu, yêu cầu của một quá trình khai phá dữ liệu. Học sinh sẽ nghiên cứu các khái niệm và thuật toán khai thác dữ liệu để giải quyết các vấn đề khám phá tri thức. Học sinh có thể phát triển các kỹ năng sử dụng phần mềm khai thác dữ liệu gần đây để giải quyết các vấn đề thực tế và tích lũy kinh nghiệm thực hiện nghiên cứu và học tập độc lập.

12.59 **IT133IU - Phát triển ứng dụng di động (Mobile Application Development, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: Phân tích và thiết kế hướng đối tượng

Mô tả môn học:

Khóa học này được thiết kế nhằm giới thiệu và làm quen với sinh viên về lập trình trên môi trường di động: Nền tảng Android sẽ được sử dụng trong suốt khóa học. Khóa học bắt đầu với phần giới thiệu về các thành phần, khái niệm, cấu trúc cơ bản của ứng dụng Android sau đó tiếp tục với các thành phần giao diện người dùng phổ biến, lưu trữ liên tục,

cơ sở dữ liệu cho thiết bị di động, v.v. Giới thiệu về hầu hết các công cụ và công cụ phổ biến kỹ thuật viết ứng dụng Android cũng được kèm theo bằng tay về kinh nghiệm dưới dạng dự án lập trình bài tập trong phòng thí nghiệm.

12.60 **IT138IU – Trực quan hóa dữ liệu (Data Science and Visualization, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Mục tiêu của khóa học này là giới thiệu cho sinh viên các nguyên tắc, phương pháp và kỹ thuật chính để phân tích dữ liệu trực quan một cách hiệu quả. Khóa học bắt đầu với mục tiêu và nguyên tắc chính của trực quan hóa dữ liệu. Khóa học tiếp tục với các khía cạnh khác nhau của trực quan hóa bao gồm các kỹ thuật và phương pháp trình bày các loại dữ liệu khác nhau cũng như thảo luận và phân tích trực quan hóa. Xuyên suốt khóa học, học viên sẽ được làm quen với nhiều hệ thống trực quan và công cụ trực quan thông qua các bài tập thực hành.

12.61 **Khái niệm cơ bản về bảo mật dữ liệu (Fundamental Concepts of Data Security)**

- **Mã MH:** IT140IU
- **Số tín chỉ:** 4 (3,1)
- **Môn học trước:** Không
- **Mô tả vắn tắt nội dung:** Khóa học này giới thiệu cho sinh viên về các nguyên tắc và hệ thống mật mã (đối xứng và mã khóa công khai), và các ứng dụng của chúng trong bảo mật dữ liệu, truyền thông an toàn, chứng thực và ủy quyền. Những nguyên tắc cốt lõi này sẽ được áp dụng cho các khái niệm quản lý rủi ro thông tin, phân tích và xử lý các hệ thống bị xâm nhập. Các đạo đức về tội phạm máy tính, quyền riêng tư và sở hữu trí tuệ được đề cập chi tiết. Cuối cùng, khóa học sẽ bao gồm các tiêu chí và các điều khiển để phân loại thông tin.

12.62 **Phân Tích Quy Trình Nghiệp Vụ (Business Process Analysis)**

- Mã MH: IT144IU
- Số tín chỉ: 4 (3,1)
- Môn học trước: Không

- Mô tả vắn tắt nội dung: Mỗi tổ chức phát triển mạnh việc thực hiện các quy trình kinh doanh hiệu quả để tăng nhân viên và sự hài lòng của khách hàng, tăng cường hiệu suất kinh doanh, giảm chi phí và tăng năng suất. Tất cả các hoạt động bao gồm thay đổi các quy trình quan trọng, sáp nhập hoặc chia tách đơn vị kinh doanh yêu cầu một khung quản lý thống nhất về những thay đổi. Khóa học nhằm cung cấp kiến thức cơ bản về phân tích quá trình kinh doanh, cải tiến và đánh giá. Nhiều phương pháp, kỹ thuật và công cụ phần mềm được sử dụng để phân tích và quản lý cải tiến quá trình kinh doanh cũng được giới thiệu trong khóa học.

12.63 **Hệ Thống Hỗ Trợ Quyết Định (Decision Support Systems)**

- Mã MH: IT145IU

- Số tín chỉ: 4 (3,1)

- Môn học trước: Lập trình hướng đối tượng

- Mô tả vắn tắt nội dung: Hệ thống Hỗ trợ Quyết định (DSS) là một hệ thống dựa trên máy tính tương tác hoặc hệ thống con nhằm giúp các nhà hoạch định chính sách sử dụng công nghệ truyền thông, dữ liệu, tài liệu, kiến thức và / hoặc mô hìn h để xác định và giải quyết các vấn đề, hoàn thành các tác vụ xử lý quyết định, và làm quyết định. DSS mô phỏng các chức năng quyết định nhận thức của con người dựa trên phương pháp luận trí tuệ nhân tạo (bao gồm hệ thống chuyên gia, khai thác dữ liệu, máy học, kết nối, lý luận logic, vv) để thực hiện các chức năng hỗ trợ quyết định. DSS là một thuật ngữ chung cho bất kỳ ứng dụng máy tính nào để trợ giúp một người hoặc nhóm khả năng đưa ra quyết định. Ngoài ra, DSS đề cập đến một lĩnh vực nghiên cứu bao gồm việc thiết kế và nghiên cứu DSS trong bối cảnh sử dụng.

12.64 **IT150IU – Chuỗi khối (Blockchain, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Môn học này giới thiệu cho sinh viên nền tảng của công nghệ chuỗi khối và các ứng dụng của nó. Học sinh sẽ nghiên cứu các khái niệm và nguyên tắc blockchain hoạt động như thế nào. Khóa học này bao gồm các chủ đề liên quan đến không gian chuỗi khối. Khóa học bắt đầu với những điều cơ bản về chuỗi khối, mật mã, hiểu biết cơ bản về bitcoin. Sau đó, các ứng dụng của công nghệ blockchain được giới thiệu trong các lĩnh vực tài chính, y tế, chuỗi cung ứng, v.v. Một bức tranh hoàn chỉnh về hệ sinh thái xung quanh công nghệ blockchain và các xu hướng phát triển cũng được thảo luận.

12.65 **IT156IU – Phát triển và vận hành liên tục (Development & Operation, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Khóa học này là phần giới thiệu về DevOps nhằm giúp sinh viên hiểu các nguyên tắc và thực tiễn của nó. Các khái niệm và thuật ngữ chính sẽ được đề cập bằng các nghiên cứu điển hình, ví dụ và bài tập thực tế trong đời thực. Các công cụ phổ biến và phổ biến để đạt được mô hình DevOps cũng sẽ được giới thiệu.

12.66 **IT157IU – Học sâu (Deep Learning, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: khônG

Mô tả môn học:

Khóa học này giúp sinh viên hiểu được các khả năng, kỹ thức và hậu quả của việc học sâu và chuẩn bị cho sinh viên tham gia phát triển công nghệ AI hàng đầu.

12.67 **IT158IU – UI Design and Evaluation (môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Khóa học này cung cấp cho sinh viên các nguyên tắc tương tác cơ bản giữa con người và máy tính.

12.68 **IT131IU – Theoretical Models in Computing (môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Khóa học này hướng đến những sinh viên đại học cần có kiến thức làm việc về các phương pháp số. Các chủ đề được đề cập bao gồm giải phương trình phi tuyến và hệ tuyến tính, phương pháp nội suy và bình phương tối thiểu, đánh giá bằng số của đạo hàm, tích phân và nghiệm của phương trình vi phân.

12.69 **IT164IU – Điện toán đám mây (Cloud Computing, môn tự chọn)**

Số tín chỉ: 4 (3LT + 1TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Khóa học này tập trung vào các kỹ thuật lập trình song song cho điện toán đám mây và các hệ thống phân tán quy mô lớn tạo thành cơ sở hạ tầng đám mây. Các chủ đề bao gồm tổng quan về điện toán đám mây, hệ thống đám mây, xử lý song song trên đám mây, hệ thống lưu trữ phân tán, ảo hóa, bảo mật trong đám mây và hệ điều hành đa lõi. Sinh viên sẽ nghiên cứu các giải pháp tiên tiến nhất cho điện toán đám mây do Google, Amazon, Microsoft, Yahoo, VMWare, v.v. phát triển. Sinh viên cũng sẽ áp dụng những gì học được vào một bài tập lập trình và một dự án được thực hiện trên Amazon Web Services.

12.70 **IT165IU – Công nghệ và Triển khai bảo mật (Security Technology and Implementation, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: Computer Network

Mô tả môn học:

Môn học giới thiệu cho sinh viên nguyên lý của an toàn thông tin, hệ thống mật mã hóa

(mã hóa đối xứng và mã hóa công cộng), quản lý rủi ro, an toàn cho kiến trúc và thiết kế,an toàn trong vận hành kinh doanh liên tục, kiểm soát truy cập, bảo vệ màng TCP/IP, tường lửa, mạng ảo, IPSec, an toàn trong phát triển phần mềm.

12.71 **IT166IU – Kiểm tra chất lượng phần mềm (Software Quality Verification and Validation, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: IT069IU (3,1) Object-Oriented Programming

Mô tả môn học:

Giới thiệu về xác minh, xác nhận và thử nghiệm phần mềm. Các chiến lược và kỹ thuật được trình bày để kiểm thử phần mềm cũng như lập kế hoạch kiểm thử phần mềm.

12.72 **IT167IU – Phát triển ứng dụng game (Game Application Development, môn tự chọn)**

Số tín chỉ: 4 (3LT+1TH)

Điều kiện tiên quyết/Môn học trước: IT069IU (3,1) Object-Oriented Programming

Mô tả môn học:

Khóa học này là phần giới thiệu về lý thuyết và thực hành về quá trình thiết kế trò chơi và trải nghiệm vui chơi. Sinh viên được làm quen với các phương pháp, khái niệm, kỹ thuật và tài liệu được sử dụng trong việc thiết kế trò chơi. Chiến lược này hướng đến quy trình, tập trung vào các khía cạnh như: Tạo mẫu nhanh, thử nghiệm trò chơi và lặp lại thiết kế bằng cách sử dụng phương pháp lấy người chơi làm trung tâm.

12.73 **PE008IU – Tư duy Phản biện (Critical Thinking, môn tự chọn)**

Số tín chỉ: 3 (3LT+0TH)

Điều kiện tiên quyết/Môn học trước: không

Mô tả môn học:

Tư duy phê phán nghiên cứu một quá trình không thể thiếu đối với tất cả những người có học thức - quá trình chúng ta phát triển và ủng hộ niềm tin của mình cũng như đánh giá sức mạnh của những lập luận của người khác trong các tình huống thực tế. Nó bao gồm thực hành về lý luận quy nạp và suy diễn, trình bày các lập luận dưới dạng nói và viết và phân tích việc sử dụng ngôn ngữ để tác động đến suy nghĩ. Khóa học cũng áp dụng quy trình suy luận vào các lĩnh vực khác như kinh doanh, khoa học, luật, khoa học xã hội, đạo đức và nghệ thuật.

TRƯỞNG KHOA

Nguyễn Văn Sinh

KT. HIỆU TRƯỞNG
PHÓ HIỆU TRƯỞNG

ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC QUỐC TẾ

Đinh Đức Anh Vũ

ĐẠI HỌC QUỐC GIA
THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC QUỐC TẾ

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập – Tự do – Hạnh phúc

Phụ lục I

NỘI DUNG ĐIỀU CHỈNH CHƯƠNG TRÌNH ĐÀO TẠO
NGÀNH CÔNG NGHỆ THÔNG TIN KHÓA 2024 SO VỚI KHÓA 2023

(Kèm theo Quyết định số: 776 /QĐ-ĐHQT ngày 11 tháng 7 năm 2024
của Hiệu trưởng trường Đại học Quốc tế)

Đối với cả hai chuyên ngành Kỹ thuật mạng và Kỹ thuật máy tính:

- Tăng số tín chỉ môn Thực tập Công Nghiệp từ 03 lên 07 tín chỉ. Đổi tên môn thành Thực tập công nghiệp cho kỹ sư để phân biệt với môn thực tập công nghiệp 03 tín chỉ trước đây.
- Hủy các môn Vật lý 02 (PH014IU, 2 tín chỉ) và Vật lý 04 (PH012IU, 2 tín chỉ).

Việc thay đổi này đã được phê duyệt bởi Hội đồng Khoa học cấp Khoa và Hội đồng Khoa học và Đào tạo cấp Trường. Tổng số tín chỉ của các chương trình không đổi.

ĐẠI HỌC QUỐC GIA
THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC QUỐC TẾ

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập – Tự do – Hạnh phúc

Phụ lục II

ĐỀ CƯƠNG CHI TIẾT CÁC MÔN HỌC

(Kèm theo Quyết định số: 776 / QĐ-ĐHQT ngày 11 tháng 7 năm 2024 của Hiệu trưởng trường Đại học Quốc tế)

Quy đổi tín chỉ ECTS cho các môn học trong phụ lục này như sau:

- Đối với nhóm các môn Thực tập, khóa luận/luận văn tốt nghiệp (Internship, Special ststudy of the field, và Thesis):

1 tín chỉ = 1,64 ECTS

- Đối với tất cả các môn khác:

1 tín chỉ lý thuyết = 3,55 ECTS,
1 tín chỉ thực hành =3,55 ECTS

Course Name: Introduction to Computing

Course Code: IT064

1. General information

<table>
<tr><td>Course designation</td><td>This course introduces students to a broad knowledge of the computer science and information technology fields. Topics covered will include basic computer concepts, components of computer hardware and operating systems software as well as data and telecommunications systems. Students can use the knowledge they've gained to strengthen their future-oriented job.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>1,3</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Nguyen Trung Ky</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 135 hours.
Contact hours: 45 hours (lecture).
Private study including examination preparation, specified in hours: 90 hours.</td></tr>
<tr><td>Credit points</td><td>Number of credits: 3
Lecture: 3
Laboratory: 0</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>None</td></tr>
<tr><td>Course objectives</td><td>This course is to provide fundamentals and basic concepts of computer science and engineering, basics of Computing such as basic concepts, models, trends in industry. Introduction to majors and curricula, career path of all majors in computing, career orientation, job requirements and career opportunities in industry are also included in this course.</td></tr>
<tr><td>Course learning outcomes</td><td><table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1, CLO2.</td></tr><tr><td>Skill</td><td>CLO3, CLO4.</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>Attitude</td><td>CLO5.</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>The Overall Picture</td><td>1</td><td>I</td></tr><tr><td>Data and Information</td><td>2</td><td>T, U</td></tr><tr><td>Hardware</td><td>2</td><td>T, U</td></tr><tr><td>Algorithm and Programming Language</td><td>2</td><td>T, U</td></tr><tr><td>Operating System</td><td>2</td><td>T, U</td></tr><tr><td>Networking</td><td>2</td><td>T, U</td></tr><tr><td>Information System and Application</td><td>2</td><td>T, U</td></tr><tr><td>Majors and Curriculum, Career Paths and Orientation Careers at a Hardware, Network and Software Company</td><td>1</td><td>I</td></tr><tr><td>Revision</td><td>1</td><td></td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Nell Dale and John Lewis, “Computer science: Illuminated”, 7th Edition, Jones & Bartlett Learning Publisher, ISBN-13 978-1284155617, 2019.
[2] J. Glenn Brookshear, “Computer Science: An Overview”, 12th Edition, Pearson Publisher, ISBN-13 978-0133760064, 2014.
[3] Peter Wentworth, Jeffrey Elkner, "How to Think Like a Computer Scientist: Learning with Python 3 Documentation", 3rd Edition, Allen B. Downey and Chris Meyers, Green Tea Press Publisher, ISBN-13 978-0971677500, 2020.</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

<table>
<tr><td></td><td>SLO</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

CLO	1	2	3	4	5	6
1	X			X		
2	X			X		
3	X					
4	X					
5					X	

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	The Overall Picture	1		Lecture, Discussion	[1]. Chapter 1
2	Binary Values and Number System	1, 2	Quiz.	Lecture, In-class quiz	[1]. Chapter 2
3	Data Representation	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 3
4	Gates and Circuits	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 4
5	Computing Components	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 5
6	Low-level Programming Languages and Pseudocode	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 6
7	**Midterm**				
8	Problem Solving and Algorithm, Abstract Data Types and Subprograms	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 7,8
9	Object-oriented Design and High-level Programming Languages	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 9
10	Operating System and File System and Directory	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 10, 11
11	Information System, Artificial Intelligence	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 12, 13
12	Simulation, Graphics, Gaming, and Other Programming Networks	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 14, 15

13	The World Wide Web Computer Security	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 16, 17
14	Majors and Curriculum, Career Paths and Orientation, Careers at Hardware, Network and Software Company	3, 4		Lecture, Discussion	
15	Revision			Review-test	
16	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO 1**	**CLO 2**	**CLO 3**	**CLO 4**	**CLO 5**
Quiz (10%)	25%	25%	33.3 %	33.3 %	25%
Midterm examination (30%)	25%	25%			25%
Projects/Presentations/ Report (20%)	25%	25%	33.3 %	33.3 %	25%
Final examination (40%)	25%	25%	33.3 %	33.3 %	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined,	Issue/ problem to be considered critically is stated without clarification or description.

			and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis)	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	acknowledged within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/

	presenter's credibility/ authority on the topic.	authority on the topic.	authority on the topic.	authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: C/C++ Programming

Course Code: IT116

1. General information

<table>
<tr><td>Course designation</td><td>Learning the basics of programming</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>2</td></tr>
<tr><td>Person responsible for the course</td><td>MSc. Le Thanh Son</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CS, NE, CE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>None</td></tr>
<tr><td>Course objectives</td><td>This course concentrates on learning the basics of programming languages which are the foundations for further studies in IT. The course enables students to get familiar with C programming language. The course covers all basic C data structures, control flows, simple data structures as well as other advanced topics which include pointers, bit operators, file processing, dynamic data types.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand programming languages and applications, how applications work
CLO 2. Understand basic data structure and control flow of C programming language
CLO 3. Able to write applications using C
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1</td></tr>
<tr><td>Skill</td><td>2, 3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Computer and Programming Language</td><td>1</td><td>I</td></tr>
<tr><td>Introduction to C Programming Language</td><td>1</td><td>I, T</td></tr>
<tr><td>C Basic Data Types</td><td>1</td><td>T, U</td></tr>
<tr><td>Control Flow: Branching statements</td><td>1</td><td>T, U</td></tr>
<tr><td>Control Flow: Iteration</td><td>1</td><td>T, U</td></tr>
<tr><td>Functions</td><td>1</td><td>T, U</td></tr>
<tr><td>Array</td><td>1</td><td>T, U</td></tr>
<tr><td>Pointers</td><td>1</td><td>T, U</td></tr>
<tr><td>String</td><td>1</td><td>T, U</td></tr>
<tr><td>File Processing</td><td>1</td><td>T, U</td></tr>
<tr><td>Dynamic Memory Allocation</td><td>1</td><td>T, U</td></tr>
<tr><td>Struct, Union</td><td>1</td><td>T, U</td></tr>
<tr><td>Bitwise Operation</td><td>1</td><td>T, U</td></tr>
<tr><td>Linked list, Stack, Queue</td><td>1</td><td>T, U</td></tr>
<tr><td>Binary tree</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions, Programming exercises</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Paul Deitel, C How to Program 8th, 2016</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLOT	1	2	3	4	5	6
1	x					
2		xxx				
3		xxx				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Computer and Programming Language	1	Quiz	Lecture	1
2	Introduction to C Programming Language	1	Quiz	Lecture	1
3	C Basic Data Types	1	Quiz	Lecture	1
4	Control Flow: Branching statements	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
5	Control Flow: Iteration	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
6	Functions	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
7	Array	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
8	Pointers	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
Midterm					
9	String	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
10	File Processing	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
11	Dynamic Memory Allocation	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
12	Struct, Union	2, 3	Quiz, Lab, Final	Lecture, Discussion	1

				, In-class Exercise	
13	Bitwise Operation	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
14	Linked list, Stack, Queue	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
15	Binary tree	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
Final					

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz / Assigment (10%)	50%	10%	10%
Labs (20%)	10%	30%	30%
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	10%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			

Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	(perspective, thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/

	presenter's credibility/ authority on the topic.	authority on the topic.	authority on the topic.	authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Object-Oriented Programming

Course Code: IT069IU

1. **General information**

<table>
<tr><td>Course designation</td><td>This subject introduces students to the object-oriented programming from basic notions to professional principles for designing an object-oriented software.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>3</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Tran Thanh Tung</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (all programs)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Prerequisite course of OOP: C/C++ Programming</td></tr>
<tr><td>Course objectives</td><td>Introduction to object-oriented programming and design. Topics include core terminologies and basic design principles of object-oriented programming such as classes, objects, abstraction, encapsulation, inheritance, polymorphism, the SOLID design principles, and design patterns</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Explain and use concepts in object-oriented programming including classes, objects, abstraction, encapsulation, inheritance, and polymorphism.
CLO 2. Implement an object-oriented solution in JAVA programming language.
CLO 3. Analyze design principles and design patterns in object-oriented programing

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1</td></tr><tr><td>Skill</td><td>CLO2, CLO3</td></tr><tr><td>Attitude</td><td></td></tr></table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Java</td><td>3</td><td>I</td></tr>
<tr><td>Introduction to Object-Oriented Programming</td><td>3</td><td>I, T</td></tr>
<tr><td>Classes and Objects</td><td>3</td><td>T</td></tr>
<tr><td>Inheritance and composition</td><td>3</td><td>T</td></tr>
<tr><td>Polymorphism</td><td>3</td><td>T</td></tr>
<tr><td>Design with interfaces and abstract classes</td><td>3</td><td>T</td></tr>
<tr><td>Building Objects</td><td>3</td><td>T</td></tr>
<tr><td>Exception handling</td><td>3</td><td>T</td></tr>
<tr><td>Generic classes and methods</td><td>3</td><td>T</td></tr>
<tr><td>Introduction to SOLID principles
Single responsibility principle</td><td>3</td><td>T, U</td></tr>
<tr><td>Open/closed principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Lisko substitution principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Interface segregation principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Dependency inversion principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Reusing Designs Through Design Patterns</td><td>6</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Paul J. Deitel (Author), Harvey Deitel (Author), Java How To Program, 11th Edition, Prentice Hall, 2017
2. Matt Weisfeld, The Object-Oriented Thought Process, 3rd Edition, Addison-Wesley, 2009
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional, 1994
4. Eric Freeman, Bert Bates, Kathy Sierra and Elisabeth Robson, Head First Design Patterns: A Brain-Friendly Guide, O'Reilly Media, 2004</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XX					
2		XX				X

3		XXX				X

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Java	1	Quiz	Lecture	[1]
2	Introduction to Object-Oriented Programming	1	Quiz	Lecture, Discussion	[1,2]
3	Classes and Objects	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
4	Inheritance and composition	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
5	Polymorphism	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
6	Design with interfaces and abstract classes	2,3	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
7	Building Objects	2,3	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
8	Exception handling	1,2	Quiz	Lecture	[1]
9	**Midterm**				
10	Generic classes and methods	2,3	Quiz, Lab, Final	Lecture, Discussion, In-class exercises	[1,2]
11	Introduction to SOLID principles Single responsibility principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
12	Open/closed principle Lisko substitution principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
13	Interface segregation principle Dependency inversion principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]

14	Reusing Designs Through Design Patterns, part 1	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
15	Reusing Designs Through Design Patterns, part 2	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
16	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz (5%)	10%		20%
Labs (10%)	30%	30%	
Midterm examination (30%)	50%	40%	
Projects/Presentations/ Report (15%)	10%		30%
Final examination (40%)		30%	50%

5. **Rubrics (optional)**

5.1. **Grading checklist**

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW

Score	Description
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

	questioned thoroughly.	subject to questioning.	of experts are taken as mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Discrete Mathematics

Course Code: IT153

1. **General information**

Course designation	The course provides students the ability to reason and think mathematically and logically; and apply this ability to analyze and solve discrete practical problems in Computer Science and IT.
Semester(s) in which the course is taught	4
Person responsible for the course	Assoc. Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	Compulsory (NE, CE, CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits : 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	C/C++ Programming Calculus 1, 2
Course objectives	This course provides students the based knowledge of discrete mathematics. To develop the ability to reason and think mathematically and logically; and to apply this ability to analyzing and solving discrete practical problems in computer science. This is an application-oriented course based upon the study of events that occur in small, or discrete in computer science, segments in business, industry, government and the digital areas. Students will be introduced to the mathematical tools of logic and set theory, counting, number theory, and graph theory. Practical applications will be introduced throughout the course
Course learning outcomes	CLO 1. Understand and apply count/enumerate objects in a systematic way. CLO 2. Understand mathematical reasoning in order to read, comprehend and construct mathematical arguments; Understand to work with discrete structures and practical problems in computer science and IT

<table>
<tr><td></td><td>CLO 3. Apply algorithm thinking and modeling; Apply knowledge in computer science for problems solving
CLO 4. Have a sense of preparation of good mathematical knowledges to approach and solve problems in computer science and information technology.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1, CLO2</td></tr><tr><td>Skill</td><td>CLO2, CLO3</td></tr><tr><td>Attitude</td><td>CLO4</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Week 1: Course syllabus and introduction; Logic and propositions</td><td>3</td><td>I,T</td></tr><tr><td>Week 2: Logic and propositions (continue)</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 3: Propositional Equivalences; predicates and quantifiers</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 4: Nested Quantifiers and Methods of Proof</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 5: Induction and recursion</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 6&7: Number of theory</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 8: Counting: part 1, 2; midterm review</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 9: Counting: part 3</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 10: Advanced counting</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 11: Boolean algebras</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 12: Graph theory</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 13: Optimal problem solving on graphs</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 14: Introduction and application of tree</td><td>3</td><td>I,T,U</td></tr><tr><td>Week 15: Search on tree; review for final exam</td><td>3</td><td>I,T,U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.</td></tr>
</table>

	Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	1. Kenneth H. Rosen, Discrete Mathematics and Its Applications 8th edition, 2019. 2. Oscar Levin, Discrete mathematics An Open Introduction. 3rd edition, 2019. 3. Vietnamese book: N.V.Sinh, T.M.Hà, N.T.T.Sang, N.M.Quân, "Nền tảng Toán học trong Công nghệ Thông tin", NXB - Đại học Quốc gia TPHCM, ISBN: 978-604-73-6518-0, 2018.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2	X	X				
3		X				
4						X

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Course syllabus and introduction; Logic and propositions	1,2	Questions and answers	Lecture, Discussion, In-class exercises	[1, 2]
2	Logic and propositions (continue)	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2]
3	Propositional Equivalences; predicates and quantifiers	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2]
4	Nested Quantifiers and Methods of Proof	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2]
5	Induction and recursion	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion,	[1, 2]

				In-class exercises	
6	Number of theory	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2]
7	Number of theory (continue)	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2]
8	Counting: part 1, 2; midterm review	2,3,4	Quiz, Homework, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
	Midterm examination				
9	Counting: part 3	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2]
10	Advanced counting	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2]
11	Boolean algebras	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
12	Graph theory	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
13	Optimal problem solving on graphs	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
14	Introduction and application of tree	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
15	Search on tree; review for final exam	2,3,4	Quiz, Homework, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
1	**Final examination**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Quiz/Homework/Assignment (25%)	20%	30%	30%	20%
Midterm examination (30%)	25%	25%	25%	25%
Final examination (45%)		30%	40%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact,	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital Logic Design

Course Code: IT067

1. General information

<table>
<tr><td>Course designation</td><td>Provide fundamentals of logic design, such as: number presentation and codes, Boolean algebra and basic tools for design with combinational and sequential digital logic.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>3</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Dr. Dinh Duc Anh Vu</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>CS, IT: Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 135
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture)
Private study including examination preparation, specified in hours: 90</td></tr>
<tr><td>Credit points</td><td>Number of credits : 3
Lecture: 3
Laboratory: 0</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>This course is to provide fundamentals of logic design, such as: number presentation and codes, Boolean algebra and basic tools for design with combinational and sequential digital logic.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Explain the presentation of number, codes systems.
CLO 2. Demonstrate the operation of arbitrarily basic combinational and sequential circuits.
CLO 3. Design basic combinational and sequential circuits.
CLO 4. Follow the discussions of instructors and classmates.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3</td></tr>
<tr><td>Skill</td><td>CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)</td></tr>
</table>

<table>
<tr><td></td><td>Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Number systems, arithmetic and codes</td><td>6</td><td>I,T</td></tr>
<tr><td>Boolean algebra and Logic Gates</td><td>9</td><td>I,T</td></tr>
<tr><td>Combinational Circuits</td><td>9</td><td>T,U</td></tr>
<tr><td>Sequential logic and flip-flops</td><td>9</td><td>T,U</td></tr>
<tr><td>Arithmetic logic Circuits</td><td>6</td><td>T,U</td></tr>
<tr><td>Counters, stacks and registers</td><td>6</td><td>I,T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Ronald J. Tocci, Neal S.Widmer, Digital Systems Principles and Applications, Prentice Hall Inc (2007)
2. J.F. Wakerly, Digital Design: Principles & Practices 4th, 2004</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					
2	X					
3		X				
4	X	X				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1,2	Number systems, arithmetic and codes	CLO1	Midterm Exam	Reading Group Presentation	Textbooks
3,4,5	Boolean algebra and Logic Gates	CLO1	Midterm Exam	Reading Lecture	Textbooks Lecture notes
	Midterm				

6,7,8	Combinational Circuits	CLO2,CLO4	Quiz Final Exam	Reading Lecture Discuss	Textbooks Lecture notes
9,10,11	Sequential logic and flip-flops	CLO2,CLO4	Exercise Final Exam	Reading Lecture Discuss Exercise	Textbooks Lecture notes
12,13	Arithmetic logic Circuits	CLO3,CLO4	Exercise Final Exam	Reading Lecture Discuss Exercise	Textbooks Lecture notes
14,15	Counters, stacks and registers	CLO3,CLO4	Exercise Final Exam	Reading Lecture Discuss Exercise	Textbooks Lecture notes
	Final exam				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%			
Final examination (40%)		20%	20%	
Exercises/ Quiz (30%)		10%	10%	10%

Note: %Pass: Target that 90% of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		

Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored,	Issue/ problem to be considered critically is stated without clarification or description.

			boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into	Specific position (perspective, thesis/hypothesis) takes into account the complexities of	Specific position (perspective, thesis/ hypothesis) acknowledges different	Specific position (perspective, thesis/ hypothesis) is stated, but is

	account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	sides of an issue.	simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable

	consistently observable and is skillful and makes the content of the presentation cohesive.	consistently observable within the presentation.	observable within the presentation.	within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)

	authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital Logic Design Lab

Course Code: IT099

1. General information

Course designation	This subject covers the fundamental knowledge of digital logic design laboratory
Semester(s) in which the course is taught	3
Person responsible for the course	Dr. Ly Tu Nga
Language	English
Relation to curriculum	Compulsory (CS, NE, CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 60 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory) Private study including examination preparation, specified in hours: 30
Credit points	Number of credits : 1 Lecture: 0 Laboratory: 1
Required and recommended prerequisites for joining the course	Digital Logic Design
Course objectives	This course provides students the fundamentals of digital logic design concepts, a sequence of laboratory experiments to present and illustrate theory of digital logic design involving Logic gates, Combinational logic circuit, MSI combinational logic circuit, Flip Flops and Counters, Counter ICs, and Shift register. Students apply contemporary agile requirements analysis, implementation and testing practices to digital logic design project work in small teams.
Course learning outcomes	CLO 1. use laboratory equipment in digital logic design. CLO 2. design, construct, analyze, and troubleshoot simple combinational and sequential circuits. CLO 3. measure and record the experimental data, analyze the results, and prepare a laboratory report for submission. CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.

Competency level	Course learning outcome (CLO)

<table>
<tr><td></td><td><table>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2,3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Logic gates and combinational logic</td><td>2</td><td>I,T</td></tr>
<tr><td>MSI combinational logic</td><td>1</td><td>T,U</td></tr>
<tr><td>MSI Combinational logic (cont.)</td><td>1</td><td>T,U</td></tr>
<tr><td>Flip flops and counters</td><td>2</td><td>T,U</td></tr>
<tr><td>Counter ICs (part I)</td><td>1</td><td>T,U</td></tr>
<tr><td>Counter ICs (part II)</td><td>1</td><td>T,U</td></tr>
<tr><td>Shift Register</td><td>2</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] M.M. Mano and M.D. Ciletti, Digital Design 4th, 2007
[2] J.F. Wakerly, Digital Design: Principles & Practices 4th, 2004
[3] R.J Tocci and N.S. Widner, Digital Systems - Principles and Applications 8th, 2001</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Teaching and Learning activities	Assessments	Resources
1	Logic gates and combinational logic	CLO1,3	-Practice and demo -Class discussion	-Report	[1,2]
2	MSI combinational logic	CLO2,3	-Practice and demo -Class discussion	-Report	[1,2]
3	MSI Combinational logic (cont.)	CLO2,3	-Practice and demo -Class discussion	-Report	[1,2]
5	Flip flops and counters	CLO2,3,4	-Practice and demo -Class discussion	-Report	[1,3]
6	Counter ICs (part I)	CLO2,3,4	-Practice and demo -Class discussion	-Report	[1,3]
7	Counter ICs (part II)	CLO2,3,4	-Practice and demo -Class discussion	-Report	[1,3]
8	Shift Register	CLO2,3,4	-Practice and demo -Class discussion	-Report	[1,3]
9	**Final exam**		Practice	Written exam	

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Final examination (30%)	30%	30%	30%	30%
Exercises/ Quiz (70%)	70%	70%	70%	70%

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. **Grading checklist**

Grading checklist for Written Reports	
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……

	Max.	Score	Comments
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. **Holistic rubric**

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. **Analytic rubric**

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensivel	Issue/ problem to be considered critically is stated, described, and clarified so that	Issue/ problem to be considered critically is stated but	Issue/ problem to be considered critically is stated without clarification

	y, delivering all relevant information necessary for full understanding.	understanding is not seriously impeded by omissions.	description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

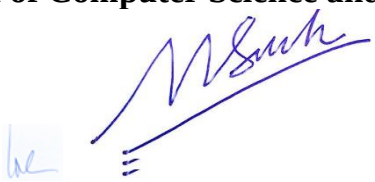
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Object-Oriented Programming

Course Code: IT069IU

2. **General information**

<table>
<tr><td>Course designation</td><td>This subject introduces students to the object-oriented programming from basic notions to professional principles for designing an object-oriented software.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>3</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Tran Thanh Tung</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (all programs)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Prerequisite course of OOP: C/C++ Programming</td></tr>
<tr><td>Course objectives</td><td>Introduction to object-oriented programming and design. Topics include core terminologies and basic design principles of object-oriented programming such as classes, objects, abstraction, encapsulation, inheritance, polymorphism, the SOLID design principles, and design patterns</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Explain and use concepts in object-oriented programming including classes, objects, abstraction, encapsulation, inheritance, and polymorphism.
CLO 2. Implement an object-oriented solution in JAVA programming language.
CLO 3. Analyze design principles and design patterns in object-oriented programing

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Java</td><td>3</td><td>I</td></tr>
<tr><td>Introduction to Object-Oriented Programming</td><td>3</td><td>I, T</td></tr>
<tr><td>Classes and Objects</td><td>3</td><td>T</td></tr>
<tr><td>Inheritance and composition</td><td>3</td><td>T</td></tr>
<tr><td>Polymorphism</td><td>3</td><td>T</td></tr>
<tr><td>Design with interfaces and abstract classes</td><td>3</td><td>T</td></tr>
<tr><td>Building Objects</td><td>3</td><td>T</td></tr>
<tr><td>Exception handling</td><td>3</td><td>T</td></tr>
<tr><td>Generic classes and methods</td><td>3</td><td>T</td></tr>
<tr><td>Introduction to SOLID principles
Single responsibility principle</td><td>3</td><td>T, U</td></tr>
<tr><td>Open/closed principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Lisko substitution principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Interface segregation principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Dependency inversion principle</td><td>1.5</td><td>T, U</td></tr>
<tr><td>Reusing Designs Through Design Patterns</td><td>6</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>5. Paul J. Deitel (Author), Harvey Deitel (Author), Java How To Program, 11th Edition, Prentice Hall, 2017
6. Matt Weisfeld, The Object-Oriented Thought Process, 3rd Edition, Addison-Wesley, 2009
7. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional, 1994
8. Eric Freeman, Bert Bates, Kathy Sierra and Elisabeth Robson, Head First Design Patterns: A Brain-Friendly Guide, O'Reilly Media, 2004</td></tr>
</table>

3. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XX					
2		XX				X
3		XXX				X

4. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Java	1	Quiz	Lecture	[1]
2	Introduction to Object-Oriented Programming	1	Quiz	Lecture, Discussion	[1,2]
3	Classes and Objects	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
4	Inheritance and composition	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
5	Polymorphism	2	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
6	Design with interfaces and abstract classes	2,3	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
7	Building Objects	2,3	Quiz, Lab, Midterm	Lecture, Discussion, In-class exercises	[1,2]
8	Exception handling	1,2	Quiz	Lecture	[1]
9	**Midterm**				
10	Generic classes and methods	2,3	Quiz, Lab, Final	Lecture, Discussion, In-class exercises	[1,2]

11	Introduction to SOLID principles Single responsibility principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
12	Open/closed principle Lisko substitution principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
13	Interface segregation principle Dependency inversion principle	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
14	Reusing Designs Through Design Patterns, part 1	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
15	Reusing Designs Through Design Patterns, part 2	2,3	Quiz, Project, Final	Lecture, Discussion, In-class exercises	[1,3,4]
16	**Final exam**				

5. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz (5%)	10%		20%
Labs (10%)	30%	30%	
Midterm examination (30%)	50%	40%	
Projects/Presentations/ Report (15%)	10%		30%
Final examination (40%)		30%	50%

Rubrics (optional)

Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.4. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.5. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermine	Issue/ problem to be considered critically is stated without clarification or description.

			d, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Linear Algebra

Course Code: IT154IU

1. **General information**

Course designation	Linear algebra provides a mathematical framework for organizing information and then using that information to solve problems, especially data analytics problems. Linear algebra is essential for understanding and creating machine learning algorithms, especially neural network and deep learning models.
Semester(s) in which the course is taught	2, 3
Person responsible for the course	Mai Hoang Bao An, PhD.
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, demo.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits: 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	Calculus 2
Course objectives	This course will provide students with the foundations of linear algebra knowledge necessary for machine learning and neural network modelling. Students will learn the overview of basic matrices and vector algebra as applied to linear systems. Then they will learn how to manipulate matrices to derive useful knowledge from data, quantify the degree of learning, and optimizing the speed of learning in vector spaces and linear transformations for data discovery. The hands-on lessons and assignments will equip students with the mathematical background required to build and train simple neural networks in data mining applications.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand concepts of vector space, matrices, tensor, linear system and their application in other fields of study. Get familiar with the fundamental concepts of linear spaces.
CLO 2. Know how to use Python to handle with matrices and linear systems. Get to know and understand the fundamental concepts of abstract vector spaces and their relationships with matrix algebra.
CLO 3. Understand the concepts and applications of linear dependence/independence, spans and linear transformation. Apply principles of matrix algebra to linear transformation. Understand the Isomorphic Vector Spaces and applications.
CLO 4. Determine eigenvalues and eigenvectors and solve eigenvalue problems. Introduction to determinant and its properties and applications. The use case of carrying out matrix operations in machine learning.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr><tr><td>Skill</td><td>CLO 2, CLO 4</td></tr><tr><td>Attitude</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to python, colab
What is linear structures</td><td>1</td><td>I, U</td></tr><tr><td>Fundamentals and geometry of $\mathbb{R}^n$ space
Matrix algebra: vectors, matrices.
Linear systems, parametric equations and systems of linear equations</td><td>2</td><td>T, U</td></tr><tr><td>Solving systems of linear equations
Subspace of $\mathbb{R}^n$, linear independence, base and dimension in $\mathbb{R}^n$
Python in linear algebra</td><td>2</td><td>T, U</td></tr><tr><td>Solving linear system with numpy
Norm in $\mathbb{R}^n$ with Python</td><td>1</td><td>T, U</td></tr><tr><td>Abstract vector spaces, base and dimension for abstract vector spaces.
Special kinds of matrices and vectors.</td><td>1</td><td>T, U</td></tr><tr><td>Span in abstract vector spaces.
Fundamentals of linear transformations.
Demo of linear transformations in Python.</td><td>2</td><td>T, U</td></tr></table></td></tr>
</table>

	Linear Transformation in abstract vector space Linear Transformation and Inverses	1	T, U
	Geometric Transformation of Plane, Image and Kernel, Isomorphism and linear map Isomorphic Vector Spaces	1	I, T, U
	Introduction to determinant Determinant expansions. Properties of determinant.	1	I, T
	Elementary Row Operations and the Determinant Eigenvectors and Eigenvalues, Eigen-decompositions Introduction to some application of linear algebra: PCA, OLS, …	2	I, T, U
Examination forms	Short-answer questions, Long-answer questions, programming questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	**1.** R.O. Hill, Elementary Linear Algebra and Its applications, 3rd edition **2.** B. Kolman and David R. Hill, Introductory Linear Algebra: An Applied First Course (8th edition, 9th edition) **3.** Jim Hefferon, Linear Algebra, 4th edition. **4.** github: Python in linear algebra, matrix computing.		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x					
2		x				
3		x	x			
4			x			

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to python, colab What is linear structures Introduction to matrix	1		Lecture, Discussion	[1, 2, 3]. Chapter 1
2-3	Fundamentals and geometry of $\mathbb{R}^n$ space Matrix algebra: vectors, matrices. Linear systems, parametric equations and systems of linear equations	1	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 2, 3, 4
4-5	Solving systems of linear equations Subspace of $\mathbb{R}^n$, linear independence, base and dimension in $\mathbb{R}^n$ Python in linear algebra	1, 2	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 4, 5, 6 [4] Chapter 1,2,3
6	Solving linear system with numpy Norm in $\mathbb{R}^n$ with Python	1, 2		Lecture, In-class Discussion	[4]. Chapter 3, 4, 5
7	Abstract vector spaces, base and dimension for abstract vector spaces. Special kinds of matrices and vectors.	1, 2	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 6, 7, 8
8	**Midterm**				
9-10	Span in abstract vector spaces. Fundamentals of linear transformations. Demo of linear transformations in Python.	3, 4	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 8, 9, 10 [4] Chapter 6, 7
11	Linear Transformation in abstract vector space Linear Transformation and Inverses	3	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 10, 11, 12

12	Geometric Transformation of Plane, Image and Kernel, Isomorphism and linear map Isomorphic Vector Spaces	3	Exercises	Lecture, In-class exercises	[1, 2, 3]. Chapter 11, 12, 13
13	Introduction to determinant Determinant expansions. Properties of determinant	3, 4	Quiz	Lecture, In-class Quiz	[1, 2]. Chapter 13. 14, 15
14-15	Elementary Row Operations and the Determinant Eigenvectors and Eigenvalues, Eigen-decompositions Introduction to some application of linear algebra: PCA, OLS, …	3, 4	Exercises	Lecture, In-class exercises	[2, 3]. Chapter 14, 15, 16 [4] Chapter 8, 9, 10
16	Revision			Review-test	
17	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Labs (20%)	25%	25%	25%	25%
Midterm examination (30%)	50%	50%		
Projects/Presentations/ Report (10%)			50%	50%
Final examination (40%)		25%	25%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports	
Student: ……..	HW/Assignment:
Date: ……	…….

	Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)			
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described	Issue/ problem to be considered critically is stated, described, and	Issue/ problem to be considered critically is	Issue/ problem to be considered critically is stated without

	comprehensively, delivering all relevant information necessary for full understanding.	clarified so that understanding is not seriously impeded by omissions.	stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Algorithms and Data Structure

Course Code: IT013

1. General information

<table>
<tr><td>Course designation</td><td>This subject introduces students to basic data structures and algorithms</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>4,6</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Tran Thanh Tung</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (All programs)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Object-Oriented Programming</td></tr>
<tr><td>Course objectives</td><td>Introduction to data structures and algorithms, including their design, analysis, and implementation.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand basic data structures and algorithms
CLO 2. Analyze and evaluate data structures and algorithms.
CLO 3. Design algorithms and select data structures for real world applications.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Review OOP & Java</td><td>3</td><td>I</td></tr>
<tr><td>Arrays</td><td>3</td><td>T</td></tr>
</table></td></tr>
</table>

		Complexity	3	T
		Sorting	3	T, U
		Queue, Stack	3	T
		List	6	T
		Recursion	3	T, U
		Advanced Sorting	6	T
		Binary Tree	3	T
		Hash Table	3	T
		Graphs	3	T
		Algorithms on graphs	3	T, U
Examination forms	Short-answer questions			
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.			
Reading list	1. Michael T. Goodrich and Roberto Tamassia, Data Structures and Algorithms in Java 6th, 2014 2. Cormen, Thomas H., et al. Introduction to algorithms. MIT press, 2009. 3. Lafore, Robert. Data structures and algorithms in Java. Sams publishing, 2017.			

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XX					
2		XXX				
3						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Review OOP & Java	1	Quiz	Lecture	
2	Arrays	1	Lab, Quiz, Midterm	Lecture, Discussion,	[1,3]

				In class exercises	
3	Complexity	2	Quiz	Lecture, Discussion	[2]
4	Sorting	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
5	Queue, Stack	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
6	List part 1	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
7	List part 2	2,3	Lab, Quiz, Midterm	Lecture, Discussion	
8	Recursion	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
9	**Midterm**				
10	Advanced Sorting part 1	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
11	Advanced Sorting part 2	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,2,3]
12	Binary Tree	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
13	Hash Table	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,3]
14	Graphs	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[2,3]
15	Algorithms on graphs	2,3	Lab, Quiz, Final	Lecture, Discussion	[2,3]
16	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**

Quiz (5%)	20%	5%	
Labs (10%)		10%	
Midterm examination (30%)	40%	30%	30%
Projects/Presentations/ Report (15%)		15%	40%
Final examination (40%)	40%	40%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact,	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Principles of Database Management

Course Code: IU079

1. General information

<table>
<tr><td>Course designation</td><td>This course focuses on the design and implementation of database management systems</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>4</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Dr. Nguyen Thi Thuy Loan</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (NE, CS,DS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>IT116IU (C Programming)</td></tr>
<tr><td>Course objectives</td><td>This subject introduces the students to basic database design and implementation concepts. Database design techniques, including relational design and E-R analysis, are presented. Database queries using SQL are covered in lectures and supported by practical exercises.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Produce an (Extended) Entity-Relationship (E-R) model from specifications.
CLO 2. Apply data normalization principles to transforming an ER model into a database schema.
CLO 3. Construct efficient SQL queries to retrieve and manipulate data as required.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO3</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Database Systems</td><td>3</td><td>I</td></tr>
<tr><td>Relational Model and Relational Algebra</td><td>6</td><td>T, U</td></tr>
<tr><td>Structured Query Language</td><td>6</td><td>T, U</td></tr>
<tr><td>(Extended) Entity Relationship Model</td><td>6</td><td>T, U</td></tr>
<tr><td>Relational Database Design</td><td>9</td><td>T, U</td></tr>
<tr><td>Normalization</td><td>6</td><td>T, U</td></tr>
<tr><td>Advanced SQL</td><td>6</td><td>T, U</td></tr>
<tr><td>Review</td><td>3</td><td>I, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concept 7th, 2020
2. Jeffrey A. Hoffer, Ramesh Venkataraman, Heikki Topi, Modern Database Management 13th, 2019
3. Ramez Elmasri, Shamkant Navathe, Fundamentals of Database Systems 7th, 2016</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XXX					
2		XXX			X	
3		XX			XX	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Database Systems	1	Quiz	Lecture	[1,3]

2	Relational Model and relational Algebra	2	Quiz, Midterm, Project	Lecture, Discussion, In-class, exercise	[1,3]
3	Structured Query Language	3	Quiz, Lab, Project, Midterm	Lecture, Discussion, In-class, exercise	[1,2,3]
4	(Extended) Entity Relationship Model	2	Quiz, Project, Midterm	Lecture, Discussion, In-class, exercise	[1,2,3]
5	**Midterm**				
6	Relational Database Design	2,3	Project, Final, Quiz, Lab	Lecture, Discussion, In-class, exercise	[1,2]
7	Normalization	2,3	Quiz, Project, Final	Lecture, Discussion, In-class, exercise	[2,3]
8	Advanced SQL	3	Quiz, Project, Final	Lecture, Discussion, In-class, exercise	[1,3]
9	Review	2,3	Quiz	Discussion, In-class, exercise	[1,2,3]
10	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Labs (10%)		10%	20%
Midterm examination (25%)	40%		20%
Quiz (5%)	10%	20%	
Projects/Presentations/ Report (20%)	30%	20%	30%
Final examination (40%)	20%	50%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports	
Student: ……..	HW/Assignment:
Date: ……	…….

	Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensivel	Issue/ problem to be considered critically is stated, described, and clarified so that	Issue/ problem to be considered critically is stated but	Issue/ problem to be considered critically is stated without clarification

	y, delivering all relevant information necessary for full understanding.	understanding is not seriously impeded by omissions.	description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Computer Architecture

Course Code: IT089

1. **General information**

Course designation	This course introduces the principles of computer organization and the basic computer architecture.
Semester(s) in which the course is taught	4
Person responsible for the course	Dr. Le Hai Duong
Language	English
Relation to curriculum	Compulsory (CS, NE, CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120 Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Digital Logic Design
Course objectives	This course provides students the principles of computer architecture and organization. It covers the subjects on assembly language and machine code, computer arithmetic and ALU design, computer performance, datapath and control, pipelining, memory hierarchy, I/O devices, multi-processor architectures, and mobile and multi-core processors.
Course learning outcomes	CLO 1. Understand the principles of computer architecture and the interfaces between its hardware and software components; CLO 2. Understand computer arithmetic (both integer and floating point), datapath, control , pipelining, pipeline hazards and their remedies, computer buses and I/O peripherals, and multiprocessor architecture;

<table>
<tr><td></td><td>CLO 3. Create assembly programs and their machine code equivalent;
CLO 4. Analyze the performance of computer;
CLO 5. Analyze computer memory and its organization, especially the interaction between cache and main memory.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
<tr><td>Skill</td><td>CLO3, CLO4, CLO5</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>History of computers, relations of software and hardware components;</td><td>1</td><td>I</td></tr>
<tr><td>Assembly language instructions</td><td>5</td><td>T, U</td></tr>
<tr><td>Computer arithmetic principles and hardware design</td><td>1</td><td>T</td></tr>
<tr><td>Computer performance</td><td>1</td><td>T,U</td></tr>
<tr><td>Datapath and its control</td><td>2</td><td>T</td></tr>
<tr><td>Microprocessor pipelining</td><td>2</td><td>T, U</td></tr>
<tr><td>Memory hierarchy</td><td>1</td><td>T</td></tr>
<tr><td>I/O devices and buses</td><td>1</td><td>T</td></tr>
<tr><td>Multiprocessor</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. David A. Patterson and John L. Hennessy, Computer Organization and Design 5th, 2013</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-5) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					

2	X					
3		X				X
4	X					
5	X					

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	History of computers, relations of software and hardware components;	1	Quiz, exam	Lecture	[1]
2	Assembly language instructions	3	Quiz, exam	Lecture, lab, exercises	[1]
3	Computer arithmetic principles and hardware design	2	Quiz, exam	Lecture, exercises	[1]
4	**Midterm**				
5	Computer performance	4	Quiz, exam	Lecture, exercises	[1]
6	Datapath and its control	1, 2	Quiz, exam	Lecture, exercises	[1]
7	Microprocessor pipelining		Quiz, exam	Lecture, exercises	[1]
8	Memory hierarchy	5	Quiz, exam	Lecture, exercises	[1]
9	I/O devices and buses	2	Quiz, exam	Lecture, exercises	[1]
10	Multiprocessor	2	Quiz, exam	Lecture, exercises	[1]
11	**Final exam**				

1. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5
Midterm examination (30%)	70%	70%	25%		
Final examination (40%)			50%	70%	70%
Exercises/ Quiz (30%)	30%	30%	25%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual

questions to lecturers after the class, all mean that about 60 minutes should be counted.

1. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's	Conclusion is logically tied to a range of information, including opposing viewpoints; related	Conclusion is logically tied to information (because information is chosen to fit the	Conclusion is inconsistently tied to some of the information discussed; related outcomes

	informed evaluation and ability to place evidence and perspectives discussed in priority order.	outcomes (consequences and implications) are identified clearly.	desired conclusion); some related outcomes (consequences and implications) are identified clearly.	(consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Computer Networks

Course Code: IT091IU

1. General information

<table>
<tr><td>Course designation</td><td>This subject covers the fundamental knowledge of computer networks</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>3,5</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Vo Thi Luu Phuong.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CS, NE, CE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>C/C++ Programming or Fundamentals of Programming</td></tr>
<tr><td>Course objectives</td><td>This course covers the fundamental knowledge of computer networks such as OSI, TCP/IP models, network architectures, LAN, WAN, the typical network protocols. The students will also study to design, implement and monitor a small / medium scale network.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Analyze the components, architecture, and protocols in computer networks;
CLO 2. Apply the theory in designing a small/medium computer networks;
CLO 3. Show the ability to work in teams;

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1</td></tr><tr><td>Skill</td><td>CLO2, CLO3</td></tr><tr><td>Attitude</td><td>CLO2</td></tr></table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction of computer networks</td><td>2</td><td>T, U</td></tr>
<tr><td>Network applications: HTTP, FTP, DNS, SMTP</td><td>2</td><td>T, U</td></tr>
<tr><td>Transport layer: congestion control, TCP, UDP</td><td>2</td><td>T, U</td></tr>
<tr><td>IP addressing, CIDR, VLSM</td><td>2</td><td>T, U</td></tr>
<tr><td>Network layer: routing algorithms, routing protocols</td><td>2</td><td>T, U</td></tr>
<tr><td>Datalink layer and physical layer</td><td>2</td><td>T, U</td></tr>
<tr><td>Wireless and mobile networks</td><td>2</td><td>T</td></tr>
<tr><td>Some advanced topics in contemporary networks</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. J. F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach 7th, 2014</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓✓					
2		✓✓✓				
3					✓	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1-2	Introduction of computer networks	1	Midterm	lecture	Chapter 1, [1]

3-4	Network applications: HTTP, FTP, DNS, SMTP	1	Midterm, Lab	lecture, lab	Chapter 2, [1]
5-6	Transport layer: congestion control, TCP, UDP	1	Midterm, Lab	lecture, lab	Chapter 3, [1]
	Midterm				
7-8	IP addressing, CIDR, VLSM	2	Final, Lab	lecture, lab	Chapter 4, [1]
9-10	Network layer: routing algorithms, routing protocols	1,2	Final, Lab	lecture, lab	Chapter 5, [1]
11-12	Datalink layer and physical layer	1,2	Final, Lab	lecture, lab	Chapter 6, [1]
13-14	Wireless and mobile networks	1	Final	lecture	Chapter 7, [1]
15	Some advanced topics in contemporary networks	3	Group project	group work	Literature
10	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Exercises, quizzes, attendants (10%)	30%		30%
Group project (5%)		30%	40%
Labs (25%)		30%	30%
Midterm examination (30%)	40%		
Final examination (30%)	30%	40%	

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			

Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously	Issue/ problem to be considered critically is stated but description leaves some	Issue/ problem to be considered critically is stated without clarification or description.

	information necessary for full understanding.	impeded by omissions.	terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Web Application Development

Course Code: IT093

1. General information

Course designation	This subject introduces to students the development of web application. How to design and program a web-app in practice based on the tools, techniques and web frameworks
Semester(s) in which the course is taught	6
Person responsible for the course	Assoc. Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	Compulsory (NE, CE, CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming Principles of Database Management
Course objectives	This course provides students the fundamentals of web design and web programming. It provide the concepts and models of HTML, Java Server Page, Java Bean, MVC model, Java utilities and development environments, extended Java frameworks, several new frameworks with different programming languages. To develop skills in understanding and evaluating web-based systems, as well as to develop skills in designing and developing web-based applications.
Course learning outcomes	CLO 1. Understand web design, web programming concepts and models. CLO 2. Apply to design and develop static/dynamic web application with HTML, Java Server Pages, Java Bean, extended Java and other frameworks based on the MVC model. CLO 3. Apply knowledge and ability to manage and use Java, XML utilities and IDE for developing web applications with DBMS.

<table>
<tr><td></td><td>CLO 4: work in group, communication, interaction and responsible within a team.

<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Introduction to the course and HTML</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Advanced HTML and CSS</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 3: Introduction to J2EE and new frameworks in web application</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 4 : Servlet</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Java server page and JDBC</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 6: Java Bean and MVC</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Web state, session, cookies & midterm review</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: Java Script, APIs and Libraries</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9&10: Node JS Framework</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Graphical models on the webpage, web multimedia and web 360</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12&13: XML & XSLT</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Ajax framework</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: the existing web frameworks & final review</td><td>3</td><td>I,T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions and programming</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>Dave Wolf and A.J. Henley. “Java EE Web Application Primer Building Bullhorn: A Messaging App with JSP, Servlets, JavaScript, Bootstrap and Oracle”, 2017.
Prem Kumar Karunakaran. “Java Web Application Development”, second edition, 2020.</td></tr>
</table>

	3. Laura Ubelhor and Christian Hur. "Developing Business Application for the Web With HTML, CSS, JSP, PHP, ASP.NET and JavaScript", 2017. **4.** *Refer VN book: N.V.Sinh, N.T.T.Sang, T.M.Hà* "Xây dựng ứng dụng Web cho Thương mại điện tử trên Netbeans", Nhà xuất bản Xây dựng 2017

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2		X				
3		X				X
4					X	

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to the course and HTML	1	Quiz	Lecture,	[1,2]
2	Advanced HTML and CSS	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3]
3	Introduction to J2EE and new frameworks in web application	1	Quiz, Midterm	Lecture, Discussion	[1,2]
4	Servlet	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
5	Java server page and JDBC	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
6	Java Bean and MVC	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]

7	Web state, session, cookies & midterm review	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
8	Java Script, APIs and Libraries & midterm review	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
9	Node JS Framework	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
10	Node JS Framework (continue)	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
11	Graphical models on the webpage, web multimedia and web 360	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
12	XML & XSLT	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
13	XML & XSLT (continue)	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
14	Ajax framework	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
15	Existing web frameworks & final review	2,3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
16	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Labs (20%)		30%	40%	30%
Midterm examination (30%)	40$	60%		
Exercises/Quiz (10%)	30%	40%	30%	
Final examination (40%)		50%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts

	presenting a position.		others' assumptions than one's own (or vice versa).	when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

	polished and confident.			
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Operating Systems

Course Code: IT017IU

1. General information

Course designation	This course covers fundamental concepts of operating systems including scheduling, virtual memory and file systems.
Semester(s) in which the course is taught	5,7
Person responsible for the course	Dr. Le Hai Duong
Language	English
Relation to curriculum	Compulsory (NE, CE, CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120 Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Algorithms and Data Structure Computer Architecture
Course objectives	This course presents the theory, design, implementation, and analysis of computer operating systems. Through classroom lectures, labs, projects and exercises, students learn the fundamentals of concurrency and process management, inter-process communication and synchronization, memory management, job scheduling algorithms, input/output management, file systems, security in operating systems. Course labs use the C/C++ language and include the design and implementation of portions of an operating system.
Course learning outcomes	CLO 1. Understand processes and process management CLO 2. Understand synchronization and communication CLO 3. Understand memory management

<table>
<tr><td></td><td>CLO 4. Given a scheduling algorithm, determine timeline of actions
CLO 5. Understand internals of file system
CLO 6. Design and implement portions of an operating system
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3, CLO4, CLO5</td></tr>
<tr><td>Skill</td><td>CLO6</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction, processes, process management</td><td>2</td><td>T</td></tr>
<tr><td>Threads</td><td>2</td><td>T,U</td></tr>
<tr><td>Inter-process communication (IPC) and synchronization, deadlocks</td><td>1</td><td>T</td></tr>
<tr><td>Memory management</td><td>2</td><td>T</td></tr>
<tr><td>process scheduling</td><td>2</td><td>T</td></tr>
<tr><td>Input/output and disk management</td><td>1</td><td>T</td></tr>
<tr><td>File systems</td><td>2</td><td>T,U</td></tr>
<tr><td>Security in operating systems</td><td>1</td><td>T,U</td></tr>
<tr><td>Embedded operating systems</td><td>1</td><td>T</td></tr>
<tr><td>Distributed system issues</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. W. Stallin, Operating Systems: Internals and design principles 7th, 2011
2. A.S. Tanenbaum, Modern Operating Systems 3rd, 2008</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO

CLO	1	2	3	4	5	6
1	X					
2	X					
3	X					
4		X				
5	X					
6		X				

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction, processes, process management	1	Quiz, exam	Lecture, exercises, lab	[1], [2]
2	Threads	1	Quiz, exam	Lecture, exercises, lab	[1], [2]
3	Inter-process communication (IPC) and synchronization, deadlocks	2	Quiz, exam	Lecture, exercises, lab	[1], [2]
4	Memory management	3	Quiz, exam	Lecture, exercises, lab	[1], [2]
5	**Midterm**				
6	process scheduling	4	Quiz, exam	Lecture, exercises, lab	[1], [2]
7	Input/output and disk management	5	Quiz, exam	Lecture, exercises, lab	[1], [2]
8	File systems	5	Quiz, exam	Lecture, exercises, lab	[1], [2]
9	Security in operating systems	6	Quiz, exam	Lecture, exercises, lab	[1], [2]
10	Embedded operating systems	6	Quiz, exam	Lecture, exercises, lab	[1], [2]
11	Distributed system issues	6	Quiz, exam	Lecture, exercises, lab	[1], [2]
12	**Final exam**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
Midterm examination (30%)	10%	10%	10%			
Projects/Presentations/ Report (20%)	3%	3%		4%		10%
Final examination (40%)			18%	17%	15%	
Exercises/ Quiz (10%)	2%	2%	2%	2%	2%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW

Score	Description
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	Milestone		Benchmark
	4	3	2	1
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

	questioned thoroughly.	subject to questioning.	Viewpoints of experts are taken as mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Net-centric Programming

Course Code: IT096IU

1. General information

<table>
<tr><td>Course designation</td><td>Advanced programming course with focus on developing network application</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>6</td></tr>
<tr><td>Person responsible for the course</td><td>MSc. Le Thanh Son</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (NE)
Elective (CS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 2
Laboratory: 1
Mini project: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Computer Networks</td></tr>
<tr><td>Course objectives</td><td>Advanced programming with a focus on developing software for networked systems using UNIX as a reference platform. Topics: Socket Programming using TCP and UDP, Network Application development using popular Internet protocols such as HTTP, FTP... Completing the mini project will help students gain a deeper understanding of current trends of Network Applications in the industry.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the structure of network applications
CLO 2. Able to develop network applications using TCP and UDP sockets
CLO 3. Understand and implement network applications using popular Internet protocols
CLO 4. Team working
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1, 2, 3</td></tr>
<tr><td>Skill</td><td>2, 3</td></tr>
<tr><td>Attitude</td><td>4</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Network revisions</td><td>3</td><td>I</td></tr>
<tr><td>TCP Socket Programming</td><td>3</td><td>T, U</td></tr>
<tr><td>UDP Socket Programming</td><td>3</td><td>T, U</td></tr>
<tr><td>Data Serialization</td><td>3</td><td>T, U</td></tr>
<tr><td>Application Protocols</td><td>3</td><td>T, U</td></tr>
<tr><td>HTTP services</td><td>3</td><td>T, U</td></tr>
<tr><td>Working with Databases</td><td>3</td><td>T, U</td></tr>
<tr><td>Working with Cloud services</td><td>3</td><td>T, U</td></tr>
<tr><td>Web Scrapping</td><td>3</td><td>T, U</td></tr>
<tr><td>Web Socket</td><td>3</td><td>T, U</td></tr>
<tr><td>Network applications in the industry</td><td>12</td><td>T, U</td></tr>
<tr><td>Mini Project Presentation</td><td>3</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Michael J.Donahoo, Kenneth L.Calvert, TCP/IP Socket in C: A Practical Guide for Programmers 2nd, 2009
2. W. R. Stevens, B. Fenner, A. M. Rudoff, Unix Network Programming, Vol. 1: The Sockets Networking API 3rd, 2003
3. Brandon Rhodes, Foundations of Python Network Programming 3rd, 2014</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLO	1	2	3	4	5	6
1	x					
2		xx				
3		xxx				
4						x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Network revisions	1	Homework	Lecture	2
2	TCP Socket Programming	2	Homework	Lecture, Discussion, Quiz	1, 2
3	UDP Socket Programming	2	Homework	Lecture, Discussion, Quiz	1, 2
4	Data Serialization	2	Homework	Lecture, Discussion, Quiz	2, 3
5	Application Protocols	2	Homework	Lecture, Discussion, Quiz	2, 3
6	HTTP Services	2	Homework	Lecture, Discussion, Quiz	2, 3
7	Working with Databases	3	Homework	Lecture, Discussion, Quiz	2, 3
8	Working with Cloud services	3	Homework	Lecture, Discussion, Quiz	
Midterm exam					
9	Web Scrapping	3	Homework	Lecture, Discussion, Quiz	2, 3
10	Web Socket	3	Homework	Lecture, Discussion, Quiz	2, 3
11 - 14	Network Applications in the Industry	3, 4	Homework	Lecture, Discussion, Presentation	2, 3
15	Mini project Demo and Presentation	3,4	Presentation	Test	
Final exam					

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Mini project (20%)		10%	30%	100%
Labs, Quizzes (20%)	30%	30%	20%	
Midterm examination (30%)	70%	40%		
Final examination (30%)		20%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports

Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/	Issue/ problem to be considered critically is stated without clarification or description.

			or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)

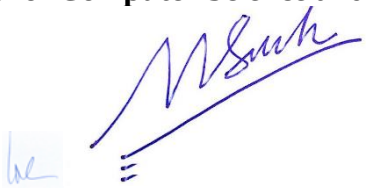
	make the presentation compelling, and speaker appears polished and confident.	make the presentation interesting, and speaker appears comfortable.	make the presentation understandable, and speaker appears tentative.	detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Information System Management

Course Code: IT094IU

1. General information

<table>
<tr><td>Course designation</td><td>This course covers the concepts of information systems and their applications to business processes</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>6</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Tran Thanh Tung</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective course (CS, DS)
Specialization (required) (NE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Principles of Database Management</td></tr>
<tr><td>Course objectives</td><td>This course will aim to provide students with:The concepts of information systems and their applications to business processes.Use of computer-based information systems in functional areas of business. Understanding of computer and information technology, resources, management and end-user decision making, and system development.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. understand basic information system concepts as applied to business operations and management.
CLO 2. identify the major components of a computer system, including hardware, software, operating systems and operating environments as they apply to information systems.
CLO 3. develop basic MIS applications such as spreadsheet, database, and web development.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>1, 2</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>Skill</td><td>3</td></tr><tr><td>Attitude</td><td></td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Information Systems in Global Business;</td><td>1</td><td>I</td></tr><tr><td>Global E-Business and Collaboration;</td><td>1</td><td>I</td></tr><tr><td>Information Systems, Organizations and Strategy</td><td>2</td><td>T</td></tr><tr><td>Ethical and Social Issues in Information Systems;</td><td>1</td><td>T</td></tr><tr><td>Telecommunications, the Internet, and Wireless Technology;</td><td>1</td><td>T</td></tr><tr><td>Foundations of Business Intelligence: Databases and Information Management</td><td>1</td><td>T,U</td></tr><tr><td>E-Commerce: Digital Markets, Digital Goods;</td><td>2</td><td>T,U</td></tr><tr><td>Achieving Operational Excellence and Customer Intimacy: Enterprise Applications;</td><td>2</td><td>T,U</td></tr><tr><td>Building Information Systems;</td><td>2</td><td>T,U</td></tr><tr><td>Managing Knowledge;</td><td>1</td><td>T</td></tr><tr><td>Enhancing Decision Making.</td><td>1</td><td>T</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems: Managing the Digital Firm 14th, 2016
2. Kenneth C. Laudon and Jane Laudon, Essentials of Management Information Systems 11th, 2015</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					

CLO	1	2	3	4	5	6
1		x		x		
2		x		x		
3		x				

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Information Systems in Global Business;	1	Midterm exam	In-class activities	
2	Global E-Business and Collaboration;	1	Midterm exam	In-class activities	
3	Information Systems, Organizations and Strategy	1,2	Midterm exam, Quiz	In-class activities, Lab	
4	Ethical and Social Issues in Information Systems;	1	Midterm exam		
5	Telecommunications, the Internet, and Wireless Technology;	2	Midterm exam	In-class activities, Lab	
6	**Midterm**				
7	Foundations of Business Intelligence: Databases and Information Management	2,3	Final exam	In-class activities, Lab	
8	E-Commerce: Digital Markets, Digital Goods;	1	Final exam	In-class activities, Lab	
9	Achieving Operational Excellence and Customer Intimacy: Enterprise Applications;	1	Final exam	In-class activities, Lab	
10	Building Information Systems;	2,3	Final exam	In-class activities, Lab	
11	Managing Knowledge;	1	Final exam		
12	Enhancing Decision Making.	1	Final exam		
13	**Final exam**				

4. **Assessment plan**

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Assessment Type	CLO1	CLO2	CLO3
Midterm examination (30%)	40%	30%	20%
Projects/Presentations/ Report (20%)		40%	60%
Final examination (40%)	30%	20%	20%
Exercises/ Quiz (20%)	30%	10%	

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.

2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's	Conclusion is logically tied to a range of information, including opposing viewpoints; related	Conclusion is logically tied to information (because information is chosen to fit the	Conclusion is inconsistently tied to some of the information discussed; related outcomes

	informed evaluation and ability to place evidence and perspectives discussed in priority order.	outcomes (consequences and implications) are identified clearly.	desired conclusion); some related outcomes (consequences and implications) are identified clearly.	(consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: System and Network Security

Course Code: IT117

1. General information

Course designation	This course introduces students to the fundamentals of compute security in including software security, cryptography, network security and web security.
Semester(s) in which the course is taught	7,9
Person responsible for the course	MSc. Le Thanh Son
Language	English
Relation to curriculum	Elective (CE) Compulsory (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Computer Networks
Course objectives	This course introduces students to cryptography systems (symmetric and public key encryptions), basic information theory, authentication and authorization, database security, malicious software, denial of service attacks, intrusion detection and prevention systems, firewalls, buffer overflow attack and software security, Internet security protocols and standards, Internet authentication applications, and wireless security.
Course learning outcomes	CLO 1. Gain understanding of the cryptography concepts including symmetric key encryption, hash function, message authentication code, public key encryption, digital signature and digital envelope; CLO 2. Apply the concepts of authentication and authorization in implementing secure systems and networks; CLO 3. Understand and categorize the malicious software and their attacking mechanisms;

<table>
<tr><td></td><td>CLO 4. Explore the buffer overflow attacks and fuzzing to find software vulnerabilities, and obtain the knowledge of software and operating system security;
CLO 5. Understand and practice Internet security protocols and authentication applications;
CLO 6. Analyze the wireless security.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3, CLO5</td></tr>
<tr><td>Skill</td><td>CLO4, CLO6</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Cryptographic systems (symmetric and public key systems);</td><td>2</td><td>T</td></tr>
<tr><td>Authentication and authorization;</td><td>1</td><td>T,U</td></tr>
<tr><td>Malicious software;</td><td>1</td><td>T</td></tr>
<tr><td>Database and cloud security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Denial of service attacks;</td><td>1</td><td>T,U</td></tr>
<tr><td>Intrusion detection and prevention systems, firewalls;</td><td>1</td><td>T</td></tr>
<tr><td>Buffer overflow and software security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Operating system security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Internet security protocols;</td><td>1</td><td>T</td></tr>
<tr><td>Internet authentication applications;</td><td>1</td><td>T</td></tr>
<tr><td>Wireless security.</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. William Stallings and Lawrence Brown, Computer Security - Principles and Practice 3rd, 2015</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X		X	X		
2		X				
3	X					
4	X					
5	X					
6	X					

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Cryptographic systems (symmetric and public key systems);	1	Quiz, Exam	Lecture, Exercises, Lab	[1]
2	Authentication and authorization;	2	Quiz, Exam	Lecture, Lab	[1]
3	Malicious software;	3	Quiz, Exam	Lecture, Lab	[1]
4	Database and cloud security;	3	Quiz, Exam	Lecture, Lab	[1]
5	Denial of service attacks;	3	Quiz, Exam	Lecture	[1]
6	**Midterm**				
7	Intrusion detection and prevention systems, firewalls;	2	Quiz, Exam	Lecture	[1]
8	Buffer overflow and software security;	4	Quiz, Exam	Lecture, Lab	[1]
9	Operating system security;	4	Quiz, Exam	Lecture, Lab	[1]
10	Internet security protocols;	5	Quiz, Exam	Lecture, Exercises,	[1]
11	Internet authentication applications;	5	Quiz, Exam	Lecture, Exercises,	[1]
12	Wireless security.	6	Quiz, Exam	Lecture, Lab	[1]
13	**Final exam**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
Midterm examination (30%)	70%	80%	55%			
Final examination (40%)				75%	70%	75%
Exercises/ Quiz (30%)	30%	20%	45%	25%	30%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response

4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Internship for Engineers

Course Code: ITxxx

1. General information

Course designation	This course helps students to do an internship in industry and prepare a topic for a pre-thesis and thesis
Semester(s) in which the course is taught	After semester 5
Person responsible for the course	Lecturer of School of Computer Science and Engineering; Advisor from the peer company/organization
Language	English
Relation to curriculum	Compulsory, Information Technology
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 210 hours Self-study specified in hours: 210
Credit points	Number of credits: 7 Lecture: 0 Laboratory: 7
Required and recommended prerequisites for joining the course	None
Course objectives	This course requires students to work in organizations or companies in the summer or main semester. Each student is jointly supervised by a faculty member at SCSE and an instructor at the organization. The student will join or implement an IT-related project. The internship time at the organization must be at least 210 hours in total. For example, if a student does the internship at the company 8 hours per day, 5 days per week, then the internship time will be around 6 weeks; if the student works for 4 hours per day and 3 days per week, then it takes 18 weeks to complete the internship. Students have to report progress to instructors after 3 weeks of receiving the project. At the end of the internship, students will submit internship reports and assessment reports from the instructor at the peer organization SCSE. Instructors read the reports and confirm the internship marks for the students. Students can also take part in internships abroad for a period of 6 months. The organizations can be companies in the industry, academic institutions, or an office or department at an International University.
Course learning outcomes	CLO 1. Recognize the roles of an engineer in a practical environment. CLO 2. Develop practical products or run product development projects in industry CLO 3. Follow requirements/regulations and laws

<table>
<tr><td></td><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
<tr><td>Skill</td><td>CLO1, CLO2</td></tr>
<tr><td>Attitude</td><td>CLO3</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: within 3 months
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction of the internship place</td><td>9</td><td>U</td></tr>
<tr><td>Review the existing issues of an assigned project</td><td>9</td><td>U</td></tr>
<tr><td>Study and solve some issues in product development</td><td>9</td><td>U</td></tr>
<tr><td>Implement some new functions or features for the project product</td><td>9</td><td>U</td></tr>
<tr><td>Presentation</td><td>9</td><td>U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Report</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X				X
2		X				X
3				X	X	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction of the internship place	1,2	Check and Evaluate	Research and working	At company or organization
3	Review the existing issues of an assigned project	1,2	Check and Evaluate	Research and working	At company or organization

4	Study and solve some issues in product development	1,2	Check and Evaluate	Research and working	At company or organization
5	Implement some new functions or features for the project product	1,2	Check and Evaluate	Research and working	At company or organization
6	Presentation	1,2,3	Check and Evaluate	Research and working	At company or organization
7	**Final grade**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Final grade (100%)	30%	40%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: …….. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Peer organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May	Shows an emerging awareness of present assumptions (sometimes labels

	relevance of contexts when presenting a position.		be more aware of others' assumptions than one's own (or vice versa).	assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and

	transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	transitions) is clearly and consistently observable within the presentation.	transitions) is intermittently observable within the presentation.	transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the

	establishes the presenter's credibility/ authority on the topic.	establishes the presenter's credibility/ authority on the topic.	credibility/ authority on the topic.	presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: May 1, 2024

Ho Chi Minh City, 1/05/2024

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Artificial Intelligence

Course Code: IT159

1. General information

<table>
<tr><td>Course designation</td><td>This subject introduces the students to the principles and fundamental algorithms of Artificial Intelligence, the use cases and the related processes in Artificial Intelligence.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>6,8</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Nguyen Trung Ky</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, laboratory.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 hours (lectures) + 30 hours (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Object-Oriented Programming
Algorithms and Data Structures
Discrete Mathematics
Probability, Statistic & Random Process</td></tr>
<tr><td>Course objectives</td><td>This course introduces students to the basic knowledge on Artificial Intelligence. Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. In this course, student will learn the foundational principles and practice implementing some of these applications including representation, problem solving, and learning methods of artificial intelligence. Accordingly, students should be able to develop intelligent systems by assembling solutions to concrete computational problems; understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering; and appreciate the role of problem solving, vision, and language in understanding human intelligence from a computational perspective.</td></tr>
<tr><td>Course learning outcomes</td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
</table>
</td></tr>
</table>

	Knowledge	CLO 1. Apply knowledge of AI techniques and synthesize solutions to the discipline and ability to develop a range of typical applications using artificial intelligence methods CLO 2. Represent knowledge corresponding to practical problems, design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs by properly using classical search algorithms, including breadth-first, depth-first, A*, and heuristic search
	Skill	CLO 3. Produce intelligent applications of machine learning with statistical learning methods (Naive Bayes), supervised and unsupervised learning models: decision tree, neural networks, single-layer (perceptron) and multilayer networks CLO 4. Communicate effectively with a range of audiences, ability to use current techniques, skills, and tools necessary for computing practice, ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices and ability to apply design and development principles in the construction of software systems of varying complexity
	Attitude	

Content

The description of the contents should clearly indicate the weighting of the content and the level.

Weight: lecture session (~~3~~ hours)

Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Introduction and Intelligent Agents	1	I
States and Searching: Uninformed Search	1	T, U
States and Searching: Informed and More Sophisticated Search	1	T, U
Features and Constraints: Constraint Satisfaction Problems	1	T, U
Features and Constraints: Constraint Satisfaction Problems (continue)	1	T, U
Reasoning Under Uncertainty:	1	T, U

	• Random Variables and Events • Joint and Marginal Distributions • Conditional Distribution • Product Rule, Chain Rule, Bayes' Rule • Inference		
	Reasoning Under Uncertainty: Naïve Bayes Classifier (continue)	1	T, U
	Supervised Learning: Neural Networks	1	T, U
	Supervised Learning: Neural Networks (continue)	1	T, U
	Supervised Learning: Support Vector Machine	1	T, U
	Supervised Learning: Support Vector Machine in Mathematics	1	T, U
	Beyond Supervised Learning: Kernels and Clustering	1	T, U
	Beyond Supervised Learning: Kernels and Clustering (continue)	1	T, U
	Gaussian Mixture Model and Expectation-Maximization Algorithm	1	T, U
	Revision	1	
Examination forms	Multiple-choice questions, short-answer questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	[1] Stuart Russell and Peter Norvig, *"Artificial Intelligence: A Modern Approach"*, Fourth Edition, 2020. [2] David L. Poole and Alan K. Mackworth, *"Artificial Intelligence Foundations of Computational Agents"*, Second Edition, 2017.		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x	x				
2		x				x

3		x				x
4	x	x				x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction and Intelligent Agents	1, 2	Quiz	Lecture, Discussion	[1]. Chapter 1, 2 [2]. Chapter 1
2	States and Searching: Graph Searching Techniques	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 3
3	States and Searching: Heuristic Search and More Sophisticated Search	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 3
4	Features and Constraints: Constraint Satisfaction Problems	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 6
5	Features and Constraints: Constraint Satisfaction Problems (continue)	1, 2	Quiz	Lecture, In-class quiz	[1]. Chapter 6
6	Reasoning Under Uncertainty	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 12
7	Reasoning Under Uncertainty (continue)	3, 4	Quiz	Lecture, In-class quiz	1]. Chapter 12
8	**Midterm**				
9	Supervised Learning: Neural Networks	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 19 [2]. Chapter 20
10	Supervised Learning: Neural Networks (continue)	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 19 [2]. Chapter 20
11	Supervised Learning: Support Vector Machine	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 19 [2]. Chapter 15
12	Supervised Learning: Support Vector Machine in Mathematics (continue)	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 19 [2]. Chapter 15

13	Beyond Supervised Learning: Kernels and Clustering	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 21 [2]. Chapter 16, 22
14	Beyond Supervised Learning: Kernels and Clustering (continue)	3, 4	Quiz	Lecture, In-class quiz	[1]. Chapter 21 [2]. Chapter 16, 22
15	Gaussian Mixture Model and Expectation-Maximization Algorithm	3, 4	Quiz	Lecture, Discussion	[1]. Chapter 20 [2]. Chapter 24
16	Revision			Review-test	
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Labs (20%)		50%	50%
Midterm examination (30%)	50%	50%	
Final examination (40%)		100%	
Exercises/ Quiz (10%)	50%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the

	analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Scalable and Distributed Computing

Course Code: IT139

1. General information

Course designation	Fundamental concepts in distributed computing and discuss system designs enabling distributed applications
Semester(s) in which the course is taught	5,7
Person responsible for the course	Assoc. Prof. Vo Thi Luu Phuong
Language	English
Relation to curriculum	Compulsory (NE, DS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Algorithms and Data Structure Fundamentals of Programming or C/C++ Programming
Course objectives	This course presents the theory, design, implementation, and analysis of distributed systems. Through classroom lectures, labs, projects and exercises, students learn the fundamentals of distributed systems, system models, remote procedure call, distributed objects, operating system support, security in distributed systems, distributed file systems, concurrency, transaction and synchronization, replication. The course also covers advanced topics related to cloud and distributed data processing technologies: data partitioning, storage schemes, stream processing, and parallel algorithms. Course introduces some modern Internet and cloud computing services running on multiple geographically distributed data centers: Google, Yahoo, Facebook, iTunes, Amazon, eBay, Bing, etc.
Course learning outcomes	CLO 1. Understand the concept and design of distributed systems CLO 2. Apply distributed data processing models and technologies

<table>
<tr><td></td><td>CLO 3. Communicate to the team to design the data pipeline that can be integrated with distributed system,
CLO 4. Design and implement components of a scalable and distributed system (millions of users and petabytes of data)
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr>
<tr><td>Skill</td><td>CLO 2, CLO 4</td></tr>
<tr><td>Attitude</td><td>CLO 3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Distributed Systems, System Models</td><td>1</td><td>I, T</td></tr>
<tr><td>Remote Procedure Call, Distributed Objects</td><td>1</td><td>I, T</td></tr>
<tr><td>Operating System Support, Distributed File Systems</td><td>1</td><td>I, T</td></tr>
<tr><td>Transaction and Synchronization</td><td>1</td><td>T, U</td></tr>
<tr><td>Concurrency Control</td><td>1</td><td>T, U</td></tr>
<tr><td>Security</td><td>1</td><td>T, U</td></tr>
<tr><td>Fault and Failure</td><td>1</td><td>T, U</td></tr>
<tr><td>Introduction to MapReduce</td><td>1</td><td>T, U</td></tr>
<tr><td>Scalable K-means algorithms</td><td>1</td><td>T, U</td></tr>
<tr><td>Graph and Random-walk algorithms</td><td>1</td><td>T, U</td></tr>
<tr><td>Web services, XML, JSON, Node.js</td><td>1</td><td>T, U</td></tr>
<tr><td>Peer-to-Peer</td><td>1</td><td>I, T</td></tr>
<tr><td>Selected seminar 1: Introduce some distributed pipeline in Industry.</td><td>1</td><td>I</td></tr>
<tr><td>Selected seminar 2: Introduce some scalable and distributed products used in Industry.</td><td>1</td><td>I</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	1. G. Coulouris, J. Dollimore, T. Kindberg, G. Blair, Distributed Systems: Concepts and Design 5th, 2011 2. T. White, Hadoop: The Definitive Guide 4th, 2015 3. A.S. Tanenbaum, M.V. Steen, Distributed Systems: Principles and Paradigms 2nd, 2007

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x					
2	x	x				
3	x	x				x
4		x				x

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Distributed Systems, System Models	1		Lecture, Discussion	[1,2,3] Chapter 1
2	Remote Procedure Call, Distributed Objects	1	Exercises	Lecture, In-class exercises	[1,3] Chapter 2
3	Operating System Support, Distributed File Systems	1	Exercises	Lecture, In-class exercises	[1,3] Chapter 3
4	Transaction and Synchronization	1,2	Labs	Lecture, In-class exercises	[1,3] Chapter 3,4
5	Concurrency Control	1,2	Labs	Lecture, In-class exercises	[1,3] Chapter 5,6
6	**Midterm**				
7	Security	2,3	Exercises	Lecture, In-class exercises	[1,3] Chapter 6,7
8	Fault and Failure	2,3	Labs	Lecture, In-class exercises	[2] Chapter 5

9	Introduction to MapReduce	2,3	Exercises	Lecture, In-class exercises	[2] Chapter 6,7
10	Scalable K-means algorithms	2,3	Labs	Lecture, In-class exercises	Outside resources
11	Graph and Random-walk algorithms	2,3	Exercises	Lecture, In-class exercises	Outside resources
12	Web services, XML, JSON, Node.js	3,4	Labs	Lecture, In-class exercises	[1,3] Chapter 9,10,11
13	Peer-to-Peer	3,4	Labs	Lecture, In-class exercises	[1,3] Chapter 12
14	Selected seminar 1: Introduce some distributed pipeline in Industry.	4		Discussion	Outside resources
15	Selected seminar 2: Introduce some scalable and distributed products used in Industry.	4		Discussion	Outside resources
16	Revision			Review-test	
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO 1**	**CLO 2**	**CLO 3**
Labs (20%)		50%	50%
Midterm examination (30%)	50%	50%	
Final examination (40%)	20%	50%	30%
Exercises/ Quiz (10%)	50%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organization of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports

Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when

				presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and	Organizational pattern (specific introduction and conclusion, sequenced material within	Organizational pattern (specific introduction and conclusion, sequenced material within	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and

	transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	the body, and transitions) is clearly and consistently observable within the presentation.	the body, and transitions) is intermittently observable within the presentation.	transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandabilit y of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference

	make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Special Study of the Field

Course Code: IT083IU

1. **General information**

Course designation	This course helps students to do a research topic and prepare for a thesis
Semester(s) in which the course is taught	7
Person responsible for the course	Lecturers (thesis advisor)
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Total workload: 90 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: 90
Credit points	Number of credits : 3 Lecture: 0 Laboratory: 3
Required and recommended prerequisites for joining the course	Required number of credits, Internship
Course objectives	Students are advised to select a subject under the guidance of a faculty member. Project content might be a research topic or building a new application that underlies the graduation thesis. Research topics include fields of academic program that are academic or practical.
Course learning outcomes	CLO 1. Research a specific topic in the field. CLO 2. Design the model or system architecture of the application product CLO 3. Have a good preparation to develop and improve the product in the thesis.

Competency level	**Course learning outcome (CLO)**
Knowledge	CLO1
Skill	CLO1, CLO2
Attitude	CLO3

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: in the whole semester.
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Find out/define a topic of the subject</td><td>3</td><td>U</td></tr>
<tr><td>Review and evaluate existing issues/problems</td><td>8</td><td>U</td></tr>
<tr><td>Research and propose some solutions</td><td>8</td><td>U</td></tr>
<tr><td>Deploy some main functions or new features for the product project</td><td>8</td><td>U</td></tr>
<tr><td>Testing and evaluating solutions or products</td><td>8</td><td>U</td></tr>
<tr><td>Write a report</td><td>10</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the appointments with lecturer. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Tasks: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>Related works and books</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X				
2		X				X
3			X			

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Find out the topic of the subject	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
2	Review and evaluate existing issues	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers

4	Research and propose some solutions	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
5	Deploy some main functions or new features for the product project	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
6	Testing and evaluating solutions or products	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
7	Write a report	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
8	**Final grade**				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Final grade (100%)	30%	40%	30%

Note: %Pass: Target that % of students having scores greater than 60 out of 100.

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		

Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the

	analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Internet of Things

Course Code: IT134IU

1. General information

<table>
<tr><td>Course designation</td><td>The course explains the architecture, components of Internet of Thing networks.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Le Duy Tan</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective (All programs)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 2
Laboratory: 1
Mini project: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Computer Networks</td></tr>
<tr><td>Course objectives</td><td>The students will study the communication techniques between the components from short range to long range such as Bluetooth, Zigbee, Wi-fi, Lora, NB-IoT,… Moreover, the data storage, organization and analytics are also studied in this course. Furthermore, the mini project within this course will elevate students' understanding of the current state of the IoT industry world.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. The ability of designing and implementing some Internet of Thing systems;
CLO 2. The ability of collecting data then applying some data mining techniques to analyze the data in some IoT applications.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1</td></tr>
<tr><td>Skill</td><td>CLO 1 and CLO 2</td></tr>
<tr><td>Attitude</td><td>CLO 1</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)</td></tr>
</table>

		Topic	**Weight**	**Level**
		Week 1: Introduction to Internet of Things	1	I
		Week 2 : IoT System Design	1	U
		Week 3: Sensors and actuators in IoTs	1	T
		Week 4-8: Communication technologies in IoTs: PAN (Bluetooth, Zigbee), LAN (IEEE 802.11), WAN (LoRa, LTE)	5	T
		Week 9: Data collection in IoT	1	T, U
		Week 10: Data analytics	1	U
		Week 11-14: IoT Applications in Industry	4	T, U
		Week 15: Mini Project Presentation	1	U
Examination forms	Multiple-choice questions, short-answer questions			
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.			
Reading list	[1] Raj Kamal, Internet of Things Architecture and Design Principles, Mc Graw Hill India, 2017 [2] Hanes, David, et al. IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press, 2017. [3] Singh, Rajesh, et al. Internet of things with Raspberry Pi and Arduino. CRC Press, 2019. [4] Dow, Colin. Internet of things programming projects: build modern IoT solutions with the Raspberry Pi 3 and Python. Packt Publishing Ltd, 2018.			

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					

CLO	1	2	3	4	5	6
1		✓✓✓			✓✓	
2						✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Internet of Things	1, 2	Homework	Lecture, Discussion, Inclass-Quiz	[1]
2	IoT System Design	1	Homework	Lecture, Group work	[2]
3	Sensors and actuators in IoTs	1	Homework	Lecture, Discussion, Inclass-Quiz	[1]
	Midterm		**Written exam**		
4 - 8	Communication technologies in IoTs: PAN (Bluetooth, Zigbee), LAN (IEEE 802.11), WAN (LoRa, LTE)	1	Homework	Lecture, Discussion, Inclass-Quiz	[1] [2]
9	Data collection in IoT	2	Homework	Lecture, Discussion, Inclass-Quiz	[1]
10	Data analytics	1, 2	Homework	Lecture, Group work	[2]
12 - 14	IoT Applications in Industry	2	Homework	Lecture, Discussion, Inclass-Quiz, Presentation	[1]
15	Week 15: Mini Project Presentation	1, 2	Presentation	Test	
	Final exam		**Written exam**		

Assessment plan

Assessment Type	CLO1	CLO2
Quiz (5%)		10%
Labs (20%)	20%	20%
Midterm examination (30%)	30%	20%
Mini Project (5%)	25%	

Final examination (40%)	25%	50%

5. Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

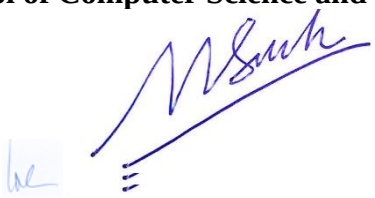
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: System and Network Administration

Course Code: IT125IU

1. General information

<table>
<tr><td>Course designation</td><td>Introduce new networking technologies, covering network topologies, deployment concepts, protocols, and system and management techniques</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>5</td></tr>
<tr><td>Person responsible for the course</td><td>MSc. Le Thanh Son</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (NE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 2
Laboratory: 1
Mini project: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Computer Networks</td></tr>
<tr><td>Course objectives</td><td>Introduce new networking technologies, covering network topologies, example deployment concepts, protocols, and management techniques. Explains the different elements and technologies that are used in enterprise network and how they relate to each other. Focus on fundamental concepts and principles. Provides a solid technical foundation to successfully navigate network management topics and apply those concepts to particular situations. Working in an industrial environment can help students deepen their understanding of administration jobs and sharpen their skills.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand key elements and services of networked systems in enterprise environments
CLO 2. Understand the technologies used in enterprise networks and how they related to each other
CLO 3. Understand the role and responsibility of system administrator

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>1, 2, 3</td></tr><tr><td>Skill</td><td>2</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>Attitude</td><td>3</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to system and network administration</td><td>3</td><td>I</td></tr><tr><td>System element: Workstations</td><td>3</td><td>T, U</td></tr><tr><td>System element: Servers</td><td>3</td><td>T, U</td></tr><tr><td>Server strategies</td><td>3</td><td>T, U</td></tr><tr><td>Enterprise Services</td><td>3</td><td>T, U</td></tr><tr><td>Data center</td><td>3</td><td></td></tr><tr><td>Networks</td><td>3</td><td>T, U</td></tr><tr><td>Disaster Recovery and Data Integrity</td><td>3</td><td>T, U</td></tr><tr><td>Security Policy</td><td>3</td><td>T, U</td></tr><tr><td>System Administrators</td><td>3</td><td>T, U</td></tr><tr><td>System and Network in the Industry</td><td>3</td><td>T, U</td></tr><tr><td>Working in Industry Report and Presentation</td><td>3</td><td>T, U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Thomas Limoncelli, Practice of System and Network Administration, Volume 1, 2016
2. Alexander Clemm, Network Management Fundamentals 1st, 2006</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLO	1	2	3	4	5	6
1	xxx					
2	xxx					
3			x	xxx		

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources

1	Introduction to system and network administration	3	Quiz	Lecture	1, 2
2	System element: Workstations	1, 2	Quiz, Midterm	Lecture	1
3	System element: Servers	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
4	Server strategies	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
5	Enterprise Services	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
6	Data center	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
7	Networks	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
8	Disaster Recovery and Data Integrity	1, 2	Quiz, Lab, Midterm	Lecture, Discussion	1
MIdterm exam					
9	Security Policy	1, 2	Quiz, Final	Lecture, Discussion	1
10	System Administrators	1, 2	Quiz, Final	Lecture, Discussion	1
11-14	System and Network in the Industry	1, 2	Quiz, Final	Lecture, Discussion	1
15	Working in Industry Report and Presentation	1, 2	Quiz, Final	Test	1
Final exam					

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Presentation (20%)	20%	20%	20%
Lab (10%)	10%	10%	
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	40%	40%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. When calculating contact time, each contact hour is counted as a full hour because the organization of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			

Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or	Issue/ problem to be considered critically is stated without clarification or description.

			backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)

	speaker appears polished and confident.	make the presentation interesting, and speaker appears comfortable.	make the presentation understandable, and speaker appears tentative.	detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Entrepreneurship

Course Code: IT120

1. **General information**

Course designation	An introduction to the creative and innovative managerial practices of successful entrepreneurship.
Semester(s) in which the course is taught	7
Person responsible for the course	MSc. Dao Tran Hoang Chau
Language	English
Relation to curriculum	Compulsory (CS, NE, CE) Elective (DS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits : 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	
Course objectives	This course reviews the significant economic and social contributions entrepreneurs provide to society, the intense lifestyle commitment, and the skills necessary for entrepreneurial success. It explores how to identify and develop solutions to the most common leadership and personal challenges faced by entrepreneurs when starting new ventures or launching new products. It also promotes a deeper understanding of what is required to be a successful entrepreneur, highlights the skills and tools necessary to start a new business and explores alternatives to common pitfalls.This course applies entrepreneurial marketing approaches used by successful entrepreneurs. These include utilizing industry sector trends, identifying emerging customer niches, developing new products/services, using guerilla marketing strategies, and Internet and social marketing strategies. It emphasizes the importance of managing cash flows, ratio analysis, pro forma development, and the basics of deal structure and harvesting a business venture. Students will identify and

<table>
<tr><td></td><td>interpret sources of information from company financial reports, financial publications, industry benchmarks, the media, and web sites.An introduction to the process of researching, writing, and presenting a business plan. Students identify and screen ideas using a business feasibility study that describes the product features, market opportunity, customer profile, sales forecast, competitive advantage, and profit potential. Following a successful feasibility study, students may use business plan software as each develops their own complete business plan.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand entrepreneurial processes;
CLO 2. Apply new technology to boost business performance;
CLO 3. Manage marketing strategy and financial statements in a enterprise;
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1, 2, 3</td></tr>
<tr><td>Skill</td><td>1, 3</td></tr>
<tr><td>Attitude</td><td>3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Entrepreneurship, Creativity and Innovation;</td><td>3</td><td>I, T</td></tr>
<tr><td>Creative Problem Solving Model;</td><td>3</td><td>T, U</td></tr>
<tr><td>Develop a Product. Generate Ideas and Protect Inventions;</td><td>2</td><td>T</td></tr>
<tr><td>Marketing Strategies;</td><td>3</td><td>T, U</td></tr>
<tr><td>Finance and Accounting</td><td>4</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Duening & Hisrich & Lechter, Technology Entrepreneurship 2nd, 2014</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1			x			
2		x				
3				x		

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Entrepreneurship, Creativity and Innovation;	1	Midterm exam	Lecture, In-class activities, Quiz	
2	Creative Problem Solving Model;	1	Midterm exam	Lecture, In-class activities, Quiz	
3	Develop a Product. Generate Ideas and Protect Inventions;	2	Midterm exam, Assignment	Lecture, In-class activities, Project	
4	Midterm				
5	Marketing Strategies;	3	Final exam, Assignment	Lecture, Project	
6	Finance and Accounting	3	Final exam, Assignment	Lecture, Project	
7	**Final exam**				

4. Assessment plan

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Assessment Type	CLO1	CLO2	CLO3
Midterm examination (25%)	50%	50%	
Projects/Presentations/ Report (25%)			60%
Final examination (40%)			40%
Exercises/ Quiz (10%)	50%	50%	

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports	
Student: ……..	HW/Assignment:
Date: ……	…….

	Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. **Analytic rubric**

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described	Issue/ problem to be considered critically is stated, described, and clarified so	Issue/ problem to be considered critically is stated but	Issue/ problem to be considered critically is stated without

	comprehensively, delivering all relevant information necessary for full understanding.	that understanding is not seriously impeded by omissions.	description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced	Organizational pattern (specific introduction and conclusion, sequenced	Organizational pattern (specific introduction and conclusion, sequenced	Organizational pattern (specific introduction and conclusion, sequenced material within

	material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	material within the body, and transitions) is clearly and consistently observable within the presentation.	material within the body, and transitions) is intermittently observable within the presentation.	the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations,	Supporting materials (explanations, examples, illustrations, statistics, analogies,	Supporting materials (explanations, examples, illustrations, statistics, analogies,	Insufficient supporting materials (explanations, examples, illustrations, statistics,

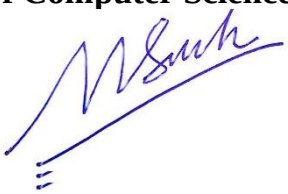
	statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Thesis

Course code: IT058IU

1. **General information**

Course designation	This course evaluates students obtained knowledges to complete the academic program.
Semester(s) in which the course is taught	8
Person responsible for the course	Lecturers (thesis advisor)
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Contact hours: 300 hours Private study including examination preparation, specified in hours: 300
Credit points	Number of credits : 10 Lecture: 0 Laboratory: 10
Required and recommended prerequisites for joining the course	Required number of credits Special Study of the Field
Course objectives	Dissertations are industrial projects designed to ensure that students have mastered their subjects in the program. All projects are based on "real projects" provided by the industry to students to develop skills and apply knowledge gained from all courses throughout the program. Students will work independently to develop requirements, design, implement and provide solutions to business problems. Students can follow any appropriate process model, must self-manage the project, follow all appropriate project management techniques. The success of the project is largely determined by whether the student adequately solves the client's problem. Students will provide the final product with all artifacts that match the process model being used (e.g. project plan, technical requirements, system architecture, design documentation, test plan, source code and installed software products).
Course learning outcomes	CLO 1. Research a specific topic in the field. CLO 2. Design the model or system architecture of the application product

<table>
<tr><td></td><td>CLO 3. Hard work to develop and finish the product of the thesis.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1</td></tr><tr><td>Skill</td><td>CLO1, CLO2</td></tr><tr><td>Attitude</td><td>CLO3</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: in the whole last semester
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Find out the thesis topic</td><td>4</td><td>U</td></tr><tr><td>Review and evaluate existing issues</td><td>20</td><td>U</td></tr><tr><td>Research and propose some solutions</td><td>30</td><td>U</td></tr><tr><td>Deploy the thesis product</td><td>40</td><td>U</td></tr><tr><td>Testing and evaluating solutions or products</td><td>40</td><td>U</td></tr><tr><td>Thesis defense</td><td>1</td><td>U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2	X	X				X
3			X			

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Find out the thesis topic	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
2	Review and evaluate existing issues	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
4	Research and propose some solutions	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
5	Deploy the thesis product	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
6	Testing and evaluating solutions or products	1,2	Check and Evaluate	Discuss and Research	Related work, books and research papers
7	Thesis defense	1,2,3	By committee	presentation	
8	**Final grade**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3
Final grade (100%)	30%	40%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or	Issue/ problem to be considered critically is stated without clarification or description.

			backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	acknowledged within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	makes the content of the presentation cohesive.	within the presentation.		
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or

	appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Principles of Electrical Engineering I

Course Code: IT068IU

1. General information

Course designation	This subject covers the fundamental knowledge of electrical engineering
Semester(s) in which the course is taught	2
Person responsible for the course	Dr. Ly Tu Nga
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture). Private study including examination preparation, specified in hours: 90
Credit points	Number of credits: 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	Calculus 1
Course objectives	This course covers the following topics: Circuit elements; Independent sources; Dependent sources; Circuit analysis in DC and AC steady state; Operational amplifiers; Power Computations; Two-port circuits; Balanced three-phase circuits. Special seminar(s).
Course learning outcomes	CLO 1. Understand how to use electric equipment, meters, multi-meters, power supplies, oscilloscopes and counters; To study the behavior of some specified circuits. CLO 2. Apply critical and analytic thinking to the principles of electrical engineering process; CLO 3. Analyze and evaluate creative thinking in the design of electrical engineering solutions; CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.

	<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1</td></tr><tr><td>Skill</td><td>CLO2,3</td></tr><tr><td>Attitude</td><td>CLO4</td></tr></table>
Content	*The description of the contents should clearly indicate the weighting of the content and the level.* Weight: lecture session (~~3~~ hours) Teaching levels: I (Introduce); T (Teach); U (Utilize) <table><tr><th>Content</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to EE051IU: Circuit variables</td><td>1</td><td>I</td></tr><tr><td>Simple resistive circuits.</td><td>1</td><td>T</td></tr><tr><td>Techniques of circuit analysis</td><td>2</td><td>T,U</td></tr><tr><td>The operational amplifier.</td><td>1</td><td>T</td></tr><tr><td>Inductance, capacitance and mutual inductance.</td><td>1</td><td>T</td></tr><tr><td>Sinusoidal steady-state analysis.</td><td>1</td><td>T</td></tr><tr><td>Sinusoidal steady-state power calculations.</td><td>1</td><td>T,U</td></tr><tr><td>Two-port circuits.</td><td>1</td><td>T</td></tr><tr><td>Balanced three-phase circuits: three-phase voltage sources, analysis of the wye-wye and wye- delta circuit, power calculation and measurements.</td><td>2</td><td>T</td></tr><tr><td>Response of first-order RL and RC circuit: natural and step responses, sequential switching and unbounded response.</td><td>1</td><td>T</td></tr><tr><td>Introduction to Laplace transform: definition, step and impulse functions, functional and operational transform, inverse transform, poles and zeros, initial and final value theorems.</td><td>1</td><td>T</td></tr><tr><td>Term project presentation</td><td>1</td><td></td></tr><tr><td>Review / Questions & Answers</td><td>1</td><td></td></tr></table>
Examination forms	Multiple-choice questions, short-answer questions
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	1. J. W. Nilsson and S. A. Riedel, Electric Circuits 9th, 2011 2. R. C. Dorf and J. A. Svoboda, Introduction to Electric Circuits 9th, 2014

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	Content	CLO	Teaching and learning activities	Assessment	Resources
1	Introduction to EE051IU: Circuit variables	CLO 1	-Lecture -Class discussion		[1]
2	Simple resistive circuits.	CLO 1	- Lecture - Class discussion	Homework	[1]
3 & 4	Techniques of circuit analysis	CLO 1, CLO 2	- Lecture - Class discussion	Quiz 1	[1]
5	The operational amplifier.	CLO 1, CLO 2	- Lecture - Class discussion	Homework	[1]
6	Inductance, capacitance and mutual inductance.	CLO 1, CLO 2	- Lecture - Class discussion	Homework	[1]
7	Sinusoidal steady-state analysis.	CLO 1, CLO 2	- Lecture - Class discussion	Homework	[1]
Midterm exam		**CLO 1; CLO 2**		**Written exam**	
8	Sinusoidal steady-state power calculations.	CLO 1, CLO 2	- Lecture - Class discussion	Quiz 2	[1,2]
9	Two-port circuits.	CLO 1, CLO 2	- Lecture - Class discussion	Quiz 3	[1,2]

10-11	Balanced three-phase circuits: three-phase voltage sources, analysis of the wye-wye and wye-delta circuit, power calculation and measurements.	CLO 1, CLO 2, CLO 3	- Lecture - Class discussion	Homework	[1,2]
12	Response of first-order RL and RC circuit: natural and step responses, sequential switching and unbounded response.	CLO 1, CLO 2, CLO 3	- Lecture - Class discussion	Homework	[1,2]
13	Introduction to Laplace transform: definition, step and impulse functions, functional and operational transform, inverse transform, poles and zeros, initial and final value theorems.	CLO 1, CLO 2, CLO 3	- Lecture - Class discussion	Homework	[1,2]
14	Term project presentation	CLO 1, CLO 2, CLO 3	Group presentation	Term project presentation	[1,2]
15	Review / Questions & Answers	CLO 1, CLO 2	- Lecture - Class discussion	Homework	
FINAL EXAMINATION				**Written exam**	

4. Assessment plan

(Hint)

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%	30%	30%	50%
Final examination (40%)	40%	40%	40%	50%
Exercises/ Quiz (30%)	30%	30%	30%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**	**Benchmark**

	4	3	2	1
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others'	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when

	presenting a position.		assumptions than one's own (or vice versa).	presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Principles of Electrical Engineering I Laboratory

Course Code: IT098IU

1. General information

<table>
<tr><td>Course designation</td><td>This subject covers the fundamental knowledge of electrical engineering laboratory</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>2</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ly Tu Nga</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 60
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory)
Private study including examination preparation, specified in hours: 30</td></tr>
<tr><td>Credit points</td><td>Number of credits : 1
Lecture: 0
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Calculus 1</td></tr>
<tr><td>Course objectives</td><td>This course helps students to understand better the course Principles of Electrical Engineering I. Experimental exercises in use of laboratory instruments. Voltage, current, impedance, frequency, and waveform measurements. Rudiments of circuit modeling and design.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand how to use electric equipment, meters, multi-meters, power supplies, oscilloscopes and counters; To study the behavior of some specified circuits.
CLO 2. Apply critical and analytic thinking to the principles of electrical engineering process;
CLO 3. Analyze and evaluate creative thinking in the design of electrical engineering solutions;
CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>Skill</td><td>CLO2,3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>1</td><td>I</td></tr>
<tr><td>Kirchoff’s current and voltage laws</td><td>1</td><td>T</td></tr>
<tr><td>Frequency and phase shift measurement</td><td>1</td><td>T,U</td></tr>
<tr><td>Thevenin’s theorem</td><td>1</td><td>T</td></tr>
<tr><td>Mesh and nodal analysis of AC circuits</td><td>2</td><td>T</td></tr>
<tr><td>Operational Amplifiers</td><td>2</td><td>T</td></tr>
<tr><td>Circuits utilizing op-amps</td><td>1</td><td>T,U</td></tr>
<tr><td>Professional and ethical case studies</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Yasir, Sultan, Principles of Electrical Engineering Lab. Manual, Book, 2019</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Teaching and learning activities	Assessments	Resources

1	Introduction	CLO1	-Lecture -Class discussion		[1]
2	Kirchoff's current and voltage laws	CLO1,2,3	-Practice -Class discussion	Report	[1]
3	Frequency and phase shift measurement	CLO1,2,3	-Practice -Class discussion	Report	[1]
5	Thevenin's theorem	CLO1,2,3	-Practice -Class discussion	Report	[1]
6	Mesh and nodal analysis of AC circuits	CLO1,2,3	-Practice -Class discussion	Report	[1]
7	Operational Amplifiers	CLO1,2,3	-Practice -Class discussion	Report	[1]
8	Circuits utilizing op-amps	CLO1,2,3	-Practice -Class discussion	Report	[1]
9	Professional and ethical case studies	CLO1,2,3	-Practice -Class discussion	Report	[1]
10	**Final exam**			**Written exam**	

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Lab. Assignments (70%)	80%	50%	50%	50%
Final examination (30%)	20%	50%	50%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports	
Student: ……..	HW/Assignment:
Date: ……	…….

	Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously	Issue/ problem to be considered critically is stated but description leaves some	Issue/ problem to be considered critically is stated without clarification or description.

	information necessary for full understanding.	impeded by omissions.	terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Electronics Devices

Course Code: IT074IU

1. General information

Course designation	This subject covers the fundamental knowledge of electronics devices
Semester(s) in which the course is taught	5
Person responsible for the course	Dr. Ly Tu Nga
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture). Private study including examination preparation, specified in hours: 90
Credit points	Number of credits: 3 Lecture: 3 Laboratory: 0
Required and recommended co-requisites for joining the course	Electronics Devices Laboratory (Co-requisite)
Course objectives	Fundamentals of semiconductor devices and microelectronic circuits, characteristics of p-n, Zener diodes, and analog diode circuits. Principles of MOSFET and BJT operation, biasing, transistor analysis at midband frequencies.
Course learning outcomes	CLO 1. Understand how to use electric equipment, meters, multi-meters, power supplies, oscilloscopes and counters; To study the behavior of some specified circuits. CLO 2. Apply critical and analytic thinking to the electronics devices process; CLO 3. Analyze and evaluate creative thinking in the design of electronic devices solutions; CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.

		Competency level	**Course learning outcome (CLO)**
		Knowledge	CLO1
		Skill	CLO2,3
		Attitude	CLO4
Content	*The description of the contents should clearly indicate the weighting of the content and the level.* Weight: lecture session (~~3~~ hours) Teaching levels: I (Introduce); T (Teach); U (Utilize)		

Topic	**Weight**	**Level**
Frequency selective circuits, passive filter design.	1	I,T
Active filter circuits.	1	T
Fourier Series.	1	T
Analog and digital signals, amplifiers, circuit models for amplifiers, network theorems.	1	T
Operational Amplifiers, Ideal Op Amp, inverting & non-inverting configurations, Op Amp circuits, non-ideal performance.	1	T
Diodes, Ideal diode, terminal characteristics, analysis of diode circuits, small signal analysis.	1	T
PN junction under reverse-bias, PN junction under forward bias, zener diodes, Diode applications, diode circuit design.	1	T
Bipolar Junction Transistors; Physical structures and models of operation, PNP & NPN transistors	1	T
DC analysis, BJT as an amplifier.	1	T
Single stage amplifier configurations; BJT in cut-off and saturation; BJT circuit applications and circuit design.	1	T
Field-Effect Transistors, structure and physical operation of enhancement-type and depletion type MOSFET.	1	T
FET circuit in DC.	1	T,U
FET as an amplifier, biasing circuits and biasing design; Basic configuration of single-stage FET amplifiers.	1	T,U

	Basic configuration of single-stage FET amplifiers; FET circuit design, CMOS and CMOS Applications.	1	T,U
	Pspice simulations.	1	T
Examination forms	Multiple-choice questions, short-answer questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	1. A. S. Sedra and K. C. Smith, Microelectronic Circuits 6th, 2009 2. J. W. Nilsson and S. A. Riedel, Electric Circuits 9th, 2011 3. R. C. Dorf and J. A. Svoboda, Introduction to Electric Circuits 9th, 2014		

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Teaching and Learning activities**	**Assessments**	**Resources**
1	Frequency selective circuits, passive filter design.	CLO 1	-Lecture -Class discussion		[2,3]
2	Active filter circuits.	CLO 1	- Lecture - Class discussion	Homework	[2,3]
3	Fourier Series.	CLO 1, CLO 2	- Lecture - Class discussion	Quiz 1	[2,3]

4	Analog and digital signals, amplifiers, circuit models for amplifiers, network theorems.	CLO 1	- Lecture - Class discussion	Homework	[1]
5	Operational Amplifiers, Ideal Op Amp, inverting & non-inverting configurations, Op Amp circuits, non-ideal performance.	CLO 1, CLO 2	- Lecture - Class discussion	Quiz 2	[1]
6	Diodes, Ideal diode, terminal characteristics, analysis of diode circuits, small signal analysis.	CLO 1	- Lecture - Class discussion	Homework	[1]
7	PN junction under reverse-bias, PN junction under forward bias, zener diodes, Diode applications, diode circuit design.	CLO 1	- Lecture - Class discussion	Homework	[1]
8	**Midterm**		**Written exam**		
9	Bipolar Junction Transistors; Physical structures and models of operation, PNP & NPN transistors	CLO 1,2	- Lecture - Class discussion	Quiz 3	[1]
10	DC analysis, BJT as an amplifier.				[1]
11	Single stage amplifier configurations; BJT in cut-off and saturation; BJT circuit applications and circuit design.	CLO 1	- Lecture - Class discussion		[1]
12	Field-Effect Transistors, structure and physical operation of enhancement-type and depletion type MOSFET.	CLO 1	- Lecture - Class discussion	Homework	[1]
13	FET circuit in DC.	CLO 1	- Lecture - Class discussion		[1]
14	FET as an amplifier, biasing circuits and biasing design; Basic	CLO 1,2	- Lecture - Class discussion	Quiz 4	[1]

	configuration of single-stage FET amplifiers.				
15	Basic configuration of single-stage FET amplifiers; FET circuit design, CMOS and CMOS Applications.	CLO 1	- Lecture - Class discussion	Homework	[1]
16	Pspice simulations.	CLO 1,2,3	- Lecture - Class discussion		[1]
17	**Final exam**		**Written exam**		

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%	30%	30%	50%
Final examination (40%)	40%	40%	40%	50%
Exercises/ Quiz (30%)	30%	30%	30%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		

Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally

	information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Electronics Devices Laboratory

Course Code: IT101IU

1. General information

Course designation	This subject covers the fundamental knowledge of electronics devices
Semester(s) in which the course is taught	5
Person responsible for the course	Dr. Ly Tu Nga
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 60 Contact hours: 30 (laboratory) Private study including examination preparation, specified in hours: 30
Credit points	Number of credits: 1 Lecture: 0 Laboratory: 1
Required and recommended prerequisites for joining the course	Electronic Devices
Course objectives	Laboratory experiments in microelectronic circuits using semiconductor devices, including diodes, MOSFETs and BJTs. Employing a learn-by-doing approach, emphasizing the hands-on-experimental experiences and computer simulation.
Course learning outcomes	CLO 1. Understand how to use electric equipment, meters, multi-meters, power supplies, oscilloscopes and counters; To study the behavior of some specified circuits. CLO 2. Apply critical and analytic thinking to the electronics devices process; CLO 3. Analyze and evaluate creative thinking in the design of electronic devices solutions; CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.

Competency level	**Course learning outcome (CLO)**
Knowledge	CLO1
Skill	CLO2,3
Attitude	CLO4

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction and Laboratory Equipment.</td><td>1</td><td>I,T</td></tr>
<tr><td>RC Circuits and Operational Amplifier.</td><td>1</td><td>T,U</td></tr>
<tr><td>Semiconductor Junction Diode.</td><td>2</td><td>T,U</td></tr>
<tr><td>Bipolar Junction Transistors: I-V Characteristics and Biasing.</td><td>1</td><td>T,U</td></tr>
<tr><td>Bipolar Junction Transistors: Amplifier Topologies.</td><td>1</td><td>T,U</td></tr>
<tr><td>MOSFET Transistors.</td><td>2</td><td>T,U</td></tr>
<tr><td>Professional and ethical case studies</td><td>1</td><td>T,U</td></tr>
<tr><td>Review.</td><td>1</td><td></td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] R.ChinnaRao, ELECTRONIC DEVICES AND CIRCUITS LABORATORY MANUAL, 2019.</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Teaching and Learning activities	Assessments	Resources

1	Introduction and Laboratory Equipment.	CLO1	-Lecture -Class discussion		[1]
2	RC Circuits and Operational Amplifier.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
3	Semiconductor Junction Diode.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
4	Bipolar Junction Transistors: I-V Characteristics and Biasing.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
5	Bipolar Junction Transistors: Amplifier Topologies.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
6	MOSFET Transistors.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
7	Professional and ethical case studies	CLO2,3,4	-Practice -Class discussion	-Report	[1]
8	Review.	CLO1,2,3	-Practice -Class discussion	-Report	[1]
9	**Final exam**		-Practice	**Written exam**	

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Lab. Assignments (70%)	70%	70%	70%	70%
Final examination (30%)	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**

Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously	Issue/ problem to be considered critically is stated but description leaves some terms	Issue/ problem to be considered critically is stated without clarification or description.

	necessary for full understanding.	impeded by omissions.	undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Micro-processing Systems

Course Code: IT128IU

1. General information

Course designation	This subject covers the fundamental knowledge of Micro-processing system
Semester(s) in which the course is taught	4
Person responsible for the course	Assoc. Prof. Dinh Duc Anh Vu
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits : 3 Lecture: 3 Laboratory: 0
Required and recommended co-requisites or prerequisites for joining the course	Co-requisites: Micro-processing System Laboratory
Course objectives	This course provides students the fundamentals of microprocessors and microcomputers; data flow; machine programming; assembly languages, architectures and instructions sets; stacks, subroutines, I/O, and interrupts; interfacing fundamentals; designing with microprocessors, and applications of micro-processing systems to some practical problems.
Course learning outcomes	CLO 1. Understand the operation of a basic computer organization. CLO 2. Apply the assembly language to solve a specific problem. CLO 3. Design the micro-processing systems for a specific purpose CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.

Competency level	Course learning outcome (CLO)

<table>
<tr><td></td><td>
<table>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2,3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Orientation</td><td>1</td><td>I</td></tr>
<tr><td>Introduction</td><td>1</td><td>I</td></tr>
<tr><td>Basic Computer Organization</td><td>1</td><td>T</td></tr>
<tr><td>The Pentium Processor</td><td>1</td><td>T</td></tr>
<tr><td>Overview of Assembly Language</td><td>1</td><td>T</td></tr>
<tr><td>Procedures and the Stack</td><td>2</td><td>T,U</td></tr>
<tr><td>Addressing Modes</td><td>1</td><td>T,U</td></tr>
<tr><td>Arithmetic Flags and Instruction</td><td>1</td><td>T,U</td></tr>
<tr><td>Selection and Iteration</td><td>1</td><td>T,U</td></tr>
<tr><td>Logical and Bit Operations</td><td>1</td><td>T,U</td></tr>
<tr><td>String Processing</td><td>1</td><td>T</td></tr>
<tr><td>ASCII and BCD Arithmetic</td><td>1</td><td>T,U</td></tr>
<tr><td>High-Level Language Interface</td><td>1</td><td>T,U</td></tr>
<tr><td>Final Exam Review</td><td>1</td><td>T</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Dandamudi, Introduction to Assembly Language Programming 2nd, 2004
2. Irvine, Assembly Language for Intel-Based Computers 4th, 2003</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6

1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Teaching and learning activities**	**Assessments**	**Resources**
1	Orientation	CLO1	-Lecture -Class discussion		[1]
2	Introduction	CLO1	- Lecture - Class discussion		[1]
3	Basic Computer Organization	CLO1,2	- Lecture - Class discussion	Homework	[1]
4	The Pentium Processor	CLO1,2	- Lecture - Class discussion	Quiz 1	[1]
5	Overview of Assembly Language	CLO1,2	- Lecture - Class discussion		[1]
6	Procedures and the Stack	CLO1,2,3	- Lecture - Class discussion	Homework	[1]
7	**Midterm**			**Written exam**	
8	Addressing Modes	CLO1,2	- Lecture - Class discussion	Quiz 2	[1]
9	Arithmetic Flags and Instruction	CLO1,2,3	- Lecture - Class discussion		[1]
10	Selection and Iteration	CLO2,3,4	- Lecture - Class discussion	Homework	[1]
11	Logical and Bit Operations	CLO2,3,4	- Lecture - Class discussion		[1]
12	String Processing	CLO2,3,4	- Lecture - Class discussion	Quiz 3	[1]
13	ASCII and BCD Arithmetic	CLO2,3,4	- Lecture		[1]

			- Class discussion		
14	High-Level Language Interface	CLO2,3,4	- Lecture - Class discussion	Homework	[1]
15	Final Exam Review	CLO2,3,4	- Lecture - Class discussion		
16	**Final exam**			**Written exam**	

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%	30%	30%	30%
Final examination (40%)	40%	40%	40%	40%
Exercises/ Quiz (30%)	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		

Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the

	analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Micro-processing Systems Lab

Course Code: IT129IU

1. General information

<table>
<tr><td>Course designation</td><td>This subject covers the fundamental knowledge of Micro-processing system Laboratory</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>4,6</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Dinh Duc Anh Vu</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 60
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory)
Private study including examination preparation, specified in hours: 30</td></tr>
<tr><td>Credit points</td><td>Number of credits : 1
Lecture: 0
Laboratory: 1</td></tr>
<tr><td>Required and recommended co-requisites for joining the course</td><td>Micro-processing System</td></tr>
<tr><td>Course objectives</td><td>In this course the students will study and do experiments with ARM microcontroller development KIT. Student will be able to practice with following topics : assembly languages, architectures and instructions sets; stacks, subroutines, I/O, and interrupts; peripheral interfacing fundamentals; designing with microprocessors, and applications of micro-processing systems to some practical problems.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. An ability to design and conduct experiments with microcontroller as well as to analyze and interpret data
CLO 2. An ability to identify, formulate, and solve engineering problems using microcontroller based solutions
CLO 3. Implement assembly language to solve a specific problem
CLO 4. Have an opportunity to exam case studies to understand the professional and ethical responsibility as an engineer.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>Skill</td><td>CLO1,3</td></tr><tr><td>Attitude</td><td>CLO4</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to KIT, Softs, and installing devices</td><td>1</td><td>I,T</td></tr><tr><td>General Input/Output; SPI interface</td><td>2</td><td>T,U</td></tr><tr><td>Memory interfacing, programming: addressing modes; UART interfaces</td><td>1</td><td>T,U</td></tr><tr><td>Interrupts and applications</td><td>1</td><td>T,U</td></tr><tr><td>Timers and applications</td><td>1</td><td>T,U</td></tr><tr><td>ADC conversion (polling and interrupt method) and applications</td><td>1</td><td>T,U</td></tr><tr><td>Sensors and applications</td><td>2</td><td>T,U</td></tr><tr><td>Professional and ethical case studies</td><td>1</td><td>T,U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Muhammad Ali Mazidi and, Sarmad Naimi and Sepehr Naimi, The AVR Microcontroller and Embedded Systems: Using Assembly and C 1st, 2010</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	✓	✓				
2	✓	✓				
3			✓			✓
4			✓			✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Teaching and learning activities	Assessments	Resources
1	Introduction to KIT, Softs, and installing devices	CLO1	-Lecture -Class discussion		[1]
2	General Input/Output; SPI interface	CLO2,3,4	-Practice -Class discussion	-Report	[1]
3	Memory interfacing, programming: addressing modes; UART interfaces	CLO2,3,4	-Practice -Class discussion	-Report	[1]
4	Interrupts and applications	CLO2,3,4	-Practice -Class discussion	-Report	[1]
5	Timers and applications	CLO2,3,4	-Practice -Class discussion	-Report	[1]
6	ADC conversion (polling and interrupt method) and applications	CLO2,3,4	-Practice -Class discussion	-Report	[1]
7	Sensors and applications	CLO2,3,4	-Practice -Class discussion	-Report	[1]
8	Professional and ethical case studies	CLO4	-Practice -Class discussion	-Report	[1]
9	**Final exam**		-Practice	-Written exam	

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Lab. Assignments (70%)	70%	70%	70%	70%
Final examination (30%)	30%	30%	30%	30%

Assessment Type

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual

questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts

	presenting a position.		others' assumptions than one's own (or vice versa).	when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital System Design

Course Code: IT105IU

1. General information

Course designation	This course introduces methodology and techniques to design digital systems
Semester(s) in which the course is taught	6
Person responsible for the course	Assoc. Prof. Vo Thi Luu Phuong
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 135 Contact hours: 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits: 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	Digital Logic Design
Parallel course	Digital System Design Lab
Course objectives	This course introduces methodology and techniques to design digital systems. The topics including the basic concepts, analysis, and system design with hardware description languages (HDL). The course provides an insight of the design of asynchronous sequential circuits and complex synchronous systems. Design process is introduced by concepts, documents, and simulation. .
Course learning outcomes	CLO 1. An ability to define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation. CLO 2. An ability to understand the different switching algebra theorems and apply them for logic functions. CLO 3. An ability to define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions. CLO 4. An ability to understand sequential circuits, such as counters and shift registers, and to perform simple projects using standard logic and integrated chips.

<table>
<tr><td></td><td>CLO 5. An ability to analyze and design asynchronous sequential digital elements
CLO 6. An ability to analyze and design synchronous digital elements
CLO 7. An ability to write and verify synthesizable VHDL models
CLO 8. An ability to effectively use VHDL simulator
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1, 2, 3</td></tr>
<tr><td>Skill</td><td>CLO 4, 5, 6</td></tr>
<tr><td>Attitude</td><td>CLO 7, 8</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Number systems, Binary and Hexadecimal</td><td>1</td><td>I</td></tr>
<tr><td>Number systems, Binary and Hexadecimal</td><td>1</td><td>I</td></tr>
<tr><td>Switching algebra, Theorems, Standard representation of logic functions.</td><td>1</td><td>T</td></tr>
<tr><td>Boolean algebra, Combinational circuits, Truth table, Karnaugh maps, Minimization techniques.</td><td>1</td><td>T</td></tr>
<tr><td>Binary and Hexadecimal arithmetic</td><td>1</td><td>T</td></tr>
<tr><td>Synchronous Sequential Logic.</td><td>2</td><td>T,U</td></tr>
<tr><td>Asynchronous Sequential Logic.</td><td>1</td><td>T,U</td></tr>
<tr><td>Counters: serial and parallel, Design examples, Shift registers.</td><td>1</td><td>T,U</td></tr>
<tr><td>Asynchronous State Machines</td><td>1</td><td>T,U</td></tr>
<tr><td>Multiple Clock Domains</td><td>1</td><td>T,U</td></tr>
<tr><td>Hardward Description Languages</td><td>1</td><td>T</td></tr>
<tr><td>Guidelines for VHDL-based Design</td><td>1</td><td>T,U</td></tr>
<tr><td>Programmable Device Technologies and Introduction to the Altera FPGA</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] M.M. Mano and M.D. Ciletti, Digital Design 4th, 2007</td></tr>
</table>

	[2] Zwolinski M, Digital System Design with VHDL 2nd, 2004 [3] R.J Tocci and N.S. Widner, Digital Systems - Principles and Applications 8th, 2001 [4] J.F. Wakerly, Digital Design Principles & Practices 4th, 2004

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-8) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		✓				
2		✓				
3		✓				
4		✓				
5		✓				✓
6		✓				✓
7						✓
8						✓

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Number systems, Binary and Hexadecimal	CLO1	Homework	-Lecture -Class discussion	[1]
2	Number systems, Binary and Hexadecimal	CLO1, 2	Homework	-Lecture -Class discussion	[1]
3	Switching algebra, Theorems, Standard representation of logic functions.	CLO3, 4	Homework	-Lecture -Class discussion	[1]
4	Boolean algebra, Combinational circuits, Truth table, Karnaugh maps, Minimization techniques.	CLO3, 4	Homework	-Lecture -Class discussion	[1]
5	Binary and Hexadecimal arithmetic	CLO3, 4	Homework	-Lecture -Class discussion	[1]
6	**Midterm**		**Written exam**		

7	Synchronous Sequential Logic.	CLO5, 6	Homework	-Lecture -Class discussion	[1]
8	Asynchronous Sequential Logic.	CLO5, 6	Homework	-Lecture -Class discussion	[1]
9	Counters: serial and parallel, Design examples, Shift registers.	CLO5, 6	Homework	-Lecture -Class discussion	[1]
10	Asynchronous State Machines	CLO7, 8	Homework	-Lecture -Class discussion	[1]
11	Multiple Clock Domains	CLO5, 6	Homework	-Lecture -Class discussion	[1]
12	Hardward Description Languages	CLO7, 8	Homework	-Lecture -Class discussion	[1]
13	Guidelines for VHDL-based Design	CLO7, 8	Homework	-Lecture -Class discussion	[1]
14	Programmable Device Technologies and Introduction to the Altera FPGA	CLO7, 8	Homework	-Lecture -Class discussion	[1]
15	**Final exam**		**Written exam**		

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**	**CLO7**	**CLO8**
Midterm examination (30%)	30%	30%	30%	30%	30%	30%	30%	30%
Final examination (40%)	40%	40%	40%	40%	40%	40%	40%	40%
Exercises/ Quiz (30%)	30%	30%	30%	30%	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts

	presenting a position.		others' assumptions than one's own (or vice versa).	when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

	polished and confident.			
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital System Design Lab

Course Code: IT106IU

1. General information

Course designation	This course introduces methodology and techniques to design digital systems
Semester(s) in which the course is taught	6
Person responsible for the course	Assoc. Prof. Vo Thi Luu Phuong
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 60 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory) Private study including examination preparation, specified in hours: 30
Credit points	Number of credits : 1 Lecture: 0 Laboratory: 1
Required and recommended prerequisites for joining the course	Digital Logic Design Digital Logic Design Lab
Parallel course	Digital System Design
Course objectives	This lab helps students understand better about techniques to design digital systems. This lab includes software and hardware topics: Introduction to Maxplus II software, Counter, Introduction to VHDL in Maxplus II, Digital Clock.
Course learning outcomes	CLO 1. Ability to describe a digital system in VHDL CLO 2. Ability to simulate and debug a digital system described in VHDL CLO 3. Ability to interface electronic components with custom hardware. CLO 4. Ability to implement logic on an FPGA CLO 5. Ability to analyze timing of digital systems, including cross-boundary, asynchronous timing

	Competency level / **Course learning outcome (CLO)** Knowledge — CLO1, 2 Skill — CLO3, 4 Attitude — CLO5
Content	*The description of the contents should clearly indicate the weighting of the content and the level.* Weight: lecture session (3 hours) Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Number systems, Binary and Hexadecimal	1	I, T
Switching algebra, Theorems, Standard representation of logic functions.	1	I, T
Boolean algebra, Combinational circuits, Truth table, Karnaugh maps, Minimization techniques.	1	I, T
Counters: serial and parallel, Design examples, Shift registers.	1	T, U
Asynchronous State Machines	1	T, U
Multiple Clock Domains	1	T, U
Hardward Description Languages	1	T, U
Guidelines for VHDL-based Design	1	T, U
Programmable Device Technologies and Introduction to the Altera FPGA	1	T, U

Examination forms	Report
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	1. M.M. Mano and M.D. Ciletti, Digital Design 4th, 2007 2. Zwolinski M, Digital System Design with VHDL 2nd, 2004 3. R.J Tocci and N.S. Widner, Digital Systems - Principles and Applications 8th, 2001 4. J.F. Wakerly, Digital Design Principles & Practices 4th, 2004

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		✓				
2		✓				
3		✓				✓
4		✓				✓
5						✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Number systems, Binary and Hexadecimal	CLO1	-Report	-Practice -Class discussion	[1]
2	Switching algebra, Theorems, Standard representation of logic functions.	CLO1	-Report	-Practice -Class discussion	[1]
3	Boolean algebra, Combinational circuits, Truth table, Karnaugh maps, Minimization techniques.	CLO2	-Report	-Practice -Class discussion	[1]
4	Counters: serial and parallel, Design examples, Shift registers.	CLO3	-Report	-Practice -Class discussion	[1]
5	Asynchronous State Machines	CLO4	-Report	-Practice -Class discussion	[1]
6	Multiple Clock Domains	CLO4	-Report	-Practice -Class discussion	[1]
7	Hardward Description Languages	CLO3, 4	-Report	-Practice -Class discussion	[1]
8	Guidelines for VHDL-based Design	CLO5	-Report	-Practice -Class discussion	[1]

9	Programmable Device Technologies and Introduction to the Altera FPGA	CLO5	-Report	-Practice -Class discussion	[1]

4. Assessment plan

Assessment Type

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5
Lab. Assignments (70%)	70%	70%	70%	70%	70%
Final examination (30%)	30%	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact,

	synthesis. Viewpoints of experts are questioned thoroughly.	synthesis. Viewpoints of experts are subject to questioning.	coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and	Language choices are thoughtful and generally support the	Language choices are mundane and commonplace and partially	Language choices are unclear and minimally support the

	compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	effectiveness of the presentation. Language in presentation is appropriate to audience.	support the effectiveness of the presentation. Language in presentation is appropriate to audience.	effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

	authority on the topic.			
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Embedded Systems

Course Code: IT115IU

1. General information

Course designation	This course addresses the considerations in designing real-time embedded systems, both from a hardware and software perspective.
Semester(s) in which the course is taught	6
Person responsible for the course	Dr. Nguyen Toan Van
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 135 Contact hours: 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits: 3 Lecture: 2 Mini project: 1
Required and recommended prerequisites for joining the course	Digital Logic Design Micro-processing Systems
Course objectives	This course addresses the considerations in designing real-time embedded systems, both from a hardware and software perspective. The primary emphasis is on real-time processing for communications and signal processing systems. Programming projects in a high level language like C/C++ will be an essential component of the course, as well as hardware design with modern design tools.
Course learning outcomes	CLO 1. An ability to understand the "big ideas" in embedded systems CLO 2. An ability to obtain direct hands-on experience on both hardware and software elements commonly used in embedded system design. CLO 3. An ability to understand basic real-time resource management theory

<table>
<tr><td></td><td>CLO 4. An ability to understand the basics of embedded system application concepts such as signal processing.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, 2</td></tr>
<tr><td>Skill</td><td>CLO1, 2</td></tr>
<tr><td>Attitude</td><td>CLO3, 4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Embedded systems</td><td>1</td><td>I, T</td></tr>
<tr><td>Hardware/software functional partitioning</td><td>1</td><td>T, U</td></tr>
<tr><td>System architectures</td><td>1</td><td>T, U</td></tr>
<tr><td>Pipelining, interrupt service routines</td><td>1</td><td>T, U</td></tr>
<tr><td>Software structures:</td><td>1</td><td>T, U</td></tr>
<tr><td>Evaluating system performance correctness, speed</td><td>1</td><td>T, U</td></tr>
<tr><td>Continuation of system performance evaluation</td><td>1</td><td>T, U</td></tr>
<tr><td>Profiling system performance</td><td>1</td><td>T, U</td></tr>
<tr><td>Continuation of performance profiling</td><td>1</td><td>T, U</td></tr>
<tr><td>Embedded systems Project (2nd presentation from industry)</td><td>1</td><td>U</td></tr>
<tr><td>Performance optimization</td><td>1</td><td>T, U</td></tr>
<tr><td>Mini Project demo and presenation</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Amos, B. (2020). Hands-On RTOS with Microcontrollers: Building real-time embedded systems using FreeRTOS, STM32 MCUs, and SEGGER debug tools. Packt Publishing Ltd.</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		✓				
2		✓				
3						✓
4						✓

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Embedded systems	CLO1	Homework	- Lecture - Class discussion	[1]
2	Hardware/software functional partitioning	CLO1	Homework	- Lecture - Class discussion	[1]
3	System architectures	CLO1, 2	Homework	- Lecture - Class discussion	[1]
4	Pipelining, interrupt service routines	CLO1, 2	Homework	- Lecture - Class discussion	[1]
5 & 6	Industrial applications of Embedded systems	CLO1, 2	Homework	- Lecture, - Group work	
	Midterm		**Written exam**		
7	Software structures:	CLO3	Homework	- Lecture - Class discussion	[1]
8	Evaluating system performance correctness, speed	CLO3	Homework	- Lecture - Class discussion	[1]
9	Continuation of system performance evaluation	CLO3	Homework	- Lecture - Class discussion	[1]
10	Profiling system performance	CLO3, 4	Homework	- Lecture	[1]

				- Class discussion	
11	Continuation of performance profiling	CLO3, 4	Homework	- Lecture - Class discussion	[1]
12	Performance optimization	CLO4	Homework	- Lecture - Class discussion	[1]
13 & 14	Industrial applications of Embedded systems	CLO3, 4	Homework	- Lecture, - Group work	
15	Mini project demo and Presentation	CLO3, 4	Homework	- Class discussion	
	Final exam		**Written exam**		

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%	30%	30%	30%
Final examination (40%)	40%	40%	40%	40%
Exercises/ Quiz (30%)	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			

Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	(perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	makes the content of the presentation cohesive.	within the presentation.		
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant

	from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Embedded Systems Laboratory

Course Code: IT127IU

1. General information

<table>
<tr><td>Course designation</td><td>This course integrates microprocessors into digital systems.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Vo Thi Luu Phuong,</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CE)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 60
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory)
Private study including examination preparation, specified in hours: 30</td></tr>
<tr><td>Credit points</td><td>Number of credits : 1
Lecture: 0
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Digital Logic Design
Micro-processing Systems</td></tr>
<tr><td>Course objectives</td><td>This course integrates microprocessors into digital systems. The course includes hardware interfacing, bus protocols and peripheral systems, embedded and real-time operating systems, real-time constraints, networking, and memory system.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. An ability to design complex electronic systems interfacing multiple integrated circuits.
CLO 2. An ability to design and conduct experiments, as well as analyze and interpret data.
CLO 3. An ability to identify, formulate, and solve engineering problems in designing and implementing embedded systems.
CLO 4. An ability to use the techniques, skills, and modern engineering tools necessary for implementing embedded systems.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, 2</td></tr>
<tr><td>Skill</td><td>CLO1, 2</td></tr>
<tr><td>Attitude</td><td>CLO3, 4</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Hardware/software codesign</td><td>1</td><td>T, U</td></tr>
<tr><td>Polled I/O</td><td>1</td><td>T, U</td></tr>
<tr><td>Interrupt-driven I/O</td><td>1</td><td>T, U</td></tr>
<tr><td>Bus Arbitration</td><td>1</td><td>T, U</td></tr>
<tr><td>Bus Saturation</td><td>1</td><td>T, U</td></tr>
<tr><td>Memory system operation and</td><td>1</td><td>T, U</td></tr>
<tr><td>Multitasking on one CPU</td><td>1</td><td>T, U</td></tr>
<tr><td>Multiprocessing</td><td>1</td><td>T, U</td></tr>
<tr><td>Real-time performance</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		✓				
2		✓				
3						✓
4						✓

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Hardware/software codesign	CLO1	-Report	-Practice -Class discussion	[1]
2	Polled I/O	CLO1	-Report	-Practice	[1]

				-Class discussion	
3	Interrupt-driven I/O	CLO1, 2	-Report	-Practice -Class discussion	[1]
5	Bus Arbitration	CLO1, 2	-Report	-Practice -Class discussion	[1]
6	Bus Saturation	CLO1, 2	-Report	-Practice -Class discussion	[1]
7	Memory system operation and	CLO3	-Report	-Practice -Class discussion	[1]
8	Multitasking on one CPU	CLO3	-Report	-Practice -Class discussion	[1]
9	Multiprocessing using multiple	CLO3, 4	-Report	-Practice -Class discussion	[1]
10	Real-time performance	CLO3, 4	-Report	-Practice -Class discussion	[1]

4. Assessment plan

Assessment Type

Assessment Type	CLO1	CLO2	CLO3	CLO4
Final examination (30%)	30%	30%	30%	30%
Exercises/ Quiz (70%)	70%	70%	70%	70%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports	
Student: ……..	HW/Assignment:
Date: ……	…….

	Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts

	presenting a position.		others' assumptions than one's own (or vice versa).	when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

	polished and confident.			
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Concepts in VLSI Design

Course Code: IT110IU

1. General information

Course designation	This subject covers the fundamental knowledge of concepts in VLSI design
Semester(s) in which the course is taught	7
Person responsible for the course	Dr. Nguyễn Toàn Văn
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) Private study including examination preparation, specified in hours: 90
Credit points	Number of credits : 3 Lecture: 3 Laboratory: 0
Required and recommended prerequisites for joining the course	Digital Logic Design Electronics Device
Course objectives	This course introduces the digital VLSI chip design based on CMOS technology and including dynamic clocked logic, analog MOSFET timing analysis, and layout design rules. The course also develops the use of computer-aided design software tools and cell library construction as well as an understanding of elementary circuit testing.
Course learning outcomes	

CLO 1	design logic circuit layouts for both static CMOS and dynamic clocked CMOS circuits
CLO 2	analyze VLSI circuit timing using Logic Effort
CLO 3	describe the sources and effects of clock skew
CLO 4	assemble an entire chip and add the appropriate pads to a layout

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1,4</td></tr>
<tr><td>Skill</td><td>CLO9</td></tr>
<tr><td>Attitude</td><td>CLO6</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Content</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction and Overview to Fabrication</td><td>1</td><td>I</td></tr>
<tr><td>Circuits and Layout</td><td>3</td><td>I</td></tr>
<tr><td>Microprocessor Example</td><td>1</td><td>I</td></tr>
<tr><td>CMOS Transistor Theory</td><td>3</td><td>T,U</td></tr>
<tr><td>DC and Transient Response</td><td>3</td><td>I</td></tr>
<tr><td>Logical Effort</td><td>3</td><td>T,U</td></tr>
<tr><td>Power</td><td>3</td><td>I</td></tr>
<tr><td>Combinational Circuit Design</td><td>3</td><td>T,U</td></tr>
<tr><td>Circuit Families</td><td>3</td><td>I</td></tr>
<tr><td>Sequential Circuit Design</td><td>3</td><td>T,U</td></tr>
<tr><td>Adders</td><td>1</td><td>I</td></tr>
<tr><td>Design for Testability</td><td>3</td><td>T,U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>

Neil W este and David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson, 2010
Sung-Mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits, 3rd edition, McGraw-Hill, 2002
Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated Circuits, 2nd edition, Prentice Hall, 2002
David A. Patterson and John L. Hennessy, Computer Organization and Design, 5th edition, Morgan Kaufmann, 2014
Michael L. Bushnell and Vishwani D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed-

</td></tr>
</table>

	Signal VLSI Circuits, 2nd edition, Kluwer Academic Publishers, 2002

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2	X	X				
3			X			
4	X	X	X			X

3. Planned learning activities and teaching methods

Week	Content	CLOs	Teaching and Learning Activities		Assessment Activities	Resources
			Lecturer	Student		
1	Introduction and Overview to Fabrication	CLO 1	Lecture	• Class discussion		[1,2,3,4,5]
2	Circuits and Layout	CLO 1	Lecture	• Class discussion	Quiz1	[1,2,3,4,5]
3	Microprocessor Example	CLO 1	Lecture	• Class discussion	Homework	[1,2,3,4,5]
4	CMOS Transistor Theory	CLO 1	Lecture	• Class discussion	Homework	[1,2,3,4,5]
5	DC and Transient Response	CLO 2	Lecture	• Class discussion	Homework	[1,2,3,4,5]
6	Logical Effort	CLO 2	Lecture	• Class discussion	Quiz2	[1,2,3,4,5]
7	Power	CLO 2	Lecture	• Class discussion	Homework	[1,2,3,4,5]
Midterm examination		CLO 1		Written exam	Quiz3	[1,2,3,4,5]
8&9	Combinational Circuit Design	CLO 2	Lecture	• Class discussion	Homework	
10&11	Circuit Families	CLO 2,3	Lecture	• Class discussion	Homework	[1,2,3,4,5]
12	Sequential Circuit Design	CLO 3	Lecture	• Class discussion	Quiz4	[1,2,3,4,5]

13	Adders	CLO 4	• Lecture	• Class discussion	Homework	[1,2,3,4,5]
14&15	Design for Testability	CLO 4	• Lecture	• Class discussion	Homework	[1,2,3,4,5]
Final Project		CLO 1,2,3,4	Group Project			[1,2,3,4,5]
Final examination		CLO 1,2,3,4		Written exam		

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	30%	30%	30%	30%
Final examination (40%)	40%	40%	40%	40%
Exercises/ Quiz (30%)	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**

5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed	Conclusion is logically tied to a range of information, including opposing viewpoints;	Conclusion is logically tied to information (because information is chosen to fit the desired	Conclusion is inconsistently tied to some of the information discussed; related

	evaluation and ability to place evidence and perspectives discussed in priority order.	related outcomes (consequences and implications) are identified clearly.	conclusion); some related outcomes (consequences and implications) are identified clearly.	outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Concepts in VLSI Design Laboratory

Course Code: IT126IU

1. General information

Course designation	This laboratory provides an introduction to digital VLSI chip design based on the use of VLSI design tools to design a MIPS microprocessor chip.
Semester(s) in which the course is taught	7
Person responsible for the course	Dr. Nguyễn Toàn Văn
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 60 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 30 (laboratory) Private study including examination preparation, specified in hours: 30
Credit points	Number of credits : 1 Lecture: 0 Laboratory: 1
Required and recommended prerequisites for joining the course	Digital Logic Design Electronics Devices
Course objectives	This laboratory provides an introduction to digital VLSI chip design based on the use of VLSI design tools to design a MIPS microprocessor chip. The laboratory employs a learning-by-doing approach, emphasizing hands-on practical design experiences and computer simulations.
Course learning outcomes	

CLO1	use the Electric VLSI design tool to build an 8-bit MIPS microprocessor including schematic entry, layout, transistor-level cell design, gate-level logic design, hierarchical design
CLO2	use the Electric VLSI design tool to build an 8-bit MIPS microprocessor including switch-level simulation (IRSIM and ModelSim), Design Rule Checking (DRC), Electrical Rule Checking (ERC),

		Network Consistency Checking (NCC), HDL design (Verilog), pad frame generation and routing, pre-tape-out verification
	CLO4	design functional units such as adders, multipliers, and PLAs
	CLO5	describe and avoid common CMOS circuit pitfalls

Competency level	**Course learning outcome (CLO)**
Knowledge	CLO1,2
Skill	CLO4
Attitude	CLO5

Content

The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)

Topic	**Weight**	**Level**
Schematic Entry and Switch-Level Simulation	1	I
Building a Standard Cell Library	1	T,U
MIPS Processor HDL Simulation	1	T,U
Datapath Design	2	T,U
Design of ALU Decoder Control Logic	1	T,U
Controller Synthesis	1	T,U
MIPS Processor Layout	1	T,U
Pad Frame Assembly	1	I

Examination forms: Multiple-choice questions, short-answer questions

Study and examination requirements: Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.

Reading list:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design 5th, 2013
2. N. H. E. Weste and D. M. Harris, CMOS VLSI Design 3rd, 2005

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO

CLO	1	2	3	4	5	6
1	X	X				
2	X	X				
4		X	X			X
5			X			

3. Planned learning activities and teaching methods

Week	Content	CLOs (Gx.x)	Teaching and Learning Activities	Assessment	Resources
1	Schematic Entry and Switch-Level Simulation	CLO 1	• Lecture • Class discussion • Pratice	Report	[1,2]
2	Building a Standard Cell Library	CLO 1	• Lecture • Class discussion • Pratice	Report	[1,2]
3	MIPS Processor HDL Simulation	CLO 1,2	• Lecture • Class discussion • Pratice	Report	[1,2]
4	Datapath Design	CLO 1,2	• Lecture • Class discussion • Pratice	Report	[1,2]
5	Design of ALU Decoder Control Logic	CLO 3	• Lecture • Class discussion • Pratice	Report	[1,2]
6	Controller Synthesis	CLO 3	• Lecture • Class discussion • Pratice	Report	[1,2]
7	MIPS Processor Layout and Pad Frame Assembly	CLO 3	• Lecture • Class discussion • Pratice	Report	[1,2]
Final Project		CLO 4,5	Group Project Design report	Report	[1,2]
Final examination		CLO 1,2,3,4	Written exam		

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5
Lab. Assignments (70%)	70%	70%	70%	70%	70%
Final examination (30%)	30%	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's	Conclusion is logically tied to a range of information, including opposing viewpoints; related	Conclusion is logically tied to information (because information is chosen to fit the	Conclusion is inconsistently tied to some of the information discussed; related outcomes

	informed evaluation and ability to place evidence and perspectives discussed in priority order.	outcomes (consequences and implications) are identified clearly.	desired conclusion); some related outcomes (consequences and implications) are identified clearly.	(consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital Signal Processing

Course Code: IT103IU

1. General information

Course designation	This subject covers the fundamental knowledge of digital signal processing
Semester(s) in which the course is taught	
Person responsible for the course	Assoc. Prof. Dinh Duc Anh Vu
Language	English
Relation to curriculum	Compulsory (CE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 Contact hours: 45 (lecture) + 30(laboratory). Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	
Course objectives	This course is an introduction to the basic principles, methods, and applications of digital signal processing, emphasizing its algorithmic, computational, and programming aspects. In particular, the students will learn the conversion from analog to digital, the concepts of discrete time linear systems, filtering, spectral analysis of discrete time signals and filter design.
Course learning outcomes	

CLO 1	Know the analysis of discrete time signals, demonstrate understanding of FIR filter design
CLO 2	Understand the theory behind interpolators, decimators, and sampling rate converters
CLO 3	Study the modern digital signal processing algorithms and applications.
CLO 4	Apply the algorithms for wide area of recent applications such as image processing, wireless communication, biomedical engineering, speech processing, video processing, etc., which are appropriate for external, societal and environmental applications

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1,2</td></tr>
<tr><td>Skill</td><td>CLO4</td></tr>
<tr><td>Attitude</td><td>CLO3</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Content</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to sampling and reconstruction</td><td>1</td><td>I</td></tr>
<tr><td>Quantization</td><td>1</td><td>T</td></tr>
<tr><td>Discrete-time systems</td><td>2</td><td>T,U</td></tr>
<tr><td>FIR filtering and convolution</td><td>1</td><td>T</td></tr>
<tr><td>Z - transform</td><td>2</td><td>T,U</td></tr>
<tr><td>Transfer function</td><td>1</td><td>T</td></tr>
<tr><td>Digital filter realization</td><td>1</td><td>T</td></tr>
<tr><td>DFT/FFT algorithms</td><td>2</td><td>T,U</td></tr>
<tr><td>Signal processing applications</td><td>2</td><td>T</td></tr>
<tr><td>Filter design techniques</td><td>3</td><td>T</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. S. J. Orfanidis, Introduction to Signal Processing 2nd, 1996</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					
2	X	X				

3	X	X				
4		X	X			X

3. Planned learning activities and teaching methods

Week	Content	CLO	Teaching and Learning Activities	Assessment	Resources
1	Introduction to sampling and reconstruction Introduction of signal	CLO 2	• Lecture • Class discussion	Homework	[1]
2	Quantization Linear Time Invariant System Properties	CLO 3	• Lecture • Class discussion	Homework	[1]
3	Discrete-time systems Discrete time and Continuous time Convolution methods	CLO 3	• Lecture • Class discussion	Quiz 1	[1]
4&5	FIR filtering and convolution	CLO 1	• Lecture • Class discussion	Homework	[1]
6&7	Fourier Series and Fourier Transforms Z - transform	CLO 3	• Lecture • Class discussion	Homework, Quiz 2	[1]
8	Transfer function	CLO 3	• Lecture • Class discussion	Homework	[1]
Midterm examination		CLO 1, CLO 2, CLO 3	-Written exam		
9&10	Digital filter realization	CLO 3, CLO 4	• Lecture • Class discussion	Homework	[1]
11&12	DFT/FFT algorithms	CLO 3	• Lecture	Quiz 3	[1]

			• Class discussion		
13&14	Signal processing applications	CLO 4	• Lecture • Class discussion • Class project	Homework	[1]
15	Filter design techniques	CLO 4	• Lecture • Class discussion	Homework	[1]
Final examination		CLO 1, CLO 2, CLO 3, CLO 4	-Written exam		

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Midterm examination (30%)	30%	30%	30%	30%
Final examination (40%)	40%	40%	40%	40%
Exercises/ Quiz (10%)	10%	10%	10%	10%
Labs (20%)	20%	20%	20%	20%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		

Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or	Issue/ problem to be considered critically is stated without clarification or description.

			backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	are acknowledged within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	is skillful and makes the content of the presentation cohesive.	within the presentation.	within the presentation.	
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference

	make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Computer Graphics

Course Code: IT024IU

1. General information

Course designation	This subject introduces the students to principles and algorithms of computer graphics and requirements of creating graphical applications.
Semester(s) in which the course is taught	
Person responsible for the course	Assoc.Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	Elective course (CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	This course provides students the fundamentals of computer graphics concepts, methodologies, and processes. It develop an understanding of the algorithms and fundamental techniques for generating and modifying pictures/objects with a digital computer, including the handling of color, and the generation of visible-surface projections of three dimensional scenes, for applications in science, engineering, and the entertainment world (i.e. connect to the VR & AR application; Games industry and Images processing).
Course learning outcomes	CLO 1. Understand and apply the algorithms and fundamental techniques for generating and modifying pictures, 2D/3D objects with a digital computer. CLO 2. Understand and apply the handling of color, and the generation of visible-surface projections of 3D scenes, for applications in science, engineering and the entertainment world.

<table>
<tr><td></td><td>CLO 3. Apply knowledge of mathematics and ability in graphical programming to develop games, construct and reconstruct 2D/3D objects, process images, VR & AR, etc.
CLO 4. Work in a team to ready build a computer graphics application
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Introduction to Computer Graphics, Mathematics Foundation</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Bessenham algorithms</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 3: Line clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 4: Polygon clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Transformation and Perspective</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 6: Transformation (cont.)</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Introduction to OpenGL programing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: View Transformation + Midterm</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9: 3D clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 10: Visual Surface Determination</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Color Models</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12: Image Rendering and Generation</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 13: Ray Tracing & Texture Mapping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Bezier Curve and Surface processing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: Building graphics application; final review</td><td>3</td><td>I,T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions (computing and programing)</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	1. Steve Marschner and Peter Shirley, Fundamentals of Computer Graphics 5th, by A K Peters/CRC Press ISBN: 9780367505035, 2021. 2. Frank Klawonn , Introduction to Computer Graphics Using Java 2D and 3D, 2nd Edition, Springer 2012. 3. Sumanta Guha, Computer Graphics Through OpenGL From Theory to Experiments Third Edition (AIT), CRC Press, 2019. 4. John Vince, Mathematics for Computer Graphics, 5th Edition, Springer 2017.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2	X	X				
3		X				X
4					X	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Computer Graphics, Mathematics Foundation	1	Quiz	Lecture,	[1, 4]
2	Bessenham algorithms	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
3	Line clipping	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
4	Polygon clipping	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
5	Transformation and Perspective	2, 3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]

6	Transformation (cont.)	2, 3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
7	Introduction to OpenGL	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
8	**Midterm**				
9	View Transformation	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
10	3D clipping	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
11	Visual Surface Determination	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
12	Color Models	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
13	Image Rendering and Generation	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
14	Ray Tracing & Texture Mapping	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
15	Bezier Curve and Surface processing	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
16	Building graphics application; final review	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, Homework	[1, 2, 3]
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Labs (20%)		30%	30%	40%

Midterm examination (30%)	40%	60%		
Final examination (40%)		50%	50%	
Exercises/ Quiz (10%)	30%	40%	30%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions).

	relevance of contexts when presenting a position.		position. May be more aware of others' assumptions than one's own (or vice versa).	Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Deep Learning

Course Code: IT157IU

1. General information

Course designation	This course helps students understand the capabilities, challenges, and consequences of deep learning and prepare students to participate in the development of leading-edge AI technology
Semester(s) in which the course is taught	
Person responsible for the course	Dr. Mai Hoang Bao An
Language	English
Relation to curriculum	Elective (CS, DS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	none
Course objectives	This course helps students understand the capabilities, challenges, and consequences of deep learning and prepare students to participate in the development of leading-edge AI technology. In this course, students will build and train neural network architectures such as Convolutional Neural Networks, Recurrent Neural Networks, Transformers, and learn how to make them better with strategies such as Dropout, BatchNorm, and more. Get ready to master theoretical concepts and their industry applications using Python and PyTorch and tackle real-world cases.
Course learning outcomes	CLO 1. Understand fundamental concepts of Deep Learning. Get familiar with some popular algorithms used in deep learning models. Understand and be able to use of popular libraries such as NumPy, PyTorch. CLO 2. Neural Networks for regression and classification. The concept of Multilayer Perceptrons. The essential networks:

<table>
<tr><td></td><td>Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN).
CLO 3. Build, train, and deploy different types of Deep Architectures from traditional to modern Architectures.
CLO 4. Understand and be able to apply deep learning techniques to real-world scenarios: Computer Vision, Natural Language Processing.

<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr>
<tr><td>Skill</td><td>CLO 3, CLO 4</td></tr>
<tr><td>Attitude</td><td>CLO 3, CLO 4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Deep Learning
Some demos on the applications of Deep Learning</td><td>1</td><td>I, U</td></tr>
<tr><td>Linear Classifiers, Optimization and Gradient Descent
Backpropagation Algorithm
Introduction to PyTorch library</td><td>1</td><td>I, T</td></tr>
<tr><td>Linear Neural Networks for Regression
Linear Neural Networks for Classification</td><td>1</td><td>T, U</td></tr>
<tr><td>Multilayer Perceptrons</td><td>1</td><td>T, U</td></tr>
<tr><td>Advances in PyTorch library</td><td>1</td><td>T, U</td></tr>
<tr><td>Convolutional Neural Networks (CNN)</td><td>1</td><td>T, U</td></tr>
<tr><td>Recurrent Neural Networks (RNN)</td><td>1</td><td>T, U</td></tr>
<tr><td>Modern CNN:
• Networks Using Blocks (VGG)
• Multi-Branch Networks (GoogLeNet)
• Residual Neural Network (Resnet)
• MobileNet</td><td>2</td><td>T, U</td></tr>
<tr><td>Modern RNN:
• Gated Recurrent Units (GRU)
• Long Short-Term Memory (LSTM)
• Bidirectional RNN
• Encoder-Decoder Architecture</td><td>2</td><td>T, U</td></tr>
<tr><td>Optimization Algorithms used in Deep Learning</td><td>1</td><td>I, T</td></tr>
</table>
</td></tr>
</table>

	Generative Adversarial Network (GAN) & Deep Convolution GAN	1	T, U
	Deep Learning in Computer Vision	1	T, U
	Deep Learning in Natural Language Processing	1	T, U
Examination forms	Short-answer questions, Long-answer questions, programming questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	[1] Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, The MIT Press 2021, ISBN: 978-0262035613. [2] Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola., Dive Into Deep Learning.		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	1	2	3	4	5	6
1	x					
2		x	x			
3			x	x		x
4				x		x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Deep Learning Some demos on the applications of Deep Learning	1		Lecture, Discussion	[1, 2] Chapter 1
2	Linear Classifiers, Optimization and Gradient Descent Backpropagation Algorithm	1	Exercises	Lecture, In-class exercises	[1, 2] Chapter 2

	Introduction to PyTorch library				
3	Linear Neural Networks for Regression Linear Neural Networks for Classification	1, 2	Exercises	Lecture, In-class exercises	[2] Chapter 3, 4
4	Multilayer Perceptrons	2	Exercises	Lecture, In-class exercises	[2] Chapter 5
5	Advances in PyTorch library	1, 2	Exercises	Lecture, In-class exercises	[2] Chapter 6
6	Convolutional Neural Networks (CNN)	2	Exercises	Lecture, In-class exercises	[2] Chapter 7
7	Recurrent Neural Networks (RNN)	2	Quiz	Lecture, In-class quiz	[2] Chapter 9
8-9	Modern CNN: • Networks Using Blocks (VGG) • Multi-Branch Networks (GoogLeNet) • Residual Neural Network (Resnet) • MobileNet	2, 3	Exercises	Lecture, In-class exercises	[2] Chapter 8
10	**Midterm**				
11-12	Modern RNN: • Gated Recurrent Units (GRU) • Long Short-Term Memory (LSTM) • Bidirectional RNN • Encoder-Decoder Architecture	2, 3	Exercises	Lecture, In-class exercises	[2] Chapter 10
13	Optimization Algorithms used in Deep Learning	1, 4	Seminar	Lecture, Discussion	[2] Chapter 12
14	Generative Adversarial Network (GAN) & Deep Convolution GAN	3, 4	Seminar	Lecture, Discussion	[2] Chapter 18
15	Deep Learning in Computer Vision	4	Seminar	Lecture, Student presentaion	[2] Chapter 14

16	Deep Learning in Natural Language Processing	4	Seminar	Lecture, Student presentaion	[2] Chapter 15
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Quiz (5%)	10%		20%	20%
Labs (10%)	30%	30%		
Midterm examination (30%)	50%	40%		
Projects/Presentations/ Report (15%)	10%		30%	30%
Final examination (40%)		30%	50%	50%

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response

4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact,	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Security Technology and Implementation

Course Code: IT165IU

1. General information

Course designation	The course will concentrate on security technologies that can be employed to safeguard and maintain a network. The course will also cover risk management, business continuity and recovery planning, operations security, access control systems, and software development security.
Semester(s) in which the course is taught	
Person responsible for the course	Dr. Le Hai Duong
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Computer Networks
Course objectives	This course introduces students to information security principles, cryptography systems (symmetric and public key encryptions), risk management, security architecture and design, business continuity operations security, access control systems, protecting TCP/IP network, firewalls, virtual private network, IPSec, software development security.
Course learning outcomes	CLO 1. Gain understanding of information security and the cryptography concepts including symmetric key encryption, hash function, message authentication code, public key encryption, digital signature and digital envelope;

<table>
<tr><td></td><td>CLO 2. Apply the concepts of authentication and authorization in implementing secure systems and networks;
CLO 3. Analyze and evaluate security risk and security design;
CLO 4. Understand and apply software development security;
CLO 5. Apply security technologies in operations.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1, CLO2, CLO4, CLO5</td></tr><tr><td>Skill</td><td>CLO2, CLO3, CLO4, CLO6</td></tr><tr><td>Attitude</td><td></td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Information security principles</td><td>1</td><td>T</td></tr><tr><td>Governance and risk management;</td><td>1</td><td>T,U</td></tr><tr><td>Security architecture and design;</td><td>1</td><td>T</td></tr><tr><td>Business continuity and disaster recovery planning;</td><td>1</td><td>T,U</td></tr><tr><td>Operation security;</td><td>2</td><td>T,U</td></tr><tr><td>Access control systems and methodology;</td><td>1</td><td>T</td></tr><tr><td>Cryptography;</td><td>2</td><td>T,U</td></tr><tr><td>Overview network and telecommunications security;</td><td>1</td><td>T,U</td></tr><tr><td>Basic security infrastructures and routers;</td><td>1</td><td>T</td></tr><tr><td>Firewalls</td><td>1</td><td>T,U</td></tr><tr><td>Intrusion detection systems and intrusion protection systems</td><td>1</td><td>T</td></tr><tr><td>Virtual private network and IPSec;</td><td>1</td><td>T</td></tr><tr><td>Software Development security.</td><td>1</td><td>T,U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	2. William Stallings and Lawrence Brown, Computer Security - Principles and Practice 4th edition, 2018 3. Mark S. Merkow and Jim Breithaupt, Information Security: Principles and Practices, 2nd edition, 2014.

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X		X	X		
2		X				
3	X					
4	X					
5	X					
6	X					

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Information security principles	1	Quiz, Exam	Lecture, Exercises, Lab	[1,2]
2	Governance and risk management;	3	Quiz, Exam	Lecture, Lab	[2]
3	Security architecture and design;	3	Quiz, Exam	Lecture, Lab	[2]
4	Business continuity and disaster recovery planning;	3	Quiz, Exam	Lecture, Lab	[2]
5,6	Operation security;	5	Quiz, Exam	Lecture, Lab	[2]
7	Access control systems and methodology;	2		Lecture, Lab	
	Midterm exam				
8, 9	Cryptography;	1	Quiz, Exam	Lecture	[1]
10	Overview network and telecommunications;	5	Quiz, Exam	Lecture, Lab	[2]
11	Basic security infrastructures and routers;	5	Quiz, Exam	Lecture, Lab	[2]

12	Firewalls	5	Quiz, Exam	Lecture, Exercises,	[1,2]
13	Intrusion detection systems and intrusion protection systems	5	Quiz, Exam	Lecture, Exercises,	[1,2]
14	Virtual private network and IPSec;	5	Quiz, Exam	Lecture, Lab	[1,2]
15	Software Development security.	4	Quiz, Exam	Lecture	[2]
	Final exam				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**
Midterm examination (30%)	30%	80%	55%		10%
Final examination (40%)	40%			75%	60%
Exercises/ Quiz (30%)	30%	20%	45%	25%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. **Rubrics (optional)**

5.4. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.5. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.6. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries	Issue/ problem to be considered critically is stated without clarification or description.

			undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged.	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and	Language choices are thoughtful and generally support the	Language choices are mundane and commonplace and partially	Language choices are unclear and minimally support the effectiveness of the

	enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	effectiveness of the presentation. Language in presentation is appropriate to audience.	support the effectiveness of the presentation. Language in presentation is appropriate to audience.	presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

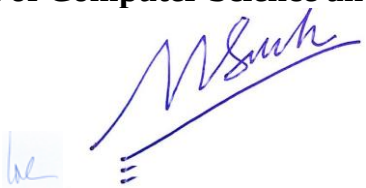
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Software Quality Verification and Validation

Course Code: IT166IU

1. General information

<table>
<tr><td>Course designation</td><td></td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Tran Thanh Tung, Dr.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Object-Oriented Programming</td></tr>
<tr><td>Course objectives</td><td>Introduction to software verification, validation, and testing. Strategies and techniques are presented for testing software, and also for planning software testing.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Describe and explain how testing activities involve within software development process.
CLO 2. Understand and apply best practices for software testing.
CLO 3. Create test cases based on system requirement
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Software Testing Overview</td><td>3</td><td>I</td></tr>
<tr><td>Software Testing Foundations</td><td>3</td><td>T</td></tr>
<tr><td>Software Testing Activities</td><td>3</td><td>T</td></tr>
<tr><td>Model-Driven Test Design</td><td>3</td><td>T, U</td></tr>
<tr><td>Test Automation</td><td>3</td><td>T, U</td></tr>
<tr><td>Testing First Approach</td><td>3</td><td>T</td></tr>
<tr><td>Criteria-Based Test Design</td><td>3</td><td>T</td></tr>
<tr><td>Input Space Partitioning</td><td>3</td><td>T</td></tr>
<tr><td>Graph Coverage</td><td>3</td><td>T</td></tr>
<tr><td>Logic Coverage</td><td>3</td><td>T</td></tr>
<tr><td>Writing Test Plans</td><td>3</td><td>T, U</td></tr>
<tr><td>Test implementation</td><td>3</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Paul Ammann, Jeff Offutt; Introduction to Software Testing, 2nd, 2017
2. James A. Whittaker; Exploratory Software Testing, 2009.
3. Glendford J. Myers, Tom Badgett, Corey Sandler; The art of Software Testing, 2012.</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XX					
2		XXX				
3						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Software Testing Overview	1	Quiz	Lecture	
2	Software Testing Foundations	1	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
3	Software Testing Activities	2	Quiz	Lecture, Discussion	[2]
4	Model-Driven Test Design	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
5	Test Automation	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
6	Test Automation – Tools	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
7	Testing First Approach	2,3	Lab, Quiz, Midterm	Lecture, Discussion	
8	Criteria-Based Test Design	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
9	**Midterm**				
10	Input Space Partitioning – Part 1	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
11	Input Space Partitioning – Part 2	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,2,3]
12	Graph Coverage	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
13	Logic Coverage	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,3]

14	Writing Test Plans	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[2,3]
15	Test implementation	2,3	Lab, Quiz, Final	Lecture, Discussion	[2,3]
16	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz (5%)	X	X	
Labs (20%)		X	
Midterm examination (30%)	X	X	X
Projects/Presentations/ Report (10%)		X	X
Final examination (40%)	X	X	X

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined,	Issue/ problem to be considered critically is stated without clarification or description.

			and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and	Language choices are thoughtful and generally support the	Language choices are mundane and commonplace and partially	Language choices are unclear and minimally support the effectiveness of the presentation.

	enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	effectiveness of the presentation. Language in presentation is appropriate to audience.	support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

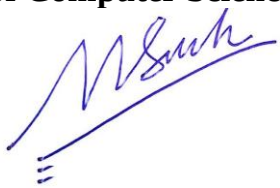
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: August 29th, 2023

Ho Chi Minh City, 29/08/2023

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Blockchain

Course Code: IT150IU

1. General information

Course designation	Introduction to Blockchain technology
Semester(s) in which the course is taught	
Person responsible for the course	Tran Thanh Tung, Dr.
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	This subject introduces the students the foundation of blockchain technology and its applications. Students will study blockchain concepts and principles how it works. This course covers relevant topics blockchain space. The course starts with the basics of blockchain, cryptography, fundamental understanding of bitcoins. Then, the applications of blockchain technology is introduced in different areas of finance, healthcare, supply chain, etc. A complete picture of the ecosystem surrounding blockchain technology and development trends are also discussed.
Course learning outcomes	CLO 1. Understand basic contents of blockchain technology. CLO 2. Explain different types of blockchain development: Ethereum, smart contract security, bitcoin CLO 3. Apply blockchain techniques to setup the development environment to writing and deploying smart contracts, the workhorse of blockchain applications, integrating cryptocurrency micropayments into web apps CLO 4. Work in a team to build a blockchain application project.

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO1</td></tr>
<tr><td>Skill</td><td>CLO3, CLO4</td></tr>
<tr><td>Attitude</td><td>CLO2</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>3</td><td>I</td></tr>
<tr><td>Cryptography & cryptocurrencies</td><td>3</td><td>T</td></tr>
<tr><td>How Bitcoin achieve decentralization</td><td>3</td><td>I, T</td></tr>
<tr><td>Mechanics of Bitcoin</td><td>3</td><td>T, U</td></tr>
<tr><td>How to store and use Bitcoin</td><td>3</td><td>T, U</td></tr>
<tr><td>Bitcoin mining</td><td>3</td><td>T</td></tr>
<tr><td>Bitcoin and Anonymity</td><td>3</td><td>T</td></tr>
<tr><td>Ethereum</td><td>3</td><td>I, T</td></tr>
<tr><td>Solidity</td><td>3</td><td>T, U</td></tr>
<tr><td>Token</td><td>3</td><td>I, T</td></tr>
<tr><td>Oracle</td><td>3</td><td>I, T</td></tr>
<tr><td>Decentralized Applications (Dapps)</td><td>3</td><td>T, U</td></tr>
<tr><td>Design pattern for blockchain applications</td><td>3</td><td>T</td></tr>
<tr><td>Real-world applications</td><td>3</td><td>I, T</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton, 2016
[2] Andreas M. Antonopoulos, and Gavin Wood Ph. D. Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media, 2018
[3] Xiwei Xu, Ingo Weber, and Mark Staples. Architecture for Blockchain Applications. Springer, 2019.</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					
2	X	X				
3		X				X
4						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction	1	Quiz	Teaching, Presentation	
2	Cryptography & cryptocurrencies	1	Quiz, In-class exercises	Teaching, Presentation	
3	How Bitcoin achieve decentralization	1, 2	Quiz, In-class exercises	Teaching, Presentation	
4	Mechanics of Bitcoin	1, 2	Quiz, In-class exercises	Teaching, Presentation	
5	How to store and use Bitcoin	1, 2	Quiz, In-class exercises	Teaching, Presentation	
6	Bitcoin mining	1, 2	Quiz, In-class exercises	Teaching, Presentation	
7	Bitcoin and Anonymity	2	Quiz, In-class exercises	Teaching, Presentation	
8	**Midterm**				
9	Ethereum	2,3	Project	Teaching, Presentation	
10	Solidity	2,3	Project	Teaching, Presentation	
11	Token	3,4	Quiz, In-class exercises	Teaching, Presentation	
12	Oracle	2,3	Quiz, In-class exercises	Teaching, Presentation Group discussion	
13	Decentralized Applications (Dapps)	3,4	Quiz, In-class exercises	Teaching, Presentation	

Week	Topic	CLO	Assessments	Learning activities	Resources
14	Design pattern for blockchain applications	3,4	Quiz, In-class exercises	Teaching, Presentation, In-class reading	
15	Real-world applications	3,4	Presentation	Teaching, Presentation Group discussion	
16	**Final exam**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Labs (20%)			x	x
Midterm examination (30%)	x	x		
Final examination (40%)		x	x	
Exercises/ Quiz (10%)	x			

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

---

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

1. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			

Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
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Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or	Issue/ problem to be considered critically is stated without clarification or description.

			backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into	Specific position (perspective, thesis/hypothesis) takes into account the complexities of	Specific position (perspective, thesis/ hypothesis) acknowledges different	Specific position (perspective, thesis/ hypothesis) is stated, but is

	account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	sides of an issue.	simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable

	consistently observable and is skillful and makes the content of the presentation cohesive.	consistently observable within the presentation.	observable within the presentation.	within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)

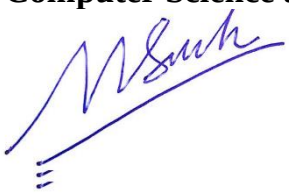
	authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Game Development

Course Code: IT167IU

1. General information

Course designation	This course is an introduction to the theory and practice of the process of designing games and playful experiences.
Semester(s) in which the course is taught	7,9
Person responsible for the course	Dr. Le Duy Tan
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total workload: 182.5 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Lecture: 37.5 hours + Laboratory: 25 hours. Private study including examination preparation, specified in hours: 120 hours.
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object Oriented Programming
Course objectives	This course is an introduction to the theory and practice of the process of designing games and playful experiences. Students are familiarized with methods, concepts, techniques, and literature used in the design of games. The strategy is process-oriented, focusing on aspects such as: Rapid prototyping, play testing, and design iteration using a player-centered approach.
Course learning outcomes	CLO 1. Understand the emergence of the academic study of design methods and game design. CLO 2. Able to structure and conduct a game design project from conceptualization to playable prototype. CLO 3. Solve a real-world problem using game design knowledge through group collaboration.

<table>
<tr><td></td><td><table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1</td></tr>
<tr><td>Skill</td><td>2, 3</td></tr>
<tr><td>Attitude</td><td>3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Game Development</td><td>1</td><td>I</td></tr>
<tr><td>Platforms and Publishing</td><td>3</td><td>T</td></tr>
<tr><td>Game Development Cycle</td><td>3</td><td>T, U</td></tr>
<tr><td>Principles of Game Design</td><td>3</td><td>T, U</td></tr>
<tr><td>Trade-Offs in Game Design</td><td>2</td><td>T, U</td></tr>
<tr><td>Game Engines, Game Systems and Elements; Map and Level Editors</td><td>2</td><td>T</td></tr>
<tr><td>Games Marketing and Distribution</td><td>1</td><td>T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions, Programming exercises</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>2. Nystrom, Robert. Game programming patterns. Genever Benning, 2014.
3. Gregory, Jason. Game engine architecture. crc Press, 2018.</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLOT	1	2	3	4	5	6
1	X					
2		XXX				
3						X

5. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Game Development	1	Quiz	Lecture	1
2	Platforms and Publishing – Part 1	1	Quiz	Lecture	1
3	Platforms and Publishing – Part 2	1	Quiz	Lecture, Discussion, In-class Exercise	2
4	Platforms and Publishing – Part 3	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
5	Game Development Cycle – Part 1	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
6	Game Development Cycle – Part 2	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	2
7	Game Development Cycle – Part 3	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
8	Principles of Game Design – Part 1	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
Midterm					
9	Principles of Game Design – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
10	Principles of Game Design – Part 3	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
11	Trade-Offs in Game Design – Part 1	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1

12	Trade-Offs in Game Design – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
13	Game Engines, Game Systems and Elements; Map and Level Editors – Part 1	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1, 2
14	Game Engines, Game Systems and Elements; Map and Level Editors – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
15	Games Marketing and Distribution	2, 3	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
Final					

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz / Assigment (10%)	50%	10%	10%
Labs (20%)	10%	30%	30%
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	10%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.4. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			

Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.5. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.6. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective,	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	position (perspective, thesis/ hypothesis).	thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of	Language choices are thoughtful and generally support the effectiveness of the	Language choices are mundane and commonplace and partially support the effectiveness of	Language choices are unclear and minimally support the effectiveness of the

	the presentation. Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	the presentation. Language in presentation is appropriate to audience.	presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

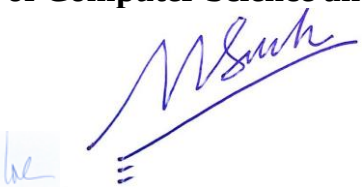
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: August 28, 2023

Ho Chi Minh City, 28/08/2023

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Development and Operations (DevOps)

Course Code: IT156IU

1. General information

Course designation	This course is an introduction to DevOps to help students understand its principles and practices. Key concepts and terminology will be covered with real-life case studies, examples and practical exercises. Common and popular tools to achieve DevOps models will be introduced as well.
Semester(s) in which the course is taught	7,8
Person responsible for the course	Tran Thanh Tung, PhD.
Language	English
Relation to curriculum	Elective (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	This course is an introduction to DevOps to help students understand its principles and practices. Key concepts and terminology will be covered with real-life case studies, example and practical exercises. Common and popular tools to achieve DevOps models will be introduced as well.
Course learning outcomes	CLO 1. Define and discuss the key concepts and principles of DevOps CLO 2 Explain the benefit of DevOps and continuous delivery CLO 3 Understand infrastructure automation, build and deployment automation, the transformation to DevOps models CLO 4. Work with common and popular DevOps tools

	<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>1,2</td></tr><tr><td>Skill</td><td>3,4</td></tr><tr><td>Attitude</td><td>4</td></tr></table>
Content	*The description of the contents should clearly indicate the weighting of the content and the level.* Weight: lecture session (~~3~~ hours) Teaching levels: I (Introduce); T (Teach); U (Utilize) <table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to DevOps</td><td>3</td><td>I</td></tr><tr><td>Introduction to Cloud Computing</td><td>3</td><td>I</td></tr><tr><td>Linux Basics and Shell Scripting</td><td>3</td><td>T,U</td></tr><tr><td>Versioning and Build Tool</td><td>3</td><td>T</td></tr><tr><td>Automation: Continuous Integration, Continuous Deployment</td><td>3</td><td>T</td></tr><tr><td>Configuration Management</td><td>3</td><td>I,T</td></tr><tr><td>Containers, Container vs Virtual Machine</td><td>3</td><td>I,T</td></tr><tr><td>Deployment pipeline</td><td>3</td><td>I,T</td></tr><tr><td>Post production</td><td>3</td><td>I,T</td></tr><tr><td>Disaster recovery</td><td>3</td><td>I</td></tr><tr><td>Continuous Monitoring for DevOps</td><td>3</td><td>I,T</td></tr><tr><td>Infrastructure and deployment security</td><td>3</td><td>I</td></tr></table>
Examination forms	Short-answer questions
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Jeffery D.Smith, Operations Anti-Patterns, DevOps Solutions, Manning Publications 2020 [2] Nicole Forsgren, Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations, IT Revolution Press 2018 [3] Jez Humble and David Farley. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Addison-Wesley Professional, 2010 [4] Paul M. Duvall, Steve Matyas, Andrew Glover. Continuous Integration: Improving Software Quality and Reducing Risk,

	Addison-Wesley Professional, 2007Len Bass and John Klein. Deployment and Operations for Software Engineers, 2019.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	1	2	3	4	5	6
1	x					
2	x					
3		x				
4						x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to DevOps				
2,3	Introduction to Cloud Computing				
4,5	Linux Basics and Shell Scripting				
6	Versioning and Build Tool				
7	Automation: Continuous Integration, Continuous Deployment				
8	Configuration Management				
Midterm exam					
9,10	Containers, Container vs Virtual Machine				
11	Deployment pipeline				
12	Post production				
13	Disaster recovery				
14	Continuous Monitoring for DevOps				
15	Infrastructure and deployment security				
Final exam					

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Quiz (5%)	10%		20%	20%
Labs (10%)	30%	30%		
Midterm examination (30%)	50%	40%		
Projects/Presentations/ Report (15%)	10%		30%	30%
Final examination (40%)		30%	50%	50%

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's	Conclusion is logically tied to a range of information, including opposing viewpoints; related	Conclusion is logically tied to information (because information is chosen to fit the	Conclusion is inconsistently tied to some of the information discussed; related outcomes

	informed evaluation and ability to place evidence and perspectives discussed in priority order.	outcomes (consequences and implications) are identified clearly.	desired conclusion); some related outcomes (consequences and implications) are identified clearly.	(consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Data Science and Visualization

Course Code: IT138IU

1. General information

<table>
<tr><td>Course designation</td><td></td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Tran Thanh Tung, Dr.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory / elective / specialisation Names of other study programmes with which the module is shared</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>none</td></tr>
<tr><td>Course objectives</td><td>The goal of this course is to introduce students to the key principles, methods, and techniques for effective visual analysis of data. The course begins with aims and key principles of data visualization. The course continues with different aspects of visualization including techniques and method for presenting different data types, and for discussing and analyzing visualizations. Thorough the course, students will be introduced to many visualization systems and visual tools via hand-on exercises.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the principles of data and graphic design.
CLO 2. Create well-designed data visualizations with appropriate tools.
CLO 3. Evaluate a visualization design.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td></td></tr>
<tr><td>Skill</td><td></td></tr>
</table>
</td></tr>
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<table>
<tr><td></td><td>
<table>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Visualization design principles</td><td></td><td></td></tr>
<tr><td>Perception, Cognition, Color</td><td></td><td></td></tr>
<tr><td>Data abstraction, data types</td><td></td><td></td></tr>
<tr><td>Visual encoding with marks and channels</td><td></td><td></td></tr>
<tr><td>Tasks and Interactivity</td><td></td><td></td></tr>
<tr><td>Validation and visualization</td><td></td><td></td></tr>
<tr><td>Arrange text and sets</td><td></td><td></td></tr>
<tr><td>Arrange spatial data</td><td></td><td></td></tr>
<tr><td>Arrange tree and graphs/networks</td><td></td><td></td></tr>
<tr><td>Facets and views</td><td></td><td></td></tr>
<tr><td>Focus+Context</td><td></td><td></td></tr>
<tr><td>Filtering and Aggregation</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1						
2						
3						
4						

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Visualization design principles				
2	Perception, Cognition, Color				
3	Data abstraction, data types				
4	Visual encoding with marks and channels				
5	Tasks and Interactivity				
6	**Midterm**				
7	Validation and visualization				
8	Arrange text and sets				
9	Arrange spatial data				
10	Arrange tree and graphs/networks				
11	Facets and views				
12	Focus+Context				
13	Filtering and Aggregation				
14	**Final exam**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3
Labs (20%)		x	x
Midterm examination (30%)	x	x	
Final examination (40%)		x	x
Exercises/ Quiz (10%)	x	x	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's	Conclusion is logically tied to a range of information, including opposing viewpoints; related	Conclusion is logically tied to information (because information is chosen to fit the	Conclusion is inconsistently tied to some of the information discussed; related outcomes

	informed evaluation and ability to place evidence and perspectives discussed in priority order.	outcomes (consequences and implications) are identified clearly.	desired conclusion); some related outcomes (consequences and implications) are identified clearly.	(consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated,	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

	memorable, and strongly supported.)			

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Digital Image Processing

Course Code: IT130IU

1. General information

<table>
<tr><td>Course designation</td><td>This course provides students fundamental knowledge of digital image processing</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ha Viet Uyen Synh</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective (All programs)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>This course helps students discuss digital image processing fundamentals; review of Digital Signal Processing algorithms such as Discrete Fourier Transform; intensity transforms, frequency domain filtering; image restoration and reconstruction; color image processing; multiresolution processing; image compression; morphological image processing.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand bases of digital image formation.
CLO 2. Understand the color image foundations.
CLO 3. Apply special-domain image filtering.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2</td></tr>
<tr><td>Skill</td><td>3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)</td></tr>
</table>

	Topic	**Weight**	**Level**
	Chapter 1: Introduction	3	I, T
	Chapter 2: Digital Image Fundamentals	6	I, T
	Chapter 3: Intensity Transformations and Spatial Filtering (part 1)	3	T, U
	Chapter 3: Intensity Transformations and Spatial Filtering (part 2)	6	T, U
	Chapter 4: Filtering in the frequency domain	6	T, U
	Chapter 5: Image restoration and reconstruction	3	T, U
	Chapter 6: Color Image processing	3	T, U
	Chapter 7: Wavelets and multiresolution processing (part 1)	3	T, U
	Chapter 7: Wavelets and multiresolution processing (part 2)	3	T, U
	Chapter 8: Image compression	3	T, U
	Chapter 9: Morphological image processing	3	T, U
	Chapter 10: Image segmentation	3	T, U
	Chapter 11: Representation and description	3	T, U
	Chapter 12: Object recognition	3	T, U
	Revision Application Design and Development	3	
Examination forms	Multiple-choice questions, short-answer questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	**1.** Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing 3rd, 2008		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x	x				
2	x	x				

3						x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Chapter 1: Introduction	1,2	Quiz, Lab, Exam	lecture, exercises	
2	Chapter 2: Digital Image Fundamentals	1,2	Quiz, Lab, Exam	lecture, exercises, lab	
3	Chapter 3: Intensity Transformations and Spatial Filtering (part 1)	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
4	Chapter 3: Intensity Transformations and Spatial Filtering (part 2)	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
5	Chapter 4: Filtering in the frequency domain	1,2	Quiz, Lab, Exam	lecture, exercises, lab	
6	Chapter 5: Image restoration and reconstruction	1,2	Quiz, Lab, Exam	lecture, exercises, lab	
7	Chapter 6: Color Image processing	1,2	Quiz, Lab, Exam	lecture, exercises, lab	
8	**Midterm**				
9	Chapter 7: Wavelets and multiresolution processing (part 1)	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
10	Chapter 7: Wavelets and multiresolution processing (part 2)	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
11	Chapter 8: Image compression	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
12	Chapter 9: Morphological image processing	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
13	Chapter 10: Image segmentation	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
14	Chapter 11: Representation and description	2,3	Quiz, Lab, Exam	lecture, exercises, lab	

15	Chapter 12: Object recognition	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
16	Revision Application Design and Development	1,2,3			
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Labs (20%)	20%	20%	20%
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	40%	40%	40%
Exercises/ Quiz (10%)	10%	10%	10%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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5. Rubrics **(optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

	experts are questioned thoroughly.	subject to questioning.	synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

	Language in presentation is appropriate to audience.	appropriate to audience.	appropriate to audience.	
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

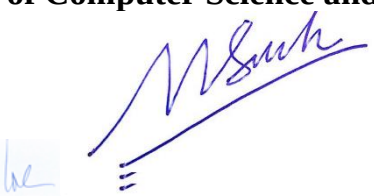
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Software Architecture

Course Code: IT114IU

1. General information

<table>
<tr><td>Course designation</td><td>This course provides student methodologies and techniques in Software Architecture.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ha Viet Uyen Synh</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective (CS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>Provides the student with a thorough understanding of varying methodologies and techniques in analysis, design and implementation of information system by using UML.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the steps of the System Development Life Cycle and the techniques for each step
CLO 2. Using a CASE tool in analysis and design of a system.
CLO 3. Apply to a real system
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2</td></tr>
<tr><td>Skill</td><td>3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
</table></td></tr>
</table>

	Introduction to systems analysis and design,	3	I
	Requirements.	3	T,U
	Use Case Modeling	6	T,U
	Dynamic Modeling	6	T,U
	State-Dependent Dynamic Interaction Modeling	6	T,U
	Data Modeling	6	T,U
	Normal Forms	6	T,U
	Structural Modeing	6	T,U
	Architectural Design.	3	I,T
Examination forms	Multiple-choice questions, short-answer questions		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	1. Kenneth E. Kendall, Julie E. Kendall, Systems Analysis and Design 7th, 2006 2. Gary B. Shelly, Thomas J. Cashman, Harry J. Rosenblatt, Systems Analysis and Design 4th, 2001		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1			x			
2			x			
3		x				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to systems analysis and design,	1,2	Quiz	lecture, exercises	
2	Requirements.	1,2,3	Quiz, Lab	lecture, exercises, lab	
3	Use Case Modeling	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	

4	**Midterm**				
5	Dynamic Modeling	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
6	State-Dependent Dynamic Interaction Modeling	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
7	Data Modeling	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
8	Normal Forms	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
9	Structural Modeing	1,2,3	Quiz, Lab, Exam	lecture, exercises, lab	
10	Architectural Design.	1,2	Quiz	lecture, exercises	
11	**Final exam**				

4. Assessment plan

Assessment Type

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	40%	40%	40%
Exercises/ Quiz (10%)	10%	10%	10%
Lab. Assignments (20%)	20%	20%	20%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		

Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries	Issue/ problem to be considered critically is stated without clarification or description.

			undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into	Specific position (perspective, thesis/hypothesis) takes into account the complexities of	Specific position (perspective, thesis/ hypothesis) acknowledges different	Specific position (perspective, thesis/ hypothesis) is stated, but is

	account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	sides of an issue.	simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable

	consistently observable and is skillful and makes the content of the presentation cohesive.	consistently observable within the presentation.	observable within the presentation.	within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)

	authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Data Mining

Course Code: IT160IU

1. General information

<table>
<tr><td>Course designation</td><td>This subject introduces the students to the principles and algorithms of data mining, and the requirements of a data mining process.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Nguyen Thi Thanh Sang</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective (CS, NE, CE)
Compulsory (DS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, laboratory.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Object-Oriented Programming</td></tr>
<tr><td>Course objectives</td><td>Students will study data mining concepts and algorithms to solve problems of knowledge discovery. They will be equipped with skills of using recent data mining software for solving practical problems and gain experience of doing independent study and research.</td></tr>
<tr><td>Course learning outcomes</td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1. Understand basic contents of data warehousing and data mining.
CLO 2. Explain modern algorithms in the area of data mining and knowledge discovery.</td></tr>
<tr><td>Skill</td><td>CLO 3. Apply data mining techniques to some case studies using existing datasets.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Attitude</td><td>CLO 4. Work in a team to build a data mining process.</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Data Mining</td><td>1</td><td>I</td></tr>
<tr><td>Know your data</td><td>1</td><td>T, U</td></tr>
<tr><td>Data preprocessing</td><td>1</td><td>T, U</td></tr>
<tr><td>Data mining knowledge representation</td><td>1</td><td>T, U</td></tr>
<tr><td>Evaluating what's been learned</td><td>1</td><td>T</td></tr>
<tr><td>Data mining algorithms: Classification</td><td>2</td><td>T, U</td></tr>
<tr><td>Mining Frequent Patterns, Association and Correlations: Basic Concept and Methods</td><td>2</td><td>T</td></tr>
<tr><td>Data mining algorithms: Clustering</td><td>2</td><td>T</td></tr>
<tr><td>Classification: Advanced Methods</td><td>1</td><td>T, I</td></tr>
<tr><td>Semantic data mining</td><td>1</td><td>I</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, 3rd Edition, 2011.
[2] Ian H.Witten, Eibe Frank, Mark A. Hall, and Christopher J. Pal, Data Mining: Practical Machine Learning Tools and Techniques, Fourth Edition, Morgan Kaufmann, 2016.
[3] A. Lawrynowicz, Semantic Data Mining: An Ontology-based Approach (Studies on the Semantic Web), IOS Press (April 15, 2017), ISBN-10 1614997454.</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6

1	x					
2	x					
3						x
4					x	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Data Mining	1		Lecture, Discussion	[1, 2]. Chapter 1
2	Know your data	1	Quiz.s2	Lecture, In-class quiz	[1]. Chapter 2
3	Data preprocessing	1,4		Lecture, Discussion	[1]. Chapter 3
4	Data mining knowledge representation	1	Quiz.s4	Lecture, In-class quiz	[2]. Chapter 3; Reading [1]. Chapter 4 – Data Warehousing
5	Evaluating what's been learned	1	Quiz.s5	Lecture, In-class quiz	[2]. Chapter 5
6-7	Data mining algorithms: Classification	2,3	Quiz.s6-7	Lecture, In-class quiz	[1]. Chapter 8; [2]. Chapter 4.3
8	Data mining to code	3		Lecture, Discussion	
9	**Midterm**				
10-11	Mining Frequent Patterns, Association and Correlations: Basic Concept and Methods	2,3,4	Quiz.s10-11	Lecture, In-class quiz	[1]. Chapter 6; [2]. Chapter 4.5
12-13	Data mining algorithms: Clustering	2,3,4	Quiz.s12-13	Lecture, In-class quiz	[1]. Chapter 10; [2]. Chapter 4.8
14	Classification: Advanced Methods	2	Quiz.s14	Lecture, In-class quiz	[1]. Chapter 9
15	Semantic data mining	2		Lecture, Discussion	[3]
16	Revision			Review-test	
17	**Final exam**				

Laboratory

Week	Lab
5	Introduction to Weka
6	Evaluation
7	Simple classifiers
8	Programming - Pre-processing data
9	More classifiers
10	Putting it all together
11	Programming - Clustering
12	Programming - Sequential pattern discovery

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Labs (10%)			100%	
Programming (20%)			70%	30%
Midterm examination (30%)	50%	50%		
Final examination (40%)		40%	60%	

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact,

	synthesis. Viewpoints of experts are questioned thoroughly.	synthesis. Viewpoints of experts are subject to questioning.	coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: IT Project Management

Course Code: IT056IU

1. **General information**

Course designation	This subject introduces to students the process of IT project management; the area of knowledge required and techniques appropriate for successful IT project management.
Semester(s) in which the course is taught	
Person responsible for the course	Assoc. Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	All programs: Elective course
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming Web application development Software engineering
Course objectives	This course provides students the fundamental IT project management knowledge, with particular emphasis on software products, project management and contemporary issues in the delivery of software solutions to business. It considers plan-driven and agile methodologies, estimating techniques, change management, risk management, and the role of project management in business. And it identifies the managerial control and reporting aspects necessary from inception to implementation of a software development project.
Course learning outcomes	CLO 1. Explain the IT project management process; CLO 2. Identify the areas of knowledge required for successful IT project management; CLO 3. Apply techniques appropriate for successful software project management;

<table>
<tr><td></td><td>CLO 4. Communicate effectively to the team and stakeholders; construct project related documentation.

<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Orientation & Introduction to the course</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Introduction to IT project management</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 3: Software project planning</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 4: Estimation (cost, time, scope)</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Project Schedules</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 6: Review process</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Software Requirement</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: Design & Programming</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9: Review for midterm examination</td><td>3</td><td>U</td></tr>
<tr><td>Week 10: Design and Programming</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Software Testing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12: Understanding Change</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 13: Management and Leadership</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Managing an Outsourced Project</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: Process Improvement.</td><td>3</td><td>I,T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions and essay writing</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Kathy Schwalbe, IT Project Management - 9th Edition, 2019
2. Stellman and Greene,
Applied Software Project Management, O’Reilly Media, 2006.</td></tr>
</table>

	3. Marchewka, J.T., Information Technology Project Management Providing Measureable Organizational Value 5th, 2016

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X				
2		X	X			
3		X				X
4			X		X	

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Orientation & Introduction to the course	1	Question and answer	Lecture,	[1, 2, 3]
2	Introduction to IT project management	1	Question and answer	Lecture, Discussion, In-class exercises	[1, 2, 3]
3	Software project planning	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
4	Estimation (cost, time, scope)	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
5	Project Schedules	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
6	Review process	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
7	Software Requirement	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion,	[1, 2, 3]

				In-class exercises	
8	Design & Programming	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
9	Review for midterm examination	1,2,3		Discussion, In-class exercises	
10	Design and Programming	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
11	Software Testing	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
12	Understanding Change	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
13	Management and Leadership	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
14	Managing an Outsourced Project	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
15	Process Improvement.	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
16	**Final examination**	2,3,4			

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Midterm examination (30%)	40%	50%		
Projects/Presentations/ Report (20%)		40%	30%	30%
Final examination (40%)			70%	30%
Exercises/ Quiz (10%)	25%	25%	25%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts

	presenting a position.		others' assumptions than one's own (or vice versa).	when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Software Engineering

Course Code: IT076IU

1. General information

Course designation	This course focuses on the design of software by implementing significant projects in teams
Semester(s) in which the course is taught	
Person responsible for the course	Assoc. Prof. Dr. Nguyen Thi Thuy Loan
Language	English
Relation to curriculum	Compulsory (CS, CE) Elective (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	IT069IU (Object-Oriented Programming)
Course objectives	This course provides students the fundamentals of software engineering concepts, methodologies, and processes. It covers the subjects on software process models, agile development methodologies, requirements engineering and analysis models, software design and implementation methods, test strategies, and software evolution. Students apply contemporary agile requirements analysis, planning, architecture, design, implementation and testing practices to software engineering project work in small teams.
Course learning outcomes	CLO 1. Describe the implement of software development process. CLO 2. Apply the principles and methods of software engineering in practice. CLO3. Practice teamwork skills in a software engineering project.

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO3</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Software development in practice</td><td>3</td><td>I</td></tr>
<tr><td>Beginning a project</td><td>3</td><td>T, U</td></tr>
<tr><td>Requirements</td><td>7.5</td><td>T, U</td></tr>
<tr><td>The user experience</td><td>4.5</td><td>T, U</td></tr>
<tr><td>System design</td><td>6</td><td>T, U</td></tr>
<tr><td>Program development</td><td>7.5</td><td>T, U</td></tr>
<tr><td>Reliability and testing</td><td>6</td><td>T, U</td></tr>
<tr><td>The business of software development</td><td>4.5</td><td>T, U</td></tr>
<tr><td>Review</td><td>3</td><td>I, U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Ian Sommerville, Software Engineering 10th, 2019.
2. Hyrum Wright, Titus Winters, and Tom Manshreck. Software Engineering at Google, 2020
3. Hans van Vliet, Software Engineering: Principles and Practice 3rd, 2008</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1						XXX
2			XX			XXX
3			XX		XXX	

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Software development in practice	1	Quiz	Lecture	[1]
2	Beginning a project	1,3	Quiz, Midterm, Project	Lecture, Discussion, In-class, exercise	[1,3]
3	Requirements	2,3	Quiz, Midterm, Project	Lecture, Discussion, In-class, exercise	[1,2]
4	The user experience	2,3	Quiz, Midterm, Project	Lecture, Discussion, In-class, exercise	[1,2]
5	System design	2,3	Quiz, Midterm, Project	Lecture, Discussion, In-class, exercise	[1,2,3]
6	**Midterm**				
7	Program development	2,3	Quiz, Final, Project	Lecture, Discussion, In-class, exercise	[1,2,3]
8	Reliability and testing	2,3	Quiz, Final, Project	Lecture, Discussion, In-class, exercise	[1,2,3]
9	The business of software development	2,3	Quiz, Project	Lecture, Discussion, In-class, exercise	[1,2,3]
10	Review	1,3	Quiz	Discussion, In-class, exercise	[1,2]
11	**Final exam**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3
Midterm examination (25%)	30%	20%	
Projects/Presentations/ Report (25%)	30%	30%	60%
Final examination (40%)	30%	40%	
Exercises/ Quiz (10%)	10%	10%	40%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described	Issue/ problem to be considered critically is stated, described, and	Issue/ problem to be considered critically is	Issue/ problem to be considered critically is stated without

	comprehensively, delivering all relevant information necessary for full understanding.	clarified so that understanding is not seriously impeded by omissions.	stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Object-Oriented Analysis and Design

Course Code: IT090IU

1. **General information**

1. Course designation	This course helps students learn about system life cycle development and the knowledge and skills required to develop object-oriented system.
Semester(s) in which the course is taught	
Person responsible for the course	MSc. Dao Tran Hoang Chau
Language	English
Relation to curriculum	Compulsory (CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 hours. Contact hours: Lecture 45 hours, Lab 30 hours: Private hours: 120 hours. Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	The course tries to solve the following questions• What are design approaches other than object-oriented design? What is object-oriented design? • What is a good design? How do you differentiate between a good and a bad design? What are the important characteristics of a good design?
Course learning outcomes	CLO 1. Identify client needs based on a written or verbal specification; CLO 2. Know how analyze and design a system with object-oriented concepts and design patterns; CLO 3. Know how to work in team effectively;

Competency level	**Course learning outcome (CLO)**
Knowledge	1, 2
Skill	1, 3

<table>
<tr><td></td><td>
<table>
<tr><td>Attitude</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (45 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Software development life cycle;</td><td>2</td><td>T</td></tr>
<tr><td>Requirements gathering techniques;</td><td>1</td><td>T</td></tr>
<tr><td>Analyze client’s requirements;</td><td>4</td><td>T</td></tr>
<tr><td>Design and implementation the system;</td><td>6</td><td>T, U</td></tr>
<tr><td>Design patterns;</td><td>2</td><td>T, U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Craig Larman, Applying UML and Patterns - An introduction to Object-Oriented Analysis And Design 3rd, 2004</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-3) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x					
2		x				
3					x	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Software development life cycle;	1	Midterm exam	Lecture, In-class activities	
2	Requirements gathering techniques;	1	Midterm exam	Lecture, In-class activities	

3	Analyze client's requirements;	1,3	Midterm exam, Assignment, Lab quiz	Lecture, In-class activities, Quiz	
4	Midterm				
5	Design and implementation the system;	2, 3	Final exam, Assignment, Lab quiz	Lecture, In-class activities, Quiz	
6	Design patterns;	2	Final exam	Lecture, In-class activities	
7	**Final exam**				

4. Assessment plan

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Midterm examination (25%)	40%	25%	
Projects/Presentations/ Report (25%)	60%	30%	70%
Final examination (40%)		30%	10%
Exercises/ Quiz (10%)		15%	20%

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or	Issue/ problem to be considered critically is stated without clarification or description.

			backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into	Specific position (perspective, thesis/hypothesis) takes into account the complexities of	Specific position (perspective, thesis/ hypothesis) acknowledges different	Specific position (perspective, thesis/ hypothesis) is stated, but is

	account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	sides of an issue.	simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable

	consistently observable and is skillful and makes the content of the presentation cohesive.	consistently observable within the presentation.	observable within the presentation.	within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)

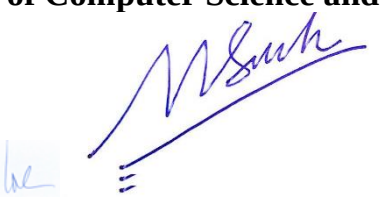
	authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Principles of Programming Languages

Course Code: IT092IU

1. General information

<table>
<tr><td>Course designation</td><td>This course provides students the important principles of programming languages.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ha Viet Uyen Synh</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (CS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>This course helps students: Learn important principles of programming languages; Learn basic components of programming languages; Learn programming language paradigms; Improve programming and software engineering skills</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand a wide range of programming paradigms
CLO 2. Understand how different programming languages evolved
CLO 3. Understand the differences in problem domains and language suitability
CLO 4. Understand the basic features of programming language translation
CLO 5. Understand implementation techniques for selected language constructs
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2,3,4,5</td></tr>
<tr><td>Skill</td><td>2</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Preliminaries</td><td>3</td><td>I,T</td></tr>
<tr><td>Evolution of the Major Programmin Languages</td><td>6</td><td>I,T</td></tr>
<tr><td>Functional Programming Languages</td><td>6</td><td>I,T</td></tr>
<tr><td>Software processes Describing Syntax and Semantics</td><td>3</td><td>I,T</td></tr>
<tr><td>Lexical and Syntax Analytics</td><td>3</td><td>I,T</td></tr>
<tr><td>Names, Bindings, Type Checking, and Scopes</td><td>3</td><td>I,T</td></tr>
<tr><td>Data Types</td><td>3</td><td>I,T</td></tr>
<tr><td>Expressions and Assignment Statement</td><td>3</td><td>I,T</td></tr>
<tr><td>Logic Programming Languages</td><td>6</td><td>I,T</td></tr>
<tr><td>Statement-Level Control Structures</td><td>3</td><td>I,T</td></tr>
<tr><td>Subprograms</td><td>3</td><td>I,T</td></tr>
<tr><td>Implement Subprograms</td><td>3</td><td>I,T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Robert W. Sebesta, Concepts of programming languages 10th, 2012
2. Terrence W.Pratt and Marvin V. Zelkowitz, Programming Languages - Design and Implementation 4th, 2011</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-5) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6

1	x					
2		x				
3	x					
4	x					
5	x					

3. **Planned learning activities and teaching methods**

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Preliminaries	1	Quiz,	lecture, exercises	
2	Evolution of the Major Programming Languages	2,3	Quiz,	lecture, exercises	
3	Functional Programming Languages	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
4	Software processes Describing Syntax and Semantics	3,4,5	Quiz, Exam	lecture, exercises	
5	Lexical and Syntax Analytics	4,5	Quiz, Exam	lecture, exercises	
6	**Midterm**				
7	Names, Bindings, Type Checking, and Scopes	4,5	Quiz, Exam	lecture, exercises	
8	Data Types	4,5	Quiz, Exam	lecture, exercises	
9	Expressions and Assignment Statement	4,5	Quiz, Exam	lecture, exercises	
10	Logic Programming Languages	2,3	Quiz, Lab, Exam	lecture, exercises, lab	
11	Statement-Level Control Structures	4,5	Quiz, Exam	lecture, exercises	
12	Subprograms	4,5	Quiz, Exam	lecture, exercises	
13	Implement Subprograms	4,5	Quiz, Exam	lecture, exercises	
14	**Final exam**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5
Midterm examination (30%)	50%	50%	50%		
Final examination (40%)				50%	50%

Exercises/ Quiz (10%)	20%	20%	20%	20%	20%
Lab. Assignments (20%)	30%	30%	30%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

---

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others'	Identifies own and others' assumptions and several relevant contexts when	Questions some assumptions. Identifies several relevant	Shows an emerging awareness of present assumptions (sometimes

	assumptions and carefully evaluates the relevance of contexts when presenting a position.	presenting a position.	contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

	discussed in priority order.		implications) are identified clearly.	

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye	Delivery techniques (posture, gesture, eye	Delivery techniques (posture, gesture, eye	Delivery techniques (posture, gesture, eye contact, and

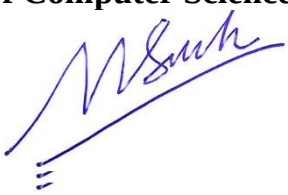
	contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Mobile Application Development

Course Code: IT133IU

1. General information

Course designation	Advanced programming course with focus on mobile environment
Semester(s) in which the course is taught	
Person responsible for the course	MSc. Le Thanh Son
Language	English
Relation to curriculum	Elective (All programs)
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-oriented analysis and design
Course objectives	This course is designed to introduce and familiarize students with programming in the mobile environment: Android platform will be used throughout the course. The course starts with introductions to basic components, concepts, structures of Android applications then move on with common user interface elements, persistent storage, database for mobile etc. Introduction to most common tools and techniques for writing Android application is also included with hands on experience in form of lab exercise programming project.
Course learning outcomes	CLO 1. Understand the structure of mobile application, especially Android application CLO 2. Understand most common mobile platform user interface, database, services CLO 3. Able to develop mobile application CLO 4. Team working

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1</td></tr>
<tr><td>Skill</td><td>2, 3</td></tr>
<tr><td>Attitude</td><td>4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to mobile programming</td><td>3</td><td>I</td></tr>
<tr><td>Android and Modal View Controller</td><td>3</td><td>I, T</td></tr>
<tr><td>Activity Lifecycle</td><td>3</td><td>I, T</td></tr>
<tr><td>Adroid SDK Versions and Compatbility</td><td>3</td><td>I, T</td></tr>
<tr><td>Creating UI: Layout and Widgets</td><td>3</td><td>T, U</td></tr>
<tr><td>ListFragment</td><td>3</td><td></td></tr>
<tr><td>ViewPager</td><td>3</td><td>T, U</td></tr>
<tr><td>Dialogs</td><td>3</td><td>T, U</td></tr>
<tr><td>MediaPlayer</td><td>3</td><td>T, U</td></tr>
<tr><td>Action Bar</td><td>3</td><td>T, U</td></tr>
<tr><td>Saving and Loading Local Files</td><td>3</td><td>T, U</td></tr>
<tr><td>Context Menu and Contextual Action Mode</td><td>3</td><td>T, U</td></tr>
<tr><td>Taking Pictures and Handling Images</td><td>3</td><td>T, U</td></tr>
<tr><td>Intents</td><td>3</td><td>T, U</td></tr>
<tr><td>Browsing the Web & WebView</td><td>3</td><td>T, U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. C. Stewart, K. Marscicano, Android Programming: The Big Nerd Ranch Guide 3rd, 2017
2. D. Griffiths, Head First Android Development: A Brain-Friendly Guide 1st, 2015</td></tr>
</table>

1. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLO	1	2	3	4	5	6
1	x					
2	x					
3		xx				xxx
4			x			xxx

2. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to mobile programming	1	Quiz	Lecture	2
2	Android and Modal View Controller	1	Quiz	Lecture	2
3	Activity Lifecycle	1	Quiz	Lecture	2
4	Adroid SDK Versions and Compatbility	1	Quiz, Lab, Midterm	Lecture, Discussion	2
5	Creating UI: Layout and Widgets	2, 3, 4	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
6	ListFragment	2, 3, 4	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
7	ViewPager	2, 3, 4	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
8	Dialogs	2, 3, 4	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
	Midterm				
9	MediaPlayer	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
10	Action Bar	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
11	Saving and Loading Local Files	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1

12	Context Menu and Contextual Action Mode	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
13	Taking Pictures and Handling Images	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
14	Intents	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
15	Browsing the Web & WebView	2, 3, 4	Quiz, Lab, Final	Lecture, Discussion, In-class Exercise	1
	Final exam				

3. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Quiz / Assigment (10%)	50%	10%	10%	70%
Labs (20%)	10%	30%	30%	30%
Midterm examination (30%)	30%	30%	30%	
Final examination (40%)	10%	30%	30%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

4. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		

Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the

	analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Optimization and Applications

Course Code: IT163IU

1. General information

Course designation	This subject covers linear programming, convex optimization theory, and applications.
Semester(s) in which the course is taught	
Person responsible for the course	Assoc. Prof. Vo Thi Luu Phuong, Ph.D.
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120.
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	
Course objectives	Optimization, particularly convex optimization, is applied in many fields such as data science, computer science, economics, engineering, logistics, etc. Optimization models of various applications in machine learning, resource allocations, etc. are introduced. Background theory of iterative algorithms solving problems such as gradient descent, mini-batch stochastic gradient descent, subgradient method, proximal gradient descent, etc. are taught. The course also covers linear programming (LP) which is a subfield of convex optimization. Some LP applications such as max flow – min cut, transportation, shortest path,… problems are mentioned.
Course learning outcomes	CLO 1. Formulate a practical problem as an optimization model and solve it using optimization solvers. CLO 2. Understand the background theory of convex problem, duality, and iterative algorithms solving the problems.

<table>
<tr><td></td><td>CLO 3. Be able to develop computer programs that applied iterative algorithms such as gradient descent, stochastic gradient descent, proximal gradient descent, subgradient method, … to solve optimization problems in various applications.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
<tr><td>Skill</td><td>CLO3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Course introduction
Mathematical background (linear algebra and calculus)</td><td>1</td><td>I, T</td></tr>
<tr><td>Linear program and applications</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Integer linear program and its applications</td><td>1</td><td>I, T</td></tr>
<tr><td>Convex sets and convex functions</td><td>1</td><td>I, T</td></tr>
<tr><td>Convex problems.</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Some applications:
- Linear regression
- Classification
- Regularization: Ridge regression, Lasso regression</td><td>1</td><td>I, T, U</td></tr>
<tr><td>First-order methods:
- gradient descent
- subgradient
- stochastic gradient
- proximal gradient</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Duality
- Lagrange, duality gap
- KKT condition
- Dual problem</td><td>2</td><td>I, T</td></tr>
<tr><td>Dual-based methods:
- Dual decomposition
- Dual of support vector machine problem</td><td>1</td><td>I, U, T</td></tr>
</table></td></tr>
</table>

	Second-order methods: - Newton method - Log-barrier method	1	I, U, T
	Advanced topic in optimization	1	I, U
	Final review	1	U
Examination forms	Multiple-choice questions, short-answer questions, programming		
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.		
Reading list	1. Stephen P. Boyd and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004. 2. Robert J. Vanderbei. Linear programming: foundations and extensions, 5th edition. Springer Nature, 2020.		

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		XX				
2	XX					
3						X

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Course introduction	2		lecture	1, 2
2	Mathematical background (linear algebra and calculus)	2		lecture	1
3-4	Linear program and applications	1, 2	Midterm, homework, lab	lecture, exercises, lab	2
5	Integer linear program and its applications	1, 2	Midterm, homework	lecture, exercises	2
6	Convex sets and convex functions	1, 2	Midterm, homework	lecture, exercises	1

7	Some applications: - Linear regression - Classification - Regularization: Ridge regression, Lasso regression	1	Midterm, homework, lab	lecture, exercises, lab	1, 2
	Midterm				
8-10	First-order methods: - gradient descent - subgradient - stochastic gradient - proximal gradient	2, 3	Final, homework, lab	lecture, exercises, lab	1
11	Duality - Lagrange, duality gap - KKT condition - Dual problem	2	Final, homework	lecture, exercises	1
12	Dual-based methods: - Dual decomposition - Dual of support vector machine problem	2, 3	Final, homework, lab	lecture, exercises, lab	1
13	Second-order methods: - Newton method - Log-barrier method	2, 3	Final, homework, lab	lecture, exercises, lab	1
14	Advanced topic in optimization	2	Final, homework	lecture, exercises	Literature
15	Final review	1		lecture	
14	**Final exam**				

4. Assessment plan

Assessment Type	**CLO 1**	**CLO 2**	**CLO 3**
Labs (25%)	25%		50%
Midterm examination (30%)	25%	40%	
Final examination (35%)	25%	40%	25%
Homeworks (10%)	25%	20%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual

questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions).

	presenting a position.		be more aware of others' assumptions than one's own (or vice versa).	Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Nguyen Van Sinh

Course Name: Fundamental Concepts of Data Security

Course Code: IT140IU

1. General information

1. Course designation	Fundamental concept of data security: This course focuses on information security, integrity and privacy techniques.
Semester(s) in which the course is taught	
Person responsible for the course	Le Thanh Son, MSc.
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120 Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	
Course objectives	This course introduces students to cryptographic principals and systems (symmetric and public key encryptions), and their applications in data security, secure communications, authentication and authorization. These core principles will be applied to the concepts of information risk management, and the analysis and handling of compromised systems. The ethics around computer crime, privacy, and intellectual property are covered in detail. Finally, the unit will cover the criteria and controls for information classification.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Gain understanding of the cryptography concepts including symmetric key encryption, hash function, message authentication code, public key encryption, digital signature and digital envelope;
CLO 2. Apply the concepts of authentication and authorization in implementing secure systems and networks;
CLO 3. Understand and categorize the malicious software and their attacking mechanisms;
CLO 4. Explore the buffer overflow attacks and fuzzing to find software vulnerabilities, and obtain the knowledge of software and operating system security;
CLO 5. Understand and practice Internet security protocols and authentication applications;
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3, CLO5</td></tr>
<tr><td>Skill</td><td>CLO4</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Symmetric-key encipherment (AES, DES)</td><td>2</td><td>T,U</td></tr>
<tr><td>Asymmetric-key encipherment (RSA, Diffie-Hellman,…);</td><td>2</td><td>T,U</td></tr>
<tr><td>Message integrity and message authentication;</td><td>2</td><td>T,U</td></tr>
<tr><td>Cryptographic hash function;</td><td>1</td><td>T,U</td></tr>
<tr><td>Digital signature;</td><td>1</td><td>T,U</td></tr>
<tr><td>Entity authentication;</td><td>1</td><td>T,U</td></tr>
<tr><td>Security at the application layer: PGP and S/MINE;</td><td>1</td><td>T</td></tr>
<tr><td>Security at the transport layer: SSL and TLS;</td><td>1</td><td>T</td></tr>
<tr><td>Security at network layer: IPSec;</td><td>1</td><td>T</td></tr>
<tr><td>Malicious software;</td><td>2</td><td>T</td></tr>
<tr><td>Database and cloud security;</td><td>1</td><td>T,U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
</table>

Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	1. William Stallings, Cryptography and Network Security 7th, 2016

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-5) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X		X	X		
2		X				
3	X					
4	X					
5	X					

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Symmetric-key encipherment (AES, DES)	1	Quiz, exam	Lecture, exercises, lab	[1]
2	Asymmetric-key encipherment (RSA, Diffie-Hellman,…);	1	Quiz, exam	Lecture, exercises, lab	[1]
3	Message integrity and message authentication;	1,2	Quiz, exam	Lecture, exercises, lab	[1]
4	Cryptographic hash function;	1	Quiz, exam	Lecture, exercises, lab	[1]
5	Digital signature;	1	Quiz, exam	Lecture, exercises, lab	[1]

6	**Midterm**				
7	Entity authentication;	2	Quiz, exam	Lecture, exercises, lab	[1]
8	Security at the application layer: PGP and S/MINE;	5	Quiz, exam	Lecture, exercises	[1]
9	Security at the transport layer: SSL and TLS;	5	Quiz, exam	Lecture, exercises	[1]
10	Security at network layer: IPSec;	5	Quiz, exam	Lecture, exercises	[1]
11	Malicious software;	3,4	Quiz, exam	Lecture, exercises, lab	[1]
12	Database and cloud security;	3,4	Quiz, exam	Lecture, exercises, lab	[1]
13	**Final exam**				

4. **Assessment plan**

Assessment Type	**CLO 1**	**CLO 2**	**CLO 3**	**CLO 4**	**CLO 5**
Midterm examination (30%)	68%	70%	55%		
Final examination (40%)				74%	67%
Exercises/ Quiz (30%)	32%	30%	45%	26%	33%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organization of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports	
Student: ……	HW/Assignment: …….
Date: ……	Evaluator: ……

	Max.	Score	Comments
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when

				presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and	Organizational pattern (specific introduction and conclusion, sequenced material within	Organizational pattern (specific introduction and conclusion, sequenced material within	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and

	transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	the body, and transitions) is clearly and consistently observable within the presentation.	the body, and transitions) is intermittently observable within the presentation.	transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandabilit y of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities)	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference

	make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Nguyen Van Sinh

Course Name: Decision support systems

Course Code: IT145IU

1. General information

Course designation	Introduction to the decision support system (DSS), an interactive computer-based system (or subsystem) intended to help decision makers. DSS simulate cognitive decision-making functions of humans based on AI methods including the area of knowledge: Expert systems, Data mining, Machine learning, Connectionism, Logical reasoning.
Semester(s) in which the course is taught	__semester__
Person responsible for the course	Nguyen Van Sinh, Assoc.Prof.
Language	English
Relation to curriculum	Compulsory / elective / specialisation Names of other study programmes with which the module is shared
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignments.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	A Decision Support System (DSS) is an interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions. DSS simulate cognitive decision-making functions of humans based on artificial intelligence methodologies (including expert systems, data mining, machine learning, connectionism, logistical reasoning,

<table>
<tr><td></td><td>etc.) in order to perform decision support functions. DSS is a general term for any computer application that enhances a person or group’s ability to make decisions. Also, DSS refers to an academic field of research that involves designing and studying DSS in their context of use.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the goals and different forms of decision support, and gain knowledge of the practical issues of implementation
CLO 2. Examine systems based on statistical and logical approaches to decision making that include statistical prediction, rule-based systems, case-based reasoning, neural networks, fuzzy logic, etc.
CLO 3. Obtain an overview of the various computerized decision support techniques together with a detailed assessment of successful and unsuccessful applications developed
CLO 4. Examine the actual and potential impact of the technology together with the challenges associated with this kind of application
<table>
<tr><td>etency level</td><td>Course learning outcome (C</td></tr>
<tr><td>edge</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>e</td><td></td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><td></td><td>Weight</td><td>Level</td></tr>
<tr><td>Introduction to Decision Making and Decision Support</td><td>3</td><td>I, U</td></tr>
<tr><td>Models, Cognitive Tools and Decision Making</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Decision support systems</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Modeling and analysis</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Data warehousing, Data Acquisition, Data Mining, Business analysis, and visualization</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Decision support system development</td><td>3</td><td>I, T, U</td></tr>
</table>
</td></tr>
</table>

		Collaborative computing technologies: Group support systems	3	I, T, U	
		Review for Midterm Exam	3	U	
		Enterprise Information Systems	3	I, T, U	
		Knowledge management	3	I, T, U	
		Artificial intelligent & Expert systems: Knowledge-Based systems	3	I, T, U	
		Knowledge Acquisition, Representation and Reasoning	3	I, T, U	
		Advanced Intelligent Systems	3	I, T, U	
		Ecommerce applications	3	I, T, U	
		Review for final exam	3	U	
Examination forms		Multiple-choice questions, short-answer questions			
Study and examination requirements		Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.			
Reading list					

2. **Learning Outcomes Matrix (optional)**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x					
2		x				
3		x				
4				x		

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Decision Making	1			

Week	Topic	CLO	Assessments	Learning activities	Resources
	and Decision Support				
2	Models, Cognitive Tools and Decision Making	2,3			
3	Decision support systems	2,3			
4	Modeling and analysis	2,3,4			
5	Data warehousing, Data Acquisition, Data Mining, Business analysis, and visualization	2,3,4			
6	**Midterm**				
7	Decision support system development	2,3,4			
8	Collaborative computing technologies: Group support systems	2,3,4			
9	Enterprise Informati	2,3,4			

Week	Topic	CLO	Assessments	Learning activities	Resources
	on Systems				
10	Knowledge management	2,3,4			
11	Artificial intelligent & Expert systems: Knowledge-Based systems	2,3,4			
12	Knowledge Acquisition, Representation and Reasoning	2,3,4			
13	Advanced Intelligent Systems	2,3,4			
14	Ecommerce applications	2,3,4			
15	**Final exam**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3	CLO4
Labs (25%)	x	x	x	x
Midterm examination (30%)	x	x		
Final examination (40%)		x	x	x

Assessment Type	CLO1	CLO2	CLO3	CLO4
Exercises/ Quiz (10%)	x	x	x	x

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**

5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications)

	discussed in priority order.	implications) are identified clearly.	and implications) are identified clearly.	are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandabilit

		interesting, and speaker appears comfortable.	understandable, and speaker appears tentative.	y of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Nguyen Van Sinh

Course Name: Cloud Computing

Course Code: IT164IU

1. General information

Course designation	The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure.
Semester(s) in which the course is taught	
Person responsible for the course	Dr. Le Duy Tan
Language	English
Relation to curriculum	Elective (CS, NE, CE)
Teaching methods	Lecture
Workload (incl. contact hours, self-study hours)	Total workload: 182.5 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Lecture: 37.5 hours + Laboratory: 25 hours. Private study including examination preparation, specified in hours: 120 hours.
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Computer Networks
Course objectives	This course concentrates on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
CLO 2. Able to deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and Google AppEngine.
CLO 3. Solve a real-world problem using cloud computing through group collaboration.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>1</td></tr><tr><td>Skill</td><td>2, 3</td></tr><tr><td>Attitude</td><td>3</td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Introduction to Cloud Computing</td><td>1</td><td>I</td></tr><tr><td>Cloud Computing Platforms</td><td>3</td><td>T</td></tr><tr><td>Parallel Programming in the Cloud</td><td>3</td><td>T, U</td></tr><tr><td>Distributed Storage Systems</td><td>3</td><td>T, U</td></tr><tr><td>Virtualization</td><td>2</td><td>T, U</td></tr><tr><td>Cloud Security</td><td>2</td><td>T</td></tr><tr><td>Multicore Operating Systems</td><td>1</td><td>T</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions, Programming exercises</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>4. Rountree, Derrick, and Ileana Castrillo. The basics of cloud computing: Understanding the fundamentals of cloud computing in theory and practice. Newnes, 2013.
5. Patterson, Scott. Learn AWS Serverless Computing: A Beginner's Guide to Using AWS Lambda, Amazon API Gateway, and Services from Amazon Web Services. Packt Publishing Ltd, 2019.</td></tr>
</table>

2. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLOT	1	2	3	4	5	6
1	X					
2		XX				
3						X

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Cloud Computing	1	Quiz	Lecture	1
2	Cloud Computing Platforms – Part 1	1	Quiz	Lecture	1
3	Cloud Computing Platforms – Part 2	1	Quiz	Lecture, Discussion, In-class Exercise	2
4	Cloud Computing Platforms – Part 3	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
5	Parallel Programming in the Cloud – Part 1	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
6	Parallel Programming in the Cloud – Part 2	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	2
7	Parallel Programming in the Cloud – Part 3	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
8	Distributed Storage Systems – Part 1	2, 3	Quiz, Lab, Midterm	Lecture, Discussion, In-class Exercise	1
Midterm					
9	Distributed Storage Systems – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion	1

				, In-class Exercise	
10	Distributed Storage Systems – Part 3	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1
11	Virtualization – Part 1	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1
12	Virtualization – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1
13	Cloud Security – Part 1	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1, 2
14	Cloud Security – Part 2	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1
15	Multicore Operating Systems	2, 3	Quiz, Lab, Final	Lecture, Discussion , In-class Exercise	1
Final					

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz / Assigment (10%)	50%	10%	10%
Labs (20%)	10%	30%	30%
Midterm examination (30%)	30%	30%	30%
Final examination (40%)	10%	30%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports	
Student: ……	HW/Assignment: ……. Evaluator: ……
Date: ……	

	Max.	Score	Comments
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/ hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	observable and is skillful and makes the content of the presentation cohesive.	consistently observable within the presentation.	observable within the presentation.	
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports

	information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: August 28, 2023

Ho Chi Minh City, 28/08/2023

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Business Process Analysis

Course Code: IT144IU

1. **General information**

Course designation	The course aims to provide fundamental knowledge of business process analysis, improvement and evaluation.
Semester(s) in which the course is	
Person responsible for the course	Assof. Pror.Dr. Vo Thi Luu Phuong
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 195 hours. Lecture: 45 hours. Lab: 30 hours. Private study including examination preparation, specified in hours: 120 hours. Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	Every organization thrives to implement effective business processes to increase employee and customer satisfaction, enhance business performance, reduce costs and boost productivity. All activities including altering critical processes, merging or splitting business units require a consistent framework to manage the changes. The course aims to provide fundamental knowledge of business process analysis, improvement and evaluation. Various approaches, techniques and software tools used to analyze and manage business process improvement are also introduced in the course.
Course learning outcomes	CLO 1. Practice the Framework for Process Improvement

<table>
<tr><td></td><td>CLO 2. Identify and analyze an organization's business process using different techniques such as ANSI, Swim Lane, Business Process Diagrams, UML, SIPOC, and Value Stream Maps
CLO 3. Evaluate process improvement effectiveness

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>1, 2, 3</td></tr><tr><td>Skill</td><td>1, 3</td></tr><tr><td>Attitude</td><td></td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th></th><th>Weight</th><th>Level</th></tr><tr><td>cience in Action</td><td>1</td><td>I</td></tr><tr><td>s Models and
s Discovery</td><td>3</td><td>T, U</td></tr><tr><td>nt Types of
s Models</td><td>4</td><td>T,U</td></tr><tr><td>s Discovery
ques and
mance
ng</td><td>3</td><td>T,U</td></tr><tr><td>ment of Process
s</td><td>3</td><td>T,U</td></tr><tr><td>ional Support
nclusions</td><td>1</td><td>I</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td></td></tr>
</table>

2. **Learning Outcomes Matrix (optional)**

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X			X	
2		X				
3		X	X			

3. **Planned learning activities and teaching methods**

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Data Science in Action	2	Midterm	In-class activities	
2	Process Models and Process Discovery	2, 5	Midterm, Quiz, Project, Lab	In-class activities, quiz	
3	**Midterm**				
4	Different Types of Process Models	2	Final, Project, Lab	In-class activities	
5	Process Discovery Techniques and Conformance Checking	2, 3	Final, Project, Quiz, Lab	In-class activities, Quiz	
6	Enrichment of Process Models	2	Final, Project, Lab	In-class activities	
7	Operational Support and Conclusions	2	Final, Project, Lab	In-class activities	

Week	Topic	CLO	Assessments	Learning activities	Resources
8	**Final exam**				

4. **Assessment plan**

Assessment Type	CLO1	CLO2	CLO3
Labs (20%)	20%	20%	
Midterm examination (30%)	50%	40%	
Final examination (40%)		20%	60%
Exercises/ Quiz/ Project (10%)	30%	20%	40%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …… HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		

Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	(perspective, thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/

	presenter's credibility/ authority on the topic.	authority on the topic.	authority on the topic.	authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Nguyen Van Sinh

Course Name: Critical Thinking

Course Code: PE008IU

1. General information

Course designation	*This course provides the nature and techniques of thought as a basis for our claims, beliefs, and attitudes about the world. The course also explores the process in which people develop their claims and support their beliefs.* *Specifically, the course includes the theory and practice of presenting arguments in oral and written forms, making deductive and inductive arguments, evaluating the validity or strength of arguments, detecting fallacies in arguments, and refuting fallacious arguments.* *Resources for the reasoning process include hypothetical and real-life situations in various fields of natural sciences, social sciences, and humanities.*
Semester(s) in which the course is taught	1, 2, 3
Person responsible for the course	Trần Thanh Tú (Ph.D) Nguyễn Thị Thủy (Ph.D) Phạm Ngọc (Ph.D) Nguyễn Văn Tiếp (Ph.D) Vũ Tiến Thịnh (MA) Đỗ Thị Diệu Ngọc (MA)
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lectures, discussions, homework assignments, students' presentations
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 135 Contact hours (lecture, exercise): 45 Private study including examination preparation, specified in hours: 90
Credit points	3

<table>
<tr><td>Required and recommended prerequisites for joining the course</td><td>None</td></tr>
<tr><td>Course objectives</td><td>his course will enable students to
develop the habits of assessing and defending the reasonableness of their beliefs and values as well as those of others
appreciate the importance of looking at an issue from a variety of perspectives
apply critical thinking skills in both public and personal settings</td></tr>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course, students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Know the general concepts and standards of critical thinking; and comprehend the disadvantages of barriers to critical thinking in various contexts
CLO2. Know the elements of an argument and two patterns of reasoning
CLO3 Know the fallacies of relevance and insufficient evidence in arguments</td></tr>
<tr><td>Skill</td><td>CLO4. Construct and evaluate deductive and inductive arguments in spoken and written forms
CLO5. Test the validity of deductive arguments using Venn diagram and truth tables
CLO6. Analyze and standardize arguments
CLO7. Evaluate truth claims and refute arguments
CLO8. Analyze weaknesses in inductive arguments to strengthen them</td></tr>
<tr><td>Attitude</td><td>CLO9. Defend personal/group beliefs with good arguments and in appropriate manners (project presentations)</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (2 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Critical thinking</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Recognizing arguments</td><td>3</td><td>T, U</td></tr>
<tr><td>Basic logical concepts</td><td>3</td><td>T, U</td></tr>
<tr><td>A little categorical logic</td><td>3</td><td>T, U</td></tr>
<tr><td>A little propositional logic</td><td>3</td><td>T, U</td></tr>
<tr><td>Logical fallacies I</td><td>3</td><td>T, U</td></tr>
<tr><td>Logical fallacies II</td><td>3</td><td>T, U</td></tr>
<tr><td>Review for Midterm test</td><td>3</td><td>U</td></tr>
<tr><td>Analyzing arguments</td><td>3</td><td>T, U</td></tr>
<tr><td>Evaluating arguments and truth claims</td><td>3</td><td>T, U</td></tr>
<tr><td>Inductive reasoning</td><td>3</td><td>T, U</td></tr>
<tr><td>Project: Group presentation</td><td>9</td><td>U</td></tr>
<tr><td>Review for Final Exam</td><td>3</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>40 multiple-choice questions for the midterm and final exams and group presentations for the final project</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Overall passing score: 50/100</td></tr>
<tr><td>Reading list</td><td>[1] Bassham, Irwin, Nardone, and Wallace, Critical Thinking: A Student's Introduction, 6th edition, McGraw-Hill Education, 2020.
[2] Moore, B.N. et al. (2009). Critical Thinking, 9th ed. McGraw-Hill
[3] Patrick J. Hurley (2012). A Concise Introduction to Logic (11th ed.), Wadsworth, Cengage Learning
+ Relevant web resources</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1						
2						
3						

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Critical thinking	1	HW 1/Quiz 1	Lecture, Discussion, Homework, Quiz	[1] Chapter 1
2	Recognizing arguments	2	HW 2/Quiz 2	Lecture, Discussion, Homework, Quiz	[1] Chapter 2
3	Basic logical concepts	2	HW 3/Quiz 3	Lecture, Discussion, Homework, Quiz	[1] Chapter 3
4	A little categorical logic	3	HW 4/Quiz 4	Lecture, Discussion, Homework, Quiz	[1] Chapter 9
5	A little propositional logic	3	HW 5/Quiz 5	Lecture, Discussion, Homework, Quiz	[1] Chapter 10
6	Logical fallacies I	4	HW 6/Quiz 6	Lecture, Discussion, Homework, Quiz	[1] Chapter 5
7	Logical fallacies II	4	HW 7/Quiz 7	Lecture, Discussion, Homework, Quiz	[1] Chapter 6
8	Review for midterm exam + sample test				
9 + 10	**Midterm exam: Chapters 1, 2, 3, 9, 10**				
11	Analyzing arguments	5	HW 8/Quiz 8	Lecture, Discussion, Homework	[1] Chapter 7
12	Evaluating arguments and truth claims	5	HW 9/Quiz 9	Lecture, Discussion, Homework	[1] Chapter 8

13	Inductive reasoning	2	HW 10/Quiz 10	Lecture, Discussion, Homework	[1] Chapter 11
14	Project: Group presentation	6	Group work	Presentation, Discussion	
15	Project: Group presentation	6	Group work	Presentation, Discussion	
16	Project: Group presentation	6	Group work	Presentation, Discussion	
17	**Review for final exam + sample test**				
18	Reserved week				
19+20	**Final exam: Chapters 5, 6, 7, 8, 11**				

4. Assessment plan

Assessment Type	**CLO 1**	**CLO 2**	**CLO 3**	**CLO 4**	**CLO 5**	**CLO 6**	**CLO 7**	**CLO 8**	**CLO 9**
Class participation and Assignments (30%)	80% Pass	80% Pass	80% Pass	80% Pass	80% Pass				80% Pass
Midterm exam (30%)						80% Pass	80% Pass	80% Pass	
Final exam (40%)						80% Pass	80% Pass	80% Pass	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

Course Name: Theoretical Models in Computing

Course Code: IT131

1. General information

<table>
<tr><td>Course designation</td><td>This course is oriented to those undergraduate students who require a working knowledge of numerical methods</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td></td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ha Viet Uyen Synh</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>This course is oriented to those undergraduate students who require a working knowledge of numerical methods. Topics to be covered include solving nonlinear equations and linear systems, interpolation and least square method, numerical evaluation of derivatives, integral and solution of differential equations. The focus will be on understanding the solving techniques and the engineering meaning of diver problems, and not on rigorous profs. &#65533;</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Solve numerically nonlinear equations by bisection, iterative and Newton methods.
CLO 2. Solve big linear systems by exact and iterative methods.
CLO 3. Fit data by interpolation polynomials, Spline &#65533; polynomials and least square methods.
CLO 4. Evaluate numerically derivatives and integrals.
CLO 5. Solve numerically Boundary value problems by Euler, Euler improved and Finite Difference methods.
CLO 6. Study diverse engineering problems by numerical methods
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2,3,4,5</td></tr>
<tr><td>Skill</td><td>6</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1. Introduction</td><td>3</td><td>I</td></tr>
<tr><td>Chapter 2. Errors & Taylor Series</td><td>3</td><td>T,U</td></tr>
<tr><td>Chapter 3. Roots of Non-linear Equations</td><td>3</td><td>T,U</td></tr>
<tr><td>Chapter 4. Linear Algebraic Equations</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 5. Optimization</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 6. Curve Fitting & Interpolation</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 7. Numerical Differentiation and Integration</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 8. Ordinary Differential Equations</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 9. Partial Differential Equations</td><td>6</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Steven C. Chapra, Raymond P. Canale, Numerical methods for engineers 6th, 2008</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x	x				
2	x					
3	x					
4		x				
5	x					
6		x				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources

1	Chapter 1. Introduction			lecture, exercises	
2	Chapter 2. Errors & Taylor Series	1	Quiz, Lab, Exam	lecture, exercises, lab	
3	Chapter 3. Roots of Non-linear Equations	1	Quiz, Lab, Exam	lecture, exercises, lab	
4	Chapter 4. Linear Algebraic Equations	2	Quiz, Lab, Exam	lecture, exercises, lab	
5	Chapter 5. Optimization	3	Quiz, Lab, Exam	lecture, exercises, lab	
6	**Midterm**				
	Chapter 6. Curve Fitting & Interpolation	4	Quiz, Lab, Exam	lecture, exercises, lab	
7	Chapter 7. Numerical Differentiation and Integration	5	Quiz, Lab, Exam	lecture, exercises, lab	
8	Chapter 8. Ordinary Differential Equations	6	Quiz, Exam	lecture, exercises, lab	
9	Chapter 9. Partial Differential Equations	6	Quiz, Exam	lecture, exercises, lab	
10	**Final exam**				

3. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
Quiz (10%)	20%	20%	20%	20%	20%	20%
Labs (20%)	30%	30%	30%	30%	30%	30%
Midterm examination (30%)	50%	50%	50%			
Final examination (40%)				50%	50%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		

Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive	Information is taken from source(s) with enough interpretation/ evaluation to develop a	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of

	analysis or synthesis. Viewpoints of experts are questioned thoroughly.	coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequence)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics,	Supporting materials (explanations, examples, illustrations, statistics, analogies,	Supporting materials (explanations, examples, illustrations, statistics, analogies,	Insufficient supporting materials (explanations, examples, illustrations, statistics,

	analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Optimization and Applications

Course Code: IT155

1. General information

<table>
<tr><td>Course designation</td><td>This subject covers linear programming, convex optimization theory, and applications.</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>6 or 7</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Vo Thi Luu Phuong, Ph.D.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120.</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>Optimization, particularly convex optimization, is applied in many fields such as data science, computer science, economics, engineering, logistics, etc. Optimization models of various applications in machine learning, resource allocations, etc. are introduced. Background theory of iterative algorithms solving problems such as gradient descent, mini-batch stochastic gradient descent, subgradient method, proximal gradient descent, etc. are taught.
The course also covers linear programming (LP) which is a subfield of convex optimization. Some LP applications such as max flow – min cut, transportation, shortest path,… problems are mentioned.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Formulate a practical problem as an optimization model and solve it using optimization solvers.
CLO 2. Understand the background theory of convex problem, duality, and iterative algorithms solving the problems.
CLO 3. Be able to develop computer programs that applied iterative algorithms such as gradient descent, stochastic gradient descent, proximal gradient descent, subgradient method, … to solve optimization problems in various applications.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>Skill</td><td>CLO3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Course introduction
Mathematical background (linear algebra and calculus)</td><td>1</td><td>I, T</td></tr>
<tr><td>Linear program and applications</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Integer linear program and its applications</td><td>1</td><td>I, T</td></tr>
<tr><td>Convex sets and convex functions</td><td>1</td><td>I, T</td></tr>
<tr><td>Convex problems.</td><td>1</td><td>I, T, U</td></tr>
<tr><td>Some applications:
- Linear regression
- Classification
- Regularization: Ridge regression, Lasso regression</td><td>1</td><td>I, T, U</td></tr>
<tr><td>First-order methods:
- gradient descent
- subgradient
- stochastic gradient
- proximal gradient</td><td>2</td><td>I, T, U</td></tr>
<tr><td>Duality
- Lagrange, duality gap
- KKT condition
- Dual problem</td><td>2</td><td>I, T</td></tr>
<tr><td>Dual-based methods:
- Dual decomposition
- Dual of support vector machine problem</td><td>1</td><td>I, U, T</td></tr>
<tr><td>Second-order methods:
- Newton method
- Log-barrier method</td><td>1</td><td>I, U, T</td></tr>
<tr><td>Advanced topic in optimization</td><td>1</td><td>I, U</td></tr>
<tr><td>Final review</td><td>1</td><td>U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions, programming</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	3. Stephen P. Boyd and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004. 4. Robert J. Vanderbei. Linear programming: foundations and extensions, 5th edition. Springer Nature, 2020.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		XX				
2	XX					
3						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Course introduction	2		lecture	1, 2
2	Mathematical background (linear algebra and calculus)	2		lecture	1
3-4	Linear program and applications	1, 2	Midterm, homework, lab	lecture, exercises, lab	2
5	Integer linear program and its applications	1, 2	Midterm, homework	lecture, exercises	2
6	Convex sets and convex functions	1, 2	Midterm, homework	lecture, exercises	1
7	Some applications: - Linear regression - Classification - Regularization: Ridge regression, Lasso regression	1	Midterm, homework, lab	lecture, exercises, lab	1, 2
	Midterm				
8-10	First-order methods: - gradient descent - subgradient - stochastic gradient - proximal gradient	2, 3	Final, homework, lab	lecture, exercises, lab	1
11	Duality - Lagrange, duality gap - KKT condition - Dual problem	2	Final, homework	lecture, exercises	1
12	Dual-based methods: - Dual decomposition	2, 3	Final, homework, lab	lecture, exercises, lab	1

	- Dual of support vector machine problem				
13	Second-order methods: - Newton method - Log-barrier method	2, 3	Final, homework, lab	lecture, exercises, lab	1
14	Advanced topic in optimization	2	Final, homework	lecture, exercises	Literature
15	Final review	1		lecture	
14	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Labs (25%)	25%		50%
Midterm examination (30%)	25%	40%	
Final examination (35%)	25%	40%	25%
Homeworks (10%)	25%	20%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.4. Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		

TOTAL SCORE	100		

5.5. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.6. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			taken as mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications)	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

			are identified clearly.	

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

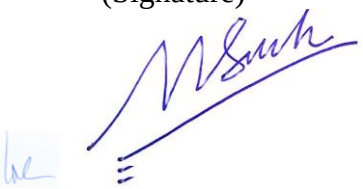
	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022
Dean of School of Computer Science and Engineering
(Signature)



Assoc.Prof. Nguyen Van Sinh

Course Name: Computer Graphics

Course Code: IT024IU

1. General information

Course designation	This subject introduces the students to principles and algorithms of computer graphics and requirements of creating graphical applications.
Semester(s) in which the course is taught	6
Person responsible for the course	Assoc.Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	Elective course (CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	This course provides students the fundamentals of computer graphics concepts, methodologies, and processes. It develop an understanding of the algorithms and fundamental techniques for generating and modifying pictures/objects with a digital computer, including the handling of color, and the generation of visible-surface projections of three dimensional scenes, for applications in science, engineering, and the entertainment world (i.e. connect to the VR & AR application; Games industry and Images processing).
Course learning outcomes	CLO 1. Understand and apply the algorithms and fundamental techniques for generating and modifying pictures, 2D/3D objects with a digital computer. CLO 2. Understand and apply the handling of color, and the generation of visible-surface projections of 3D scenes, for applications in science, engineering and the entertainment world.

<table>
<tr><td></td><td>CLO 3. Apply knowledge of mathematics and ability in graphical programming to develop games, construct and reconstruct 2D/3D objects, process images, VR & AR, etc.
CLO 4. Work in a team to ready build a computer graphics application
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Introduction to Computer Graphics, Mathematics Foundation</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Bessenham algorithms</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 3: Line clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 4: Polygon clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Transformation and Perspective</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 6: Transformation (cont.)</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Introduction to OpenGL programing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: View Transformation + Midterm</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9: 3D clipping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 10: Visual Surface Determination</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Color Models</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12: Image Rendering and Generation</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 13: Ray Tracing & Texture Mapping</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Bezier Curve and Surface processing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: Building graphics application; final review</td><td>3</td><td>I,T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions (computing and programing)</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	5. Steve Marschner and Peter Shirley, Fundamentals of Computer Graphics 5th, by A K Peters/CRC Press ISBN: 9780367505035, 2021. 6. Frank Klawonn , Introduction to Computer Graphics Using Java 2D and 3D, 2nd Edition, Springer 2012. 7. Sumanta Guha, Computer Graphics Through OpenGL From Theory to Experiments Third Edition (AIT), CRC Press, 2019. 8. John Vince, Mathematics for Computer Graphics, 5th Edition, Springer 2017.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2	X	X				
3		X				X
4					X	

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Computer Graphics, Mathematics Foundation	1	Quiz	Lecture,	[1, 4]
2	Bessenham algorithms	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
3	Line clipping	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
4	Polygon clipping	1, 2	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]

5	Transformation and Perspective	2, 3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
6	Transformation (cont.)	2, 3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
7	Introduction to OpenGL	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
8	**Midterm**				
9	View Transformation	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
10	3D clipping	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
11	Visual Surface Determination	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
12	Color Models	2, 3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
13	Image Rendering and Generation	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
14	Ray Tracing & Texture Mapping	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
15	Bezier Curve and Surface processing	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
16	Building graphics application; final review	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, Homework	[1, 2, 3]

17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Labs (20%)		30%	30%	40%
Midterm examination (30%)	40%	60%		
Final examination (40%)		50%	50%	
Exercises/ Quiz (10%)	30%	40%	30%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response

4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			taken as mostly fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in	Language choices are mundane and commonplace and partially support the effectiveness of the presentation.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is

	of the presentation. Language in presentation is appropriate to audience.	presentation is appropriate to audience.	Language in presentation is appropriate to audience.	not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is	Central message is	Central message is	Central message can be deduced

	compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	clear and consistent with the supporting material.	basically understandable but is not often repeated and is not memorable.	but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: IT Project Management

Course Code: IT056IU

1. General information

Course designation	This subject introduces to students the process of IT project management; the area of knowledge required and techniques appropriate for successful IT project management.
Semester(s) in which the course is taught	7
Person responsible for the course	Assoc. Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	All programs: Elective course
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	This course provides students the fundamental IT project management knowledge, with particular emphasis on software products, project management and contemporary issues in the delivery of software solutions to business. It considers plan-driven and agile methodologies, estimating techniques, change management, risk management, and the role of project management in business. And it identifies the managerial control and reporting aspects necessary from inception to implementation of a software development project.
Course learning outcomes	CLO 1. Explain the IT project management process;

<table>
<tr><td></td><td>CLO 2. Identify the areas of knowledge required for successful IT project management;
CLO 3. Apply techniques appropriate for successful software project management;
CLO 4. Communicate effectively to the team and stakeholders; construct project related documentation.

<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Orientation & Introduction to the course</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Introduction to IT project management</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 3: Software project planning</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 4: Estimation (cost, time, scope)</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Project Schedules</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 6: Review process</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Software Requirement</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: Design & Programming</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9: Review for midterm examination</td><td>3</td><td>U</td></tr>
<tr><td>Week 10: Design and Programming</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Software Testing</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12: Understanding Change</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 13: Management and Leadership</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Managing an Outsourced Project</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: Process Improvement.</td><td>3</td><td>I,T,U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions and essay writing</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
</table>

Reading list	**6.** Kathy Schwalbe, IT Project Management - 9th Edition, 2019 **7.** Stellman and Greene, *Applied Software Project Management*, O'Reilly Media, 2006. **8.** Marchewka, J.T., Information Technology Project Management Providing Measureable Organizational Value 5th, 2016

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X				
2		X	X			
3		X				X
4			X		X	

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Orientation & Introduction to the course	1	Question and answer	Lecture,	[1, 2, 3]
2	Introduction to IT project management	1	Question and answer	Lecture, Discussion, In-class exercises	[1, 2, 3]
3	Software project planning	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
4	Estimation (cost, time, scope)	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
5	Project Schedules	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]

6	Review process	2,3	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
7	Software Requirement	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
8	Design & Programming	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
9	Review for midterm examination	1,2,3		Discussion, In-class exercises	
10	Design and Programming	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
11	Software Testing	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
12	Understanding Change	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
13	Management and Leadership	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
14	Managing an Outsourced Project	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
15	Process Improvement.	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1, 2, 3]
16	**Final examination**	2,3,4			

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**

Midterm examination (30%)	40%	50%		
Projects/Presentations/ Report (20%)		40%	30%	30%
Final examination (40%)			70%	30%
Exercises/ Quiz (10%)	25%	25%	25%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.

2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications)

	perspectives discussed in priority order.	identified clearly.	and implications) are identified clearly.	are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and

	presentation compelling, and speaker appears polished and confident.	presentation interesting, and speaker appears comfortable.	presentation understandable, and speaker appears tentative.	speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Web Application Development

Course Code: IT093IU

1. General information

Course designation	This subject introduces to students the development of web application. How to design and program a web-app in practice based on the tools, techniques and web frameworks
Semester(s) in which the course is taught	6
Person responsible for the course	Assoc. Prof. Nguyen Van Sinh
Language	English
Relation to curriculum	Compulsory (NE, CE, CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming Principles of Database Management
Course objectives	This course provides students the fundamentals of web design and web programming. It provide the concepts and models of HTML, Java Server Page, Java Bean, MVC model, Java utilities and development environments, extended Java frameworks, several new frameworks with different programming languages. To develop skills in understanding and evaluating web-based systems, as well as to develop skills in designing and developing web-based applications.
Course learning outcomes	CLO 1. Understand web design, web programming concepts and models. CLO 2. Apply to design and develop static/dynamic web application with HTML, Java Server Pages, Java Bean, extended Java and other frameworks based on the MVC model. CLO 3. Apply knowledge and ability to manage and use Java, XML utilities and IDE for developing web applications with DBMS. CLO 4: work in group, communication, interaction and responsible within a team.

Competency level	Course learning outcome (CLO)

<table>
<tr><td></td><td>
<table>
<tr><td>Knowledge</td><td>CLO1</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 teaching hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Week 1: Introduction to the course and HTML</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 2: Advanced HTML and CSS</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 3: Introduction to J2EE and new frameworks in web application</td><td>3</td><td>I,T</td></tr>
<tr><td>Week 4: Servlet</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 5: Java server page and JDBC</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 6: Java Bean and MVC</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 7: Web state, session, cookies & midterm review</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 8: Java Script, APIs and Libraries</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 9&10: Node JS Framework</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 11: Graphical models on the webpage, web multimedia and web 360</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 12&13: XML & XSLT</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 14: Ajax framework</td><td>3</td><td>I,T,U</td></tr>
<tr><td>Week 15: the existing web frameworks & final review</td><td>3</td><td>I,T,U</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions and programming</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Dave Wolf and A.J. Henley. “Java EE Web Application Primer Building Bullhorn: A Messaging App with JSP, Servlets, JavaScript, Bootstrap and Oracle”, 2017.
2. Prem Kumar Karunakaran. “Java Web Application Development”, second edition, 2020.
3. Laura Ubelhor and Christian Hur. “Developing Business Application for the Web With HTML, CSS, JSP, PHP, ASP.NET and JavaScript”, 2017.
4. Refer VN book: N.V.Sinh, N.T.T.Sang, T.M.Hà “Xây dựng ứng dụng Web cho Thương mại điện tử trên Netbeans”, Nhà xuất bản Xây dựng 2017</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X	X				
2		X				
3		X				X
4					X	

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to the course and HTML	1	Quiz	Lecture,	[1,2]
2	Advanced HTML and CSS	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3]
3	Introduction to J2EE and new frameworks in web application	1	Quiz, Midterm	Lecture, Discussion	[1,2]
4	Servlet	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
5	Java server page and JDBC	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
6	Java Bean and MVC	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
7	Web state, session, cookies & midterm review	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
8	Java Script, APIs and Libraries & midterm review	2,3,4	Quiz, Lab, Midterm exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
9	Node JS Framework	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
10	Node JS Framework (continue)	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
11	Graphical models on the webpage, web multimedia and web 360	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]

12	XML & XSLT	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
13	XML & XSLT (continue)	2,3,4	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
14	Ajax framework	2,3	Quiz, Lab	Lecture, Discussion, In-class exercises	[1,2,3,4]
15	Existing web frameworks & final review	2,3	Quiz, Lab, Final exam	Lecture, Discussion, In-class exercises	[1,2,3,4]
16	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**
Labs (20%)		30%	40%	30%
Midterm examination (30%)	40$	60%		
Exercises/Quiz (10%)	30%	40%	30%	
Final examination (40%)		50%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications)	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

			are identified clearly.	

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

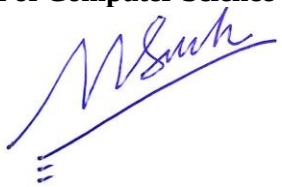
	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022
Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Information System Management

Course Code: IT094IU

1. General information

Course designation	This course covers the concepts of information systems and their applications to business processes
Semester(s) in which the course is taught	6
Person responsible for the course	Dr. Tran Thanh Tung
Language	English
Relation to curriculum	Elective course (CS, DS) Specialization (required) (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Principles of Database Management
Course objectives	This course will aim to provide students with:The concepts of information systems and their applications to business processes.Use of computer-based information systems in functional areas of business. Understanding of computer and information technology, resources, management and end-user decision making, and system development.
Course learning outcomes	CLO 1. understand basic information system concepts as applied to business operations and management. CLO 2. identify the major components of a computer system, including hardware, software, operating systems and operating environments as they apply to information systems. CLO 3. develop basic MIS applications such as spreadsheet, database, and web development.

Competency level	Course learning outcome (CLO)

<table>
<tr><td></td><td>
<table>
<tr><td>Knowledge</td><td>1, 2</td></tr>
<tr><td>Skill</td><td>3</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Information Systems in Global Business;</td><td>1</td><td>I</td></tr>
<tr><td>Global E-Business and Collaboration;</td><td>1</td><td>I</td></tr>
<tr><td>Information Systems, Organizations and Strategy</td><td>2</td><td>T</td></tr>
<tr><td>Ethical and Social Issues in Information Systems;</td><td>1</td><td>T</td></tr>
<tr><td>Telecommunications, the Internet, and Wireless Technology;</td><td>1</td><td>T</td></tr>
<tr><td>Foundations of Business Intelligence: Databases and Information Management</td><td>1</td><td>T,U</td></tr>
<tr><td>E-Commerce: Digital Markets, Digital Goods;</td><td>2</td><td>T,U</td></tr>
<tr><td>Achieving Operational Excellence and Customer Intimacy: Enterprise Applications;</td><td>2</td><td>T,U</td></tr>
<tr><td>Building Information Systems;</td><td>2</td><td>T,U</td></tr>
<tr><td>Managing Knowledge;</td><td>1</td><td>T</td></tr>
<tr><td>Enhancing Decision Making.</td><td>1</td><td>T</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>3. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems: Managing the Digital Firm 14th, 2016
4. Kenneth C. Laudon and Jane Laudon, Essentials of Management Information Systems 11th, 2015</td></tr>
</table>

3. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		x		x		
2		x		x		
3		x				

4. **Planned learning activities *and teaching methods***

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Information Systems in Global Business;	1	Midterm exam	In-class activities	
2	Global E-Business and Collaboration;	1	Midterm exam	In-class activities	
3	Information Systems, Organizations and Strategy	1,2	Midterm exam, Quiz	In-class activities, Lab	
4	Ethical and Social Issues in Information Systems;	1	Midterm exam		
5	Telecommunications, the Internet, and Wireless Technology;	2	Midterm exam	In-class activities, Lab	
6	**Midterm**				
7	Foundations of Business Intelligence: Databases and Information Management	2,3	Final exam	In-class activities, Lab	
8	E-Commerce: Digital Markets, Digital Goods;	1	Final exam	In-class activities, Lab	
9	Achieving Operational Excellence and Customer Intimacy: Enterprise Applications;	1	Final exam	In-class activities, Lab	
10	Building Information Systems;	2,3	Final exam	In-class activities, Lab	
11	Managing Knowledge;	1	Final exam		
12	Enhancing Decision Making.	1	Final exam		
13	**Final exam**				

5. Assessment plan

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

Assessment Type	CLO1	CLO2	CLO3
Midterm examination (30%)	40%	30%	20%
Projects/Presentations/ Report (20%)		40%	60%
Final examination (40%)	30%	20%	20%
Exercises/ Quiz (20%)	30%	10%	

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6. Rubrics (optional)

5.2. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……		HW/Assignment: ……. Evaluator: ……	
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.3. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**

5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact,

	Viewpoints of experts are questioned thoroughly.	Viewpoints of experts are subject to questioning.	analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in	Language choices are mundane and commonplace and partially support the effectiveness of the presentation.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is

	of the presentation. Language in presentation is appropriate to audience.	presentation is appropriate to audience.	Language in presentation is appropriate to audience.	not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

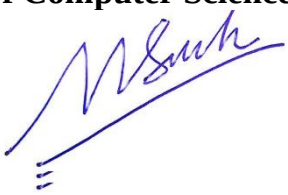
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: System and Network Security

Course Code: IT117

1. General information

Course designation	This course introduces students to the fundamentals of compute security in including software security, cryptography, network security and web security.
Semester(s) in which the course is taught	7,9
Person responsible for the course	MSc. Le Thanh Son
Language	English
Relation to curriculum	Elective (CE) Compulsory (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Computer Networks
Course objectives	This course introduces students to cryptography systems (symmetric and public key encryptions), basic information theory, authentication and authorization, database security, malicious software, denial of service attacks, intrusion detection and prevention systems, firewalls, buffer overflow attack and software security, Internet security protocols and standards, Internet authentication applications, and wireless security.
Course learning outcomes	CLO 1. Gain understanding of the cryptography concepts including symmetric key encryption, hash function, message authentication code, public key encryption, digital signature and digital envelope; CLO 2. Apply the concepts of authentication and authorization in implementing secure systems and networks; CLO 3. Understand and categorize the malicious software and their attacking mechanisms; CLO 4. Explore the buffer overflow attacks and fuzzing to find software vulnerabilities, and obtain the knowledge of software and operating system security; CLO 5. Understand and practice Internet security protocols and authentication applications;

<table>
<tr><td></td><td>CLO 6. Analyze the wireless security.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2, CLO3, CLO5</td></tr>
<tr><td>Skill</td><td>CLO4, CLO6</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Cryptographic systems (symmetric and public key systems);</td><td>2</td><td>T</td></tr>
<tr><td>Authentication and authorization;</td><td>1</td><td>T,U</td></tr>
<tr><td>Malicious software;</td><td>1</td><td>T</td></tr>
<tr><td>Database and cloud security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Denial of service attacks;</td><td>1</td><td>T,U</td></tr>
<tr><td>Intrusion detection and prevention systems, firewalls;</td><td>1</td><td>T</td></tr>
<tr><td>Buffer overflow and software security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Operating system security;</td><td>2</td><td>T,U</td></tr>
<tr><td>Internet security protocols;</td><td>1</td><td>T</td></tr>
<tr><td>Internet authentication applications;</td><td>1</td><td>T</td></tr>
<tr><td>Wireless security.</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. William Stallings and Lawrence Brown, Computer Security - Principles and Practice 3rd, 2015</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X		X	X		
2		X				
3	X					

4	X					
5	X					
6	X					

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Cryptographic systems (symmetric and public key systems);	1	Quiz, Exam	Lecture, Exercises, Lab	[1]
2	Authentication and authorization;	2	Quiz, Exam	Lecture, Lab	[1]
3	Malicious software;	3	Quiz, Exam	Lecture, Lab	[1]
4	Database and cloud security;	3	Quiz, Exam	Lecture, Lab	[1]
5	Denial of service attacks;	3	Quiz, Exam	Lecture	[1]
6	**Midterm**				
7	Intrusion detection and prevention systems, firewalls;	2	Quiz, Exam	Lecture	[1]
8	Buffer overflow and software security;	4	Quiz, Exam	Lecture, Lab	[1]
9	Operating system security;	4	Quiz, Exam	Lecture, Lab	[1]
10	Internet security protocols;	5	Quiz, Exam	Lecture, Exercises,	[1]
11	Internet authentication applications;	5	Quiz, Exam	Lecture, Exercises,	[1]
12	Wireless security.	6	Quiz, Exam	Lecture, Lab	[1]
13	**Final exam**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
Midterm examination (30%)	70%	80%	55%			
Final examination (40%)				75%	70%	75%
Exercises/ Quiz (30%)	30%	20%	45%	25%	30%	25%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/

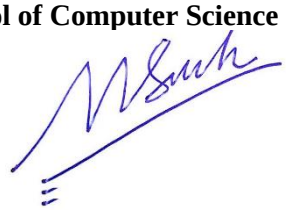
	authority on the topic.	authority on the topic.		authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Scalable and Distributed Computing

Course Code: IT139

1. General information

<table>
<tr><td>Course designation</td><td>Fundamental concepts in distributed computing and discuss system designs enabling distributed applications</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>5,7</td></tr>
<tr><td>Person responsible for the course</td><td>Assoc. Prof. Vo Thi Luu Phuong</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory (NE, DS)</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Algorithms and Data Structure
Fundamentals of Programming</td></tr>
<tr><td>Course objectives</td><td>This course presents the theory, design, implementation, and analysis of distributed systems. Through classroom lectures, labs, projects and exercises, students learn the fundamentals of distributed systems, system models, remote procedure call, distributed objects, operating system support, security in distributed systems, distributed file systems, concurrency, transaction and synchronization, replication. The course also covers advanced topics related to cloud and distributed data processing technologies: data partitioning, storage schemes, stream processing, and parallel algorithms. Course introduces some modern Internet and cloud computing services running on multiple geographically distributed data centers: Google, Yahoo, Facebook, iTunes, Amazon, eBay, Bing, etc.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the concept and design of distributed systems
CLO 2. Apply distributed data processing models and technologies
CLO 3. Communicate to the team to design the data pipeline that can be integrated with distributed system,
CLO 4. Design and implement components of a scalable and distributed system (millions of users and petabytes of data)
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>Skill</td><td>CLO 2, CLO 4</td></tr>
<tr><td>Attitude</td><td>CLO 3</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Distributed Systems, System Models</td><td>1</td><td>I, T</td></tr>
<tr><td>Remote Procedure Call, Distributed Objects</td><td>1</td><td>I, T</td></tr>
<tr><td>Operating System Support, Distributed File Systems</td><td>1</td><td>I, T</td></tr>
<tr><td>Transaction and Synchronization</td><td>1</td><td>T, U</td></tr>
<tr><td>Concurrency Control</td><td>1</td><td>T, U</td></tr>
<tr><td>Security</td><td>1</td><td>T, U</td></tr>
<tr><td>Fault and Failure</td><td>1</td><td>T, U</td></tr>
<tr><td>Introduction to MapReduce</td><td>1</td><td>T, U</td></tr>
<tr><td>Scalable K-means algorithms</td><td>1</td><td>T, U</td></tr>
<tr><td>Graph and Random-walk algorithms</td><td>1</td><td>T, U</td></tr>
<tr><td>Web services, XML, JSON, Node.js</td><td>1</td><td>T, U</td></tr>
<tr><td>Peer-to-Peer</td><td>1</td><td>I, T</td></tr>
<tr><td>Selected seminar 1: Introduce some distributed pipeline in Industry.</td><td>1</td><td>I</td></tr>
<tr><td>Selected seminar 2: Introduce some scalable and distributed products used in Industry.</td><td>1</td><td>I</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. G. Coulouris, J. Dollimore, T. Kindberg, G. Blair, Distributed Systems: Concepts and Design 5th, 2011
2. T. White, Hadoop: The Definitive Guide 4th, 2015
3. A.S. Tanenbaum, M.V. Steen, Distributed Systems: Principles and Paradigms 2nd, 2007</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

<table>
<tr><td></td><td>SLO</td></tr>
</table>

CLO	1	2	3	4	5	6
1	x					
2	x	x				
3	x	x				x
4		x				x

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to Distributed Systems, System Models	1		Lecture, Discussion	[1,2,3] Chapter 1
2	Remote Procedure Call, Distributed Objects	1	Exercises	Lecture, In-class exercises	[1,3] Chapter 2
3	Operating System Support, Distributed File Systems	1	Exercises	Lecture, In-class exercises	[1,3] Chapter 3
4	Transaction and Synchronization	1,2	Labs	Lecture, In-class exercises	[1,3] Chapter 3,4
5	Concurrency Control	1,2	Labs	Lecture, In-class exercises	[1,3] Chapter 5,6
6	**Midterm**				
7	Security	2,3	Exercises	Lecture, In-class exercises	[1,3] Chapter 6,7
8	Fault and Failure	2,3	Labs	Lecture, In-class exercises	[2] Chapter 5
9	Introduction to MapReduce	2,3	Exercises	Lecture, In-class exercises	[2] Chapter 6,7
10	Scalable K-means algorithms	2,3	Labs	Lecture, In-class exercises	Outside resources
11	Graph and Random-walk algorithms	2,3	Exercises	Lecture, In-class exercises	Outside resources
12	Web services, XML, JSON, Node.js	3,4	Labs	Lecture, In-class exercises	[1,3] Chapter 9,10,11
13	Peer-to-Peer	3,4	Labs	Lecture, In-class exercises	[1,3] Chapter 12

14	Selected seminar 1: Introduce some distributed pipeline in Industry.	4		Discussion	Outside resources
15	Selected seminar 2: Introduce some scalable and distributed products used in Industry.	4		Discussion	Outside resources
16	Revision			Review-test	
17	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Labs (20%)		50%	50%
Midterm examination (30%)	50%	50%	
Final examination (40%)	20%	50%	30%
Exercises/ Quiz (10%)	50%	50%	

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organization of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: ……. Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			fact, with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

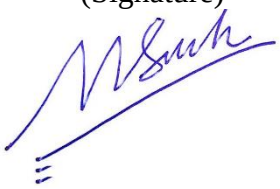
	Capstone	Milestone		Benchmark
	4	3	2	1
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies,	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies,

	quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022
Dean of School of Computer Science and Engineering
(Signature)



Assoc.Prof. Nguyen Van Sinh

Course Name: Business Process Analysis

Course Code: IT144

General information

Course designation	The course aims to provide fundamental knowledge of business process analysis, improvement and evaluation.
Semester(s) in which the course is	7
Person responsible for the course	Assof. Pror.Dr. Vo Thi Luu Phuong
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 195 hours. Lecture: 45 hours. Lab: 30 hours. Private study including examination preparation, specified in hours: 120 hours. Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	Every organization thrives to implement effective business processes to increase employee and customer satisfaction, enhance business performance, reduce costs and boost productivity. All activities including altering critical processes, merging or splitting business units require a consistent framework to manage the changes. The course aims to provide fundamental knowledge of business process analysis, improvement and evaluation. Various approaches, techniques and software tools used to analyze and manage business process improvement are also introduced in the course.
Course learning outcomes	CLO 1. Practice the Framework for Process Improvement CLO 2. Identify and analyze an organization's business process using different techniques such as ANSI, Swim Lane, Business Process Diagrams, UML, SIPOC, and Value Stream Maps CLO 3. Evaluate process improvement effectiveness

	Competency level / **Course learning outcome (CLO)** Knowledge: 1, 2, 3 Skill: 1, 3 Attitude:
Content	*The description of the contents should clearly indicate the weighting of the content and the level.* Weight: lecture session (3 hours) Teaching levels: I (Introduce); T (Teach); U (Utilize)
Examination forms	Multiple-choice questions, short-answer questions
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	

	Weight	**Level**
ience in Action	1	I
Models and Discovery	3	T, U
nt Types of Models	4	T,U
Discovery ques and mance Checking	3	T,U
nent of Process	3	T,U
onal Support and sions	1	I

Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1		X			X	
2		X				
3		X	X			

Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Data Science in Action	2	Midterm	In-class activities	
2	Process Models and Process Discovery	2, 5	Midterm, Quiz, Project, Lab	In-class activities, quiz	
3	**Midterm**				
4	Different Types of Process Models	2	Final, Project, Lab	In-class activities	
5	Process Discovery Techniques and Conformance Checking	2, 3	Final, Project, Quiz, Lab	In-class activities, Quiz	
6	Enrichment of Process Models	2	Final, Project, Lab	In-class activities	
7	Operational Support and Conclusions	2	Final, Project, Lab	In-class activities	
8	**Final exam**				

Assessment plan

Assessment Type	CLO1	CLO2	CLO3
Labs (20%)	20%	20%	
Midterm examination (30%)	50%	40%	
Final examination (40%)		20%	60%
Exercises/ Quiz/ Project (10%)	30%	20%	40%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.4. Grading checklist

Grading checklist for Written Reports			
Student: …….. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.5. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.6. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

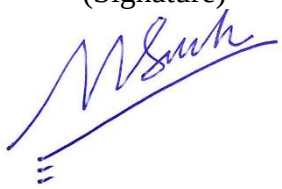
	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022
Dean of School of Computer Science and Engineering
(Signature)



Assoc.Prof. Nguyen Van Sinh

Course Name: Big Data Analytics

Course Code: IT173IU

General information

Course name	- (In English): Big Data Analytics - (In Vietnamese): Phân tích dữ liệu lớn
Course designation	The aim of this course is first to provide the students revision on the critical concepts and knowledges of big data, the goals of big data. Secondly, it gives the students the overview on the popular techniques and latest technologies used to deal with big data analytics.
Course type	☐ *General knowledge* ☐ *Fundamental* ☑ *Specialized knowledge* *Internship/Project/Thesis* ☐ *Others:……..* ☐
Semester(s) in which the course is taught	7
Person responsible for the course	Mai Hoang Bao An, PhD.
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 182.5 hours Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Lecture: 37.5 hours + Laboratory: 25 hours Private study including examination preparation, specified in hours: 120 hours
Credit points	4 credits (Theory: 3 + Practice: 1) 6.18 ECTS
Number of periods	Theory: 45 Practice: 30
Required and recommended prerequisites for joining the course	Data Analysis
Course objectives	Big Data Analytics provides baseline general knowledge of the techniques and technologies used in Data era of both small-to-medium tabular data to Big Data solutions. It covers the development of solutions using the Hadoop ecosystem, including MapReduce, HDFS, Apache Spark programming frameworks. This course helps students build a foundation for working with Apache Big Data solutions.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Revise the knowledge of data pipeline, small-to-medium data, types of data and related use cases. Revision on the programming used to handle with data pipeline.
CLO 2. Get knowledge of selecting data solutions. Identify common tools and technologies that can be used to create Big Data solutions.
CLO 3. Get knowledges on popular models of Big Data Analytics with Spark. Design the MapReduce programming framework, including the map, shuffle and sort, and reduce components.
CLO 4. Get to know how to do the learning pipelines with Big Data. Implement Big Data solutions using different big data programming frameworks.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO 1, CLO 2, CLO 3, CLO 4</td></tr>
<tr><td>Skill</td><td>CLO 2, CLO 3, CLO 4</td></tr>
<tr><td>Attitude</td><td>CLO 3, CLO 4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Revision on data pipeline concepts
Introduction to some successful data solutions.</td><td>1</td><td>I</td></tr>
<tr><td>Introduction to Big Data
Introduction to necessary tools</td><td>1</td><td>I, U</td></tr>
<tr><td>Remind on EDA
Remind on Python and some related libraries used to analyze data.</td><td>1</td><td>T, U</td></tr>
<tr><td>Advanced on programming used to deal with data pipeline, Big Data.
Applications in Text Analytics
Support Visual Analytics in data pipeline</td><td>1</td><td>T, U</td></tr>
<tr><td>Summary on data preparation
Databases for common data and related contents</td><td>1</td><td>T, U</td></tr>
<tr><td>Introduction to Dask for handling with Big data.</td><td>1</td><td>T, U</td></tr>
<tr><td>Practice with Dask</td><td>2</td><td></td></tr>
<tr><td>Remind to Hadoop/MapReduce
Some examples with the concepts of MapReduce in python.</td><td>1</td><td>T, U</td></tr>
<tr><td>Data preparation with pySpark
- Data manipulation
- Data preparation
- Miscellaneous</td><td>2</td><td>I, T</td></tr>
<tr><td>Machine Learning with Spark
- Regression
- Classification</td><td>3</td><td>T, U</td></tr>
<tr><td>Basic Text Mining with Spark</td><td>1</td><td>T, U</td></tr>
</table>
</td></tr>
</table>

			A case study Some advanced topics: Apache Kafka				

Examination forms	Short-answer questions, Long-answer questions, projects
Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	[1] Viktor Mayer-Schönberger, Kenneth Cukier., Big Data: A Revolution That Will Transform How We Live, Work, and Think., Harper Business; Reprint edition. [2] Sumit Pal., SQL on Big Data: Technology, Architecture, and Innovation., Apress; 1st edition. [3] Nandhini Abirami R, Seifedine Kadry, Amir H. Gandomi, Balamurugan Balusamy., Big Data: Concepts, Technology, and Architecture., Wiley; 1st edition. [4] Bill Chambers, Matei Zaharia., Spark: The Definitive Guide: Big Data Processing Made Simple., O'Reilly Media; 1st edition.

Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					
2	X	X	X			
3		X		X	X	X
4					X	X

Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Revision on data pipeline concepts Introduction to some successful data solutions.	1		Lecture, Discussion	[1] Chapter 1, 2
2	Introduction to Big Data Introduction to necessary tools	1, 2	Exercises	Lecture, In-class exercises	[1,2] Chapter 2, 3
3	Remind on EDA Remind on Python and some related libraries.	1, 2	Exercises	Lecture, In-class exercises	[1,2,3] Chapter 4, 5
4	Advanced on programming used to deal with data pipeline, Big Data. Applications in Text Analytics Support Visual Analytics in data pipeline	1, 2	Exercises, labs	Lecture, In-class exercises	[2,3] Chapter 5, 6
5	Summary on data preparation	2, 3	Exercises, labs	Lecture,	[2,3] Chapter 7

Week	Topic	CLO	Assessments	Learning activities	Resources
	Databases for common data and related contents			In-class exercises	
6	Introduction to Dask for handling with Big data.	2, 3	Exercises, labs	Lecture, In-class exercises	[2,3] Chapter 8, 9
7-8	Practice with Dask	2, 3, 4	Exercises, labs	Lecture, In-class exercises	[2,3] Chapter 10, 11
9	**Midterm**				
10	Remind to Hadoop/MapReduce Some examples with the concepts of MapReduce in python.	2, 3, 4	Exercises, labs	Lecture, In-class exercises	[4] Chapter 3, 4, 5
11-12	Data preparation with pySpark - Data manipulation - Data preparation - Miscellaneous	2, 3, 4	Exercises, labs	Lecture, In-class exercises	[4] Chapter 6, 7, 8
13-15	Machine Learning with Spark - Regression - Classification	2, 3, 4	Projects, labs	Lecture, In-class exercises	[4] Chapter 8, 9, 10, 11
16	Basic Text Mining with Spark A case study Some advanced topics: Apache Kafka	3, 4	Seminar	Lecture, Discussion	[4] Chapter 12
17	**Final exam**				

Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Quiz (15%)	20%		20%	20%
Midterm examination (30%)	50%	50%		
Projects/Presentations/ Report (15%)	30%		30%	30%
Final examination (40%)		50%	50%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		

Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.

Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: April 24, 2024

Ho Chi Minh City, 24/04/2024

Dean of the School of Computer Science and Engineering

(Signature)

Nguyen Van Sinh

Course Name: Decision support systems

Course Code: IT145IU

General information

Course designation	Introduction to the decision support system (DSS), an interactive computer-based system (or subsystem) intended to help decision makers. DSS simulate cognitive decision-making functions of humans based on AI methods including the area of knowledge: Expert systems, Data mining, Machine learning, Connectionism, Logical reasoning.
Semester(s) in which the course is taught	__semester__
Person responsible for the course	Nguyen Van Sinh, Assoc.Prof.
Language	English
Relation to curriculum	Compulsory / elective / specialisation Names of other study programmes with which the module is shared
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignments.
Credit points	Number of credits : 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Object-Oriented Programming
Course objectives	A Decision Support System (DSS) is an interactive computer-based system or subsystem intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems, complete decision process tasks, and make decisions. DSS simulate cognitive decision-making functions of humans based on artificial intelligence methodologies (including expert systems, data mining, machine learning, connectionism, logistical reasoning, etc.) in order to perform decision support functions. DSS is a general term for any computer application that enhances a person or group's ability to make decisions. Also, DSS refers to an academic field of research that involves designing and studying DSS in their context of use.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Understand the goals and different forms of decision support, and gain knowledge of the practical issues of implementation
CLO 2. Examine systems based on statistical and logical approaches to decision making that include statistical prediction, rule-based systems, case-based reasoning, neural networks, fuzzy logic, etc.
CLO 3. Obtain an overview of the various computerized decision support techniques together with a detailed assessment of successful and unsuccessful applications developed
CLO 4. Examine the actual and potential impact of the technology together with the challenges associated with this kind of application
<table>
<tr><td>tency level</td><td>Course learning outcome (CL</td></tr>
<tr><td>edge</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>e</td><td></td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (<s>3</s> hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><td></td><td>Weight</td><td>Level</td></tr>
<tr><td>Introduction to Decision Making and Decision Support</td><td>3</td><td>I, U</td></tr>
<tr><td>Models, Cognitive Tools and Decision Making</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Decision support systems</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Modeling and analysis</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Data warehousing, Data Acquisition, Data Mining, Business analysis, and visualization</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Decision support system development</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Collaborative computing technologies: Group support systems</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Review for Midterm Exam</td><td>3</td><td>U</td></tr>
<tr><td>Enterprise Information Systems</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Knowledge management</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Artificial intelligent & Expert systems: Knowledge-Based systems</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Knowledge Acquisition, Representation and Reasoning</td><td>3</td><td>I, T, U</td></tr>
<tr><td>Advanced Intelligent Systems</td><td>3</td><td>I, T, U</td></tr>
</table>
</td></tr>
</table>

		Ecommerce applications	3	I, T, U	
		Review for final exam	3	U	
Examination forms		Multiple-choice questions, short-answer questions			
Study and examination requirements		Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.			
Reading list					

Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x					
2		x				
3		x				
4				x		

Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Introduction to Decision Making and Decision Support	1			
2	Models, Cognitive Tools and Decision Making	2,3			
3	Decision support systems	2,3			
4	Modeling and analysis	2,3,4			
5	Data warehousing, Data Acquisition, Data Mining, Business analysis, and visualization	2,3,4			
6	**Midterm**				
7	Decision support system development	2,3,4			
8	Collaborative computing	2,3,4			

Week	Topic	CLO	Assessments	Learning activities	Resources
	technologies: Group support systems				
9	Enterprise Information Systems	2,3,4			
10	Knowledge management	2,3,4			
11	Artificial intelligent & Expert systems: Knowledge-Based systems	2,3,4			
12	Knowledge Acquisition, Representation and Reasoning	2,3,4			
13	Advanced Intelligent Systems	2,3,4			
14	Ecommerce applications	2,3,4			
15	**Final exam**				

Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Labs (25%)	x	x	x	x
Midterm examination (30%)	x	x		
Final examination (40%)		x	x	x
Exercises/ Quiz (10%)	x	x	x	x

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports	
Student: …….	HW/Assignment: …….

Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities	Issue/ problem to be considered critically is stated without clarification or description.

		impeded by omissions.	unexplored, boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	(perspective, thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

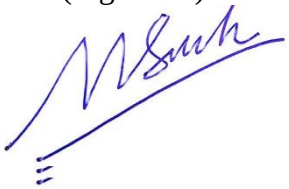
	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal	Delivery techniques (posture, gesture, eye contact, and vocal	Delivery techniques (posture, gesture, eye contact, and vocal

	make the presentation compelling, and speaker appears polished and confident.	expressiveness) make the presentation interesting, and speaker appears comfortable.	expressiveness) make the presentation understandable, and speaker appears tentative.	expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022
Dean of School of Computer Science and Engineering
(Signature)



Assoc.Prof. Nguyen Van Sinh

Course Name: Blockchain

Course Code: IT150IU

2. General information

Course designation	Introduction to Blockchain technology
Semester(s) in which the course is taught	6,7
Person responsible for the course	Tran Thanh Tung, Dr.
Language	English
Relation to curriculum	Elective
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	This subject introduces the students the foundation of blockchain technology and its applications. Students will study blockchain concepts and principles how it works. This course covers relevant topics blockchain space. The course starts with the basics of blockchain, cryptography, fundamental understanding of bitcoins. Then, the applications of blockchain technology is introduced in different areas of finance, healthcare, supply chain, etc. A complete picture of the ecosystem surrounding blockchain technology and development trends are also discussed.
Course learning outcomes	CLO 1. Understand basic contents of blockchain technology. CLO 2. Explain different types of blockchain development: Ethereum, smart contract security, bitcoin CLO 3. Apply blockchain techniques to setup the development environment to writing and deploying smart contracts, the workhorse of blockchain applications, integrating cryptocurrency micropayments into web apps

<table>
<tr><td></td><td>CLO 4. Work in a team to build a blockchain application project.
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO1</td></tr>
<tr><td>Skill</td><td>CLO3, CLO4</td></tr>
<tr><td>Attitude</td><td>CLO2</td></tr>
</table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction</td><td>3</td><td>I</td></tr>
<tr><td>Cryptography & cryptocurrencies</td><td>3</td><td>T</td></tr>
<tr><td>How Bitcoin achieve decentralization</td><td>3</td><td>I, T</td></tr>
<tr><td>Mechanics of Bitcoin</td><td>3</td><td>T, U</td></tr>
<tr><td>How to store and use Bitcoin</td><td>3</td><td>T, U</td></tr>
<tr><td>Bitcoin mining</td><td>3</td><td>T</td></tr>
<tr><td>Bitcoin and Anonymity</td><td>3</td><td>T</td></tr>
<tr><td>Ethereum</td><td>3</td><td>I, T</td></tr>
<tr><td>Solidity</td><td>3</td><td>T, U</td></tr>
<tr><td>Token</td><td>3</td><td>I, T</td></tr>
<tr><td>Oracle</td><td>3</td><td>I, T</td></tr>
<tr><td>Decentralized Applications (Dapps)</td><td>3</td><td>T, U</td></tr>
<tr><td>Design pattern for blockchain applications</td><td>3</td><td>T</td></tr>
<tr><td>Real-world applications</td><td>3</td><td>I, T</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton, 2016
[2] Andreas M. Antonopoulos, and Gavin Wood Ph. D. Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media, 2018
[3] Xiwei Xu, Ingo Weber, and Mark Staples. Architecture for Blockchain Applications. Springer, 2019.</td></tr>
</table>

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X					
2	X	X				
3		X				X
4						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction	1	Quiz	Teaching, Presentation	
2	Cryptography & cryptocurrencies	1	Quiz, In-class exercises	Teaching, Presentation	
3	How Bitcoin achieve decentralization	1, 2	Quiz, In-class exercises	Teaching, Presentation	
4	Mechanics of Bitcoin	1, 2	Quiz, In-class exercises	Teaching, Presentation	
5	How to store and use Bitcoin	1, 2	Quiz, In-class exercises	Teaching, Presentation	
6	Bitcoin mining	1, 2	Quiz, In-class exercises	Teaching, Presentation	
7	Bitcoin and Anonymity	2	Quiz, In-class exercises	Teaching, Presentation	
8	**Midterm**				
9	Ethereum	2,3	Project	Teaching, Presentation	
10	Solidity	2,3	Project	Teaching, Presentation	
11	Token	3,4	Quiz, In-class exercises	Teaching, Presentation	
12	Oracle	2,3	Quiz, In-class exercises	Teaching, Presentation Group discussion	
13	Decentralized Applications (Dapps)	3,4	Quiz, In-class exercises	Teaching, Presentation	

Week	Topic	CLO	Assessments	Learning activities	Resources
14	Design pattern for blockchain applications	3,4	Quiz, In-class exercises	Teaching, Presentation, In-class reading	
15	Real-world applications	3,4	Presentation	Teaching, Presentation Group discussion	
16	**Final exam**				

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Labs (20%)			x	x
Midterm examination (30%)	x	x		
Final examination (40%)		x	x	
Exercises/ Quiz (10%)	x			

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

2. Rubrics (optional)

5.2. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			

Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.3. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.4. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective,	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	(perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	presentation cohesive.			
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the

	analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	supports the presentation or establishes the presenter's credibility/ authority on the topic.	presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Development and Operations (DevOps)

Course Code: IT156IU

1. General information

Course designation	This course is an introduction to DevOps to help students understand its principles and practices. Key concepts and terminology will be covered with real-life case studies, examples and practical exercises. Common and popular tools to achieve DevOps models will be introduced as well.
Semester(s) in which the course is taught	7,8
Person responsible for the course	Tran Thanh Tung, PhD.
Language	English
Relation to curriculum	Elective (NE)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Software Engineering Computer Network
Course objectives	This course is an introduction to DevOps to help students understand its principles and practices. Key concepts and terminology will be covered with real-life case studies, example and practical exercises. Common and popular tools to achieve DevOps models will be introduced as well.
Course learning outcomes	CLO 1. Define and discuss the key concepts and principles of DevOps CLO 2 Explain the benefit of DevOps and continuous delivery CLO 3 Understand infrastructure automation, build and deployment automation, the transformation to DevOps models CLO 4. Work with common and popular DevOps tools

<table>
<tr><td></td><td>
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2</td></tr>
<tr><td>Skill</td><td>3,4</td></tr>
<tr><td>Attitude</td><td>4</td></tr>
</table>
</td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to DevOps</td><td>3</td><td>I</td></tr>
<tr><td>Introduction to Cloud Computing</td><td>3</td><td>I</td></tr>
<tr><td>Linux Basics and Shell Scripting</td><td>3</td><td>T,U</td></tr>
<tr><td>Versioning and Build Tool</td><td>3</td><td>T</td></tr>
<tr><td>Automation: Continuous Integration, Continuous Deployment</td><td>3</td><td>T</td></tr>
<tr><td>Configuration Management</td><td>3</td><td>I,T</td></tr>
<tr><td>Containers, Container vs Virtual Machine</td><td>3</td><td>I,T</td></tr>
<tr><td>Deployment pipeline</td><td>3</td><td>I,T</td></tr>
<tr><td>Post production</td><td>3</td><td>I,T</td></tr>
<tr><td>Disaster recovery</td><td>3</td><td>I</td></tr>
<tr><td>Continuous Monitoring for DevOps</td><td>3</td><td>I,T</td></tr>
<tr><td>Infrastructure and deployment security</td><td>3</td><td>I</td></tr>
</table>
</td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Jeffery D.Smith, Operations Anti-Patterns, DevOps Solutions, Manning Publications 2020

[2] Nicole Forsgren, Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations, IT Revolution Press 2018

[3] Jez Humble and David Farley. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Addison-Wesley Professional, 2010</td></tr>
</table>

	[4] Paul M. Duvall, Steve Matyas, Andrew Glover. Continuous Integration: Improving Software Quality and Reducing Risk, Addison-Wesley Professional, 2007Len Bass and John Klein. Deployment and Operations for Software Engineers, 2019.

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

CLO\SLO T	1	2	3	4	5	6
1	X					
2		XXX				
3						X

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Introduction to DevOps				
2,3	Introduction to Cloud Computing				
4,5	Linux Basics and Shell Scripting				
6	Versioning and Build Tool				
7	Automation: Continuous Integration, Continuous Deployment				
8	Configuration Management				
Midterm exam					
9,10	Containers, Container vs Virtual Machine				
11	Deployment pipeline				
12	Post production				
13	Disaster recovery				
14	Continuous Monitoring for DevOps				
15	Infrastructure and deployment security				
Final exam					

4. Assessment plan

Assessment Type	CLO1	CLO2	CLO3	CLO4
Quiz (5%)	10%		20%	20%
Labs (10%)	30%	30%		
Midterm examination (30%)	50%	40%		
Projects/Presentations/ Report (15%)	10%		30%	30%
Final examination (40%)		30%	50%	50%

5. Rubrics (optional)

5.4. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.5. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.

3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.6.

Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation / evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact,	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.

			with little questioning.	
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the	Language choices are thoughtful and generally support the effectiveness of the presentation.	Language choices are mundane and commonplace and partially support the effectiveness of the	Language choices are unclear and minimally support the effectiveness of the presentation. Language in

	effectiveness of the presentation. Language in presentation is appropriate to audience.	Language in presentation is appropriate to audience.	presentation. Language in presentation is appropriate to audience.	presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.

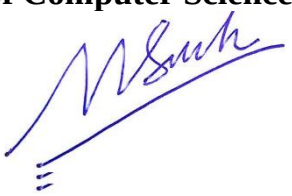
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: UI Design and Evaluation

Course Code: IT158IU

1. General information

Course designation	This course provides students with fundamental interaction principles between human and computers.
Semester(s) in which the course is taught	7,8
Person responsible for the course	MSc. Dao Tran Hoang Chau
Language	English
Relation to curriculum	Elective (CS)
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	None
Course objectives	This course provides students with fundamental interaction principles between human and computers.
Course learning outcomes	CLO 1. Know how to gather requirements. CLO 2 Apply human-computer interaction principles in user interface design process CLO 3 Choose the appropriate interface evaluation method CLO 4. Understand different design principles for mobile applications and the Web.
Content	*The description of the contents should clearly indicate the weighting of the content and the level.*

Competency level	**Course learning outcome (CLO)**
Knowledge	2, 3, 4
Skill	1
Attitude	1

<table>
<tr><td></td><td>Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Human factors</td><td>1</td><td>I</td></tr>
<tr><td>Human perception and cognition principles</td><td>2</td><td>T</td></tr>
<tr><td>User-centered design</td><td>2</td><td>T,U</td></tr>
<tr><td>Requirements gathering techniques</td><td>1</td><td>T,U</td></tr>
<tr><td>Interface design process</td><td>2</td><td>T,U</td></tr>
<tr><td>Prototyping techniques</td><td>2</td><td>T,U</td></tr>
<tr><td>Interface evaluation methodology</td><td>1</td><td>T,U</td></tr>
<tr><td>Interaction styles and techniques</td><td>1</td><td>T</td></tr>
<tr><td>HCI for mobile applications and the Web</td><td>2</td><td>T,U</td></tr>
<tr><td>Typography</td><td>1</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>[1] Debbie Stone, Caroline Jarrett, Mark Woodroffe, Shailey Minocha, User Interface Design and Evaluation, 1st Edition, Morgan Kaufmann, 2005

[2] Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Human-Computer Interaction, 3rd Edition, Prenctice Hall, 2004

[3] Gerard Jounghyun Kim, Human-Computer Interaction, Fundamentals and Practice, CRC Press, 2015</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	1	2	3	4	5	6
1			x			
2	x				x	
3		x			x	
4		x				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Human factors	1	Midterm exam	In-class activities	

2,3	Human perception and cognition principles	2	Midterm exam	In-class activities	
4,5	User-centered design	2	Midterm exam, Project, Lab quiz	In-class activities	
6	Requirements gathering techniques	1	Midterm exam, Project	In-class activities	
7,8	Interface design process	2	Midterm exam, Project	In-class activities	
Midterm exam					
9,10	Prototyping techniques	2	Project	In-class activities	
11	Interface evaluation methodology	3	Final exam, Project	In-class activities	
12	Interaction styles and techniques	3	Final exam	In-class activities	
13,14	HCI for mobile applications and the Web	4	Lab quiz	In-class activities	
15	Typography	2, 4	Final exam, Project	In-class activities	
Final exam					

4. Assessment plan

Assessment Type	**CLO 1**	**CLO2**	**CLO3**	**CLO4**
Quiz (5%)	10%		20%	20%
Labs (10%)	30%	30%		
Midterm examination (30%)	50%	40%		
Projects/Presentations/ Report (15%)	10%		30%	30%
Final examination (40%)		30%	50%	50%

5. Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: ……. HW/Assignment: ……. Date: …… Evaluator: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		

Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.

Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness)	Delivery techniques (posture, gesture, eye contact, and vocal	Delivery techniques (posture, gesture, eye contact, and vocal	Delivery techniques (posture, gesture, eye contact, and vocal

	make the presentation compelling, and speaker appears polished and confident.	expressiveness) make the presentation interesting, and speaker appears comfortable.	expressiveness) make the presentation understandable, and speaker appears tentative.	expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Theoretical Models in Computing

Course Code: IT131

1. General information

<table>
<tr><td>Course designation</td><td>This course is oriented to those undergraduate students who require a working knowledge of numerical methods</td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>3</td></tr>
<tr><td>Person responsible for the course</td><td>Dr. Ha Viet Uyen Synh</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Total workload: 195
Contact hours: 45 (lecture) + 30 (laboratory)
Private study including examination preparation, specified in hours: 120</td></tr>
<tr><td>Credit points</td><td>Number of credits : 4
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td></td></tr>
<tr><td>Course objectives</td><td>This course is oriented to those undergraduate students who require a working knowledge of numerical methods. Topics to be covered include solving nonlinear equations and linear systems, interpolation and least square method, numerical evaluation of derivatives, integral and solution of differential equations. The focus will be on understanding the solving techniques and the engineering meaning of diver problems, and not on rigorous profs. &#65533;</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Solve numerically nonlinear equations by bisection, iterative and Newton methods.
CLO 2. Solve big linear systems by exact and iterative methods.
CLO 3. Fit data by interpolation polynomials, Spline &#65533; polynomials and least square methods.
CLO 4. Evaluate numerically derivatives and integrals.
CLO 5. Solve numerically Boundary value problems by Euler, Euler improved and Finite Difference methods.
CLO 6. Study diverse engineering problems by numerical methods
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>1,2,3,4,5</td></tr>
<tr><td>Skill</td><td>6</td></tr>
<tr><td>Attitude</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1. Introduction</td><td>3</td><td>I</td></tr>
<tr><td>Chapter 2. Errors & Taylor Series</td><td>3</td><td>T,U</td></tr>
<tr><td>Chapter 3. Roots of Non-linear Equations</td><td>3</td><td>T,U</td></tr>
<tr><td>Chapter 4. Linear Algebraic Equations</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 5. Optimization</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 6. Curve Fitting & Interpolation</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 7. Numerical Differentiation and Integration</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 8. Ordinary Differential Equations</td><td>6</td><td>T,U</td></tr>
<tr><td>Chapter 9. Partial Differential Equations</td><td>6</td><td>T,U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>1. Steven C. Chapra, Raymond P. Canale, Numerical methods for engineers 6th, 2008</td></tr>
</table>

2. Learning Outcomes Matrix

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	x	x				
2	x					
3	x					
4		x				
5	x					
6		x				

3. Planned learning activities and teaching methods

Week	Topic	CLO	Assessments	Learning activities	Resources
1	Chapter 1. Introduction			lecture, exercises	
2	Chapter 2. Errors & Taylor Series	1	Quiz, Lab, Exam	lecture, exercises, lab	
3	Chapter 3. Roots of Non-linear Equations	1	Quiz, Lab, Exam	lecture, exercises, lab	
4	Chapter 4. Linear Algebraic Equations	2	Quiz, Lab, Exam	lecture, exercises, lab	
5	Chapter 5. Optimization	3	Quiz, Lab, Exam	lecture, exercises, lab	
6	**Midterm**				
	Chapter 6. Curve Fitting & Interpolation	4	Quiz, Lab, Exam	lecture, exercises, lab	
7	Chapter 7. Numerical Differentiation and Integration	5	Quiz, Lab, Exam	lecture, exercises, lab	
8	Chapter 8. Ordinary Differential Equations	6	Quiz, Exam	lecture, exercises, lab	
9	Chapter 9. Partial Differential Equations	6	Quiz, Exam	lecture, exercises, lab	
10	**Final exam**				

3. Assessment plan

Assessment Type	CLO 1	CLO2	CLO3	CLO4	CLO5	CLO6
Quiz (10%)	20%	20%	20%	20%	20%	20%
Labs (20%)	30%	30%	30%	30%	30%	30%
Midterm examination (30%)	50%	50%	50%			
Final examination (40%)				50%	50%	50%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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1. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

Rubrics (optional)

5.1.Grading checklist

Grading checklist for Written Reports			
Student: …….	HW/Assignment: …….		
Date: ……	Evaluator: ……		
	Max.	**Score**	**Comments**

Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2.Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3.Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored,	Issue/ problem to be considered critically is stated without clarification or description.

			boundaries undetermined, and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	(perspective, thesis/ hypothesis).			
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make	Delivery techniques (posture, gesture, eye contact, and	Delivery techniques (posture, gesture, eye contact, and

	the presentation compelling, and speaker appears polished and confident.	the presentation interesting, and speaker appears comfortable.	vocal expressiveness) make the presentation understandable, and speaker appears tentative.	vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering

Assoc.Prof. Nguyen Van Sinh

Course Name: Security Technology and Implementation

Course Code: IT165IU

1. General information

Course designation	The course will concentrate on security technologies that can be employed to safeguard and maintain a network. The course will also cover risk management, business continuity and recovery planning, operations security, access control systems, and software development security.
Semester(s) in which the course is taught	7,9
Person responsible for the course	Dr. Le Hai Duong
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	Total workload: 195 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 45 (lecture) + 30 (laboratory) Private study including examination preparation, specified in hours: 120
Credit points	Number of credits: 4 (ECTS: 6.18) Lecture: 3 Laboratory: 1
Required and recommended prerequisites for joining the course	Computer Networks
Course objectives	This course introduces students to information security principles, cryptography systems (symmetric and public key encryptions), risk management, security architecture and design, business continuity operations security, access control systems, protecting TCP/IP network, firewalls, virtual private network, IPSec, software development security.

<table>
<tr><td>Course learning outcomes</td><td>CLO 1. Gain understanding of information security and the cryptography concepts including symmetric key encryption, hash function, message authentication code, public key encryption, digital signature and digital envelope;
CLO 2. Apply the concepts of authentication and authorization in implementing secure systems and networks;
CLO 3. Analyze and evaluate security risk and security design;
CLO 4. Understand and apply software development security;
CLO 5. Apply security technologies in operations.

<table><tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr><tr><td>Knowledge</td><td>CLO1, CLO2, CLO4, CLO5</td></tr><tr><td>Skill</td><td>CLO2, CLO3, CLO4, CLO6</td></tr><tr><td>Attitude</td><td></td></tr></table></td></tr>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table><tr><th>Topic</th><th>Weight</th><th>Level</th></tr><tr><td>Information security principles</td><td>1</td><td>T</td></tr><tr><td>Governance and risk management;</td><td>1</td><td>T,U</td></tr><tr><td>Security architecture and design;</td><td>1</td><td>T</td></tr><tr><td>Business continuity and disaster recovery planning;</td><td>1</td><td>T,U</td></tr><tr><td>Operation security;</td><td>2</td><td>T,U</td></tr><tr><td>Access control systems and methodology;</td><td>1</td><td>T</td></tr><tr><td>Cryptography;</td><td>2</td><td>T,U</td></tr><tr><td>Overview network and telecommunications security;</td><td>1</td><td>T,U</td></tr><tr><td>Basic security infrastructures and routers;</td><td>1</td><td>T</td></tr><tr><td>Firewalls</td><td>1</td><td>T,U</td></tr><tr><td>Intrusion detection systems and intrusion protection systems</td><td>1</td><td>T</td></tr><tr><td>Virtual private network and IPSec;</td><td>1</td><td>T</td></tr><tr><td>Software Development security.</td><td>1</td><td>T,U</td></tr></table></td></tr>
<tr><td>Examination forms</td><td>Multiple-choice questions, short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of</td></tr>
</table>

	their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	2. William Stallings and Lawrence Brown, Computer Security - Principles and Practice 4th edition, 2018 3. Mark S. Merkow and Jim Breithaupt, Information Security: Principles and Practices, 2nd edition, 2014.

3. **Learning Outcomes Matrix**

The relationship between Course Learning Outcomes (CLO) (1-6) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	X		X	X		
2		X				
3	X					
4	X					
5	X					
6	X					

4. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Information security principles	1	Quiz, Exam	Lecture, Exercises, Lab	[1,2]
2	Governance and risk management;	3	Quiz, Exam	Lecture, Lab	[2]
3	Security architecture and design;	3	Quiz, Exam	Lecture, Lab	[2]
4	Business continuity and disaster recovery planning;	3	Quiz, Exam	Lecture, Lab	[2]
5,6	Operation security;	5	Quiz, Exam	Lecture, Lab	[2]
7	Access control systems and methodology;	2		Lecture, Lab	
	Midterm exam				
8, 9	Cryptography;	1	Quiz, Exam	Lecture	[1]
10	Overview network and telecommunications;	5	Quiz, Exam	Lecture, Lab	[2]

11	Basic security infrastructures and routers;	5	Quiz, Exam	Lecture, Lab	[2]
12	Firewalls	5	Quiz, Exam	Lecture, Exercises,	[1,2]
13	Intrusion detection systems and intrusion protection systems	5	Quiz, Exam	Lecture, Exercises,	[1,2]
14	Virtual private network and IPSec;	5	Quiz, Exam	Lecture, Lab	[1,2]
15	Software Development security.	4	Quiz, Exam	Lecture	[2]
	Final exam				

4. **Assessment plan**

Assessment Type	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**
Midterm examination (30%)	30%	80%	55%		10%
Final examination (40%)	40%			75%	60%
Exercises/ Quiz (30%)	30%	20%	45%	25%	30%

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. **Rubrics (optional)**

5.1. Grading checklist

Grading checklist for Written Reports			
Student: …….. Date: ……	HW/Assignment: ……. Evaluator: ……		
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		

Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined,	Issue/ problem to be considered critically is stated without clarification or description.

			and/ or backgrounds unknown.	
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged.	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.

	Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	within position (perspective, thesis/ hypothesis).		
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/

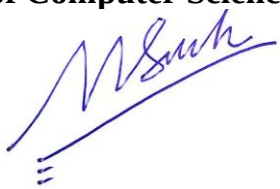
	presenter's credibility/ authority on the topic.	authority on the topic.	authority on the topic.	authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: February 15, 2022

Ho Chi Minh City, 15/02/2022

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

Course Name: Software Quality Verification and Validation

Course Code: IT166IU

1. General information

<table>
<tr><td>1. Course designation</td><td></td></tr>
<tr><td>Semester(s) in which the course is taught</td><td>7,9</td></tr>
<tr><td>Person responsible for the course</td><td>Tran Thanh Tung, Dr.</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective</td></tr>
<tr><td>Teaching methods</td><td>Lecture, lesson, project, seminar.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>(Estimated) Total workload: Contact hours (please specify whether lecture, exercise, laboratory session, etc.): Private study including examination preparation, specified in hours: Student responsibility: Students are expected to spend at least 8 hours per week for self – studying. This time should be made up of reading, working on exercises and problems and group assignment.</td></tr>
<tr><td>Credit points</td><td>Number of credits: 4 (ECTS: 6.18)
Lecture: 3
Laboratory: 1</td></tr>
<tr><td>Required and recommended prerequisites for joining the course</td><td>Object-Oriented Programming</td></tr>
<tr><td>Course objectives</td><td>Introduction to software verification, validation, and testing. Strategies and techniques are presented for testing software, and also for planning software testing.</td></tr>
<tr><td>Course learning outcomes</td><td>CLO 1. Describe and explain how testing activities involve within software development process.
CLO 2. Understand and apply best practices for software testing.
CLO 3. Create test cases based on system requirement
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1, CLO2</td></tr>
<tr><td>Skill</td><td>CLO2, CLO3</td></tr>
<tr><td>Attitude</td><td>CLO2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (~~3~~ hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Software Testing Overview</td><td>3</td><td>I</td></tr>
<tr><td>Software Testing Foundations</td><td>3</td><td>T</td></tr>
<tr><td>Software Testing Activities</td><td>3</td><td>T</td></tr>
<tr><td>Model-Driven Test Design</td><td>3</td><td>T, U</td></tr>
<tr><td>Test Automation</td><td>3</td><td>T, U</td></tr>
<tr><td>Testing First Approach</td><td>3</td><td>T</td></tr>
<tr><td>Criteria-Based Test Design</td><td>3</td><td>T</td></tr>
<tr><td>Input Space Partitioning</td><td>3</td><td>T</td></tr>
<tr><td>Graph Coverage</td><td>3</td><td>T</td></tr>
<tr><td>Logic Coverage</td><td>3</td><td>T</td></tr>
<tr><td>Writing Test Plans</td><td>3</td><td>T, U</td></tr>
<tr><td>Test implementation</td><td>3</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Short-answer questions</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
<tr><td>Reading list</td><td>4. Paul Ammann, Jeff Offutt; Introduction to Software Testing, 2nd, 2017
5. James A. Whittaker; Exploratory Software Testing, 2009.</td></tr>
</table>

	6. Glendford J. Myers, Tom Badgett, Corey Sandler; The art of Software Testing, 2012.

2. Learning Outcomes Matrix (optional)

The relationship between Course Learning Outcomes (CLO) (1-4) and Program/Student Learning Outcomes (SLO) (1-6) is shown in the following table:

	SLO					
CLO	1	2	3	4	5	6
1	XX					
2		XXX				
3						X

3. Planned learning activities and teaching methods

Week	**Topic**	**CLO**	**Assessments**	**Learning activities**	**Resources**
1	Software Testing Overview	1	Quiz	Lecture	
2	Software Testing Foundations	1	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
3	Software Testing Activities	2	Quiz	Lecture, Discussion	[2]
4	Model-Driven Test Design	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
5	Test Automation	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
6	Test Automation – Tools	1,2	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
7	Testing First Approach	2,3	Lab, Quiz, Midterm	Lecture, Discussion	
8	Criteria-Based Test Design	2,3	Lab, Quiz, Midterm	Lecture, Discussion, In class exercises	[1,3]
9	**Midterm**				

10	Input Space Partitioning – Part 1	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
11	Input Space Partitioning – Part 2	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,2,3]
12	Graph Coverage	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[1,3]
13	Logic Coverage	2,3	Lab, Quiz, Final	Lecture, Discussion	[1,3]
14	Writing Test Plans	1,2	Lab, Quiz, Final	Lecture, Discussion, In class exercises	[2,3]
15	Test implementation	2,3	Lab, Quiz, Final	Lecture, Discussion	[2,3]
16	**Final exam**				

4. Assessment plan

Assessment Type	**CLO1**	**CLO2**	**CLO3**
Quiz (5%)	X	X	
Labs (20%)		X	
Midterm examination (30%)	X	X	X
Projects/Presentations/ Report (10%)		X	X
Final examination (40%)	X	X	X

Note: %Pass: Target that % of students having scores greater than 50 out of 100.

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2. When calculating contact time, each contact hour is counted as a full hour because the organisation of the schedule, moving from room to room, and individual questions to lecturers after the class, all mean that about 60 minutes should be counted.↩

5. Rubrics (optional)

5.1. Grading checklist

Grading checklist for Written Reports	
Student:	HW/Assignment: …….
……..	Evaluator: ……

Date: ……			
	Max.	**Score**	**Comments**
Technical content (60%)			
Abstract clearly identifies purpose and summarizes principal content	10		
Introduction demonstrates thorough knowledge of relevant background and prior work	15		
Analysis and discussion demonstrate good subject mastery	30		
Summary and conclusions appropriate and complete	5		
Organization (10%)			
Distinct introduction, body, conclusions	5		
Content clearly and logically organized, good transitions	5		
Presentation (20%)			
Correct spelling, grammar, and syntax	10		
Clear and easy to read	10		
Quality of Layout and Graphics (10%)	10		
TOTAL SCORE	100		

5.2. Holistic rubric

Holistic rubric for evaluating the entire document, e.g., exercises/quizzes/HW	
Score	**Description**
5	Demonstrates complete understanding of the problem. All requirements of task are included in response
4	Demonstrates considerable understanding of the problem. All requirements of task are included.
3	Demonstrates partial understanding of the problem. Most requirements of task are included.
2	Demonstrates little understanding of the problem. Many requirements of task are missing.
1	Demonstrates no understanding of the problem.
0	No response/task not attempted

Note: this rubric is also used to evaluate questions in an exam.

5.3. Analytic rubric

Critical thinking value rubric for evaluating questions in exams:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**

Explanation of issues	Issue/ problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/ problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/ problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/ or backgrounds unknown.	Issue/ problem to be considered critically is stated without clarification or description.
Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
Influence of context and assumptions	Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies own and others' assumptions and several relevant contexts when presenting a position.	Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.

Student's position (perspective, thesis/hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.

Source: Association of American Colleges and Universities

Oral communication value rubric for evaluating presentation tasks:

	Capstone	**Milestone**		**Benchmark**
	4	**3**	**2**	**1**
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.

	is skillful and makes the content of the presentation cohesive.	observable within the presentation.	within the presentation.	
Language	Language choices are imaginative, memorable, and compelling, and enhance the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are thoughtful and generally support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language in presentation is appropriate to audience.	Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to audience.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.
Supporting Material	A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that	Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports

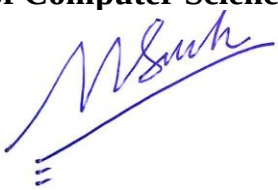
	information or analysis that significantly supports the presentation or establishes the presenter's credibility/ authority on the topic.	generally supports the presentation or establishes the presenter's credibility/ authority on the topic.	partially supports the presentation or establishes the presenter's credibility/ authority on the topic.	the presentation or establishes the presenter's credibility/ authority on the topic.
Central Message	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)	Central message is clear and consistent with the supporting material.	Central message is basically understandable but is not often repeated and is not memorable.	Central message can be deduced but is not explicitly stated in the presentation.

Source: Association of American Colleges and Universities

Date revised: August 29th, 2023

Ho Chi Minh City, 29/08/2023

Dean of School of Computer Science and Engineering



Assoc.Prof. Nguyen Van Sinh

ĐẠI HỌC QUỐC GIA
THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC QUỐC TẾ

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

Phụ lục III

BẢNG MÔ TẢ SỐ TÍN CHỈ THỰC TẬP CỦA CTĐT ĐƯỢC THỂ HIỆN CỤ THỂ THEO MÔN HỌC ĐỂ ĐẢM BẢO 8TC THỰC TẬP THEO QUY ĐỊNH TẠI THÔNG TƯ 17/2021/TT-BGDĐT

(Kèm theo Quyết định số 776 /QĐ-ĐHQT ngày 11 tháng 7 năm 2024 của Hiệu trưởng Trường Đại học Quốc tế)

Chương trình kỹ sư Công nghệ thông tin - chuyên ngành Kỹ Thuật Mạng có tổng cộng 10 tín chỉ thực tập:

- Thực tập công nghiệp cho kỹ sư (IT174IU): 07 tín chỉ
- Thực tập tốt nghiệp (IT083IU): 03 tín chỉ

Chương trình kỹ sư Công nghệ thông tin - chuyên ngành Kỹ Thuật Máy Tính có tổng cộng 10 tín chỉ thực tập:

- Thực tập công nghiệp cho kỹ sư (IT174IU): 07 tín chỉ
- Thực tập tốt nghiệp (IT083IU): 03 tín chỉ