

**BỘ THÔNG TIN VÀ TRUYỀN THÔNG
HỌC VIỆN CÔNG NGHỆ BƯU CHÍNH VIỄN THÔNG**

CHƯƠNG TRÌNH ĐÀO TẠO CHẤT LƯỢNG CAO
NGÀNH
CÔNG NGHỆ THÔNG TIN

Hà Nội 2020

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Số: /QĐ-HV

Hà Nội, ngày tháng năm 2020

CHƯƠNG TRÌNH KHUNG GIÁO DỤC ĐẠI HỌC

NGÀNH CÔNG NGHỆ THÔNG TIN

HỆ CHẤT LƯỢNG CAO

(Ban hành kèm theo Quyết định số /QĐ-HV ngày tháng năm 2020)

1. MỤC TIÊU ĐÀO TẠO

Chương trình đào tạo ngành Công nghệ thông tin hệ chất lượng cao tại Học viện Công nghệ Bưu chính Viễn thông có mục tiêu trang bị cho sinh viên các kỹ năng nghề nghiệp trong tương lai về công nghệ thông tin bao gồm cả chuyên môn, đạo đức nghề nghiệp, và kỹ năng mềm. Sinh viên tốt nghiệp chương trình đào tạo có thể: (The objectives of the Information Technology program at PTIT are to prepare students for future work and careers in computing with proficiency and integrity. Graduates of the program can):

Làm việc chuyên nghiệp trong ít nhất một trong các lĩnh vực sau: thiết kế phần mềm, phát triển phần mềm, kiểm thử phần mềm, khoa học dữ liệu, học máy, nghiên cứu về khoa học máy tính, an toàn thông tin. (Work professionally in one or more of the following areas: software design, developing, and testing; data science, machine learning engineering; computer science research; information security).

Làm việc hiệu quả, độc lập cũng như tập thể, trong nhiều môi trường làm việc khác nhau. (Work effectively in a variety of contexts, both as individuals and in team environments).

Có khả năng tự học suốt đời để đảm bảo làm việc chuyên nghiệp và hiệu quả trong thế giới công nghệ không ngừng thay đổi. (Engage in lifelong learning to remain effective professionals in a constantly changing world of technology).

Hiểu biết về các giá trị đạo đức nghề nghiệp, ý thức về những vấn đề đương đại, hiểu rõ vai trò của các giải pháp kỹ thuật trong bối cảnh kinh tế, môi trường, xã hội toàn cầu và trong bối cảnh riêng của đất nước. (Be aware of professional and societal responsibilities, and committed to ethical actions).

Sử dụng tiếng Anh thành thạo, làm việc hiệu quả trong môi trường quốc tế. (Use English in their work, and work effectively in an international environment).

2. CHUẨN ĐẦU RA

2.1 Chuẩn đầu ra chung (General engineering outcomes)

Sinh viên tốt nghiệp chương trình dự kiến có thể: (Graduates of the program are expected

to be able to:)

1. Áp dụng tri thức toán học, khoa học, và công nghệ để xác định, mô hình và giải quyết các vấn đề công nghệ. (Apply the knowledge of mathematics, science, and engineering to identify, formulate, and solve engineering problems).
2. Thiết kế và thực hiện các thực nghiệm, cũng như phân tích, đánh giá, và diễn giải các kết quả thực nghiệm. (Design and conduct experiments, as well to analyze and interpret data).
3. Thiết kế hệ thống, các thành phần, các tiến trình phù hợp với những ràng buộc thực tế trên nhiều khía cạnh như kinh tế, môi trường, xã hội, chính trị, văn hóa, an toàn sức khỏe, công nghiệp và bền vững. (Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability).
4. Hoạt động trong các nhóm đa ngành. (Function on multidisciplinary teams).
5. Nhận biết, mô hình, và giải quyết các vấn đề công nghệ. (Identify, formulate, and solve engineering problems).
6. Hiểu rõ đạo đức và trách nhiệm nghề nghiệp. (Understand professional and ethical responsibility).
7. Giao tiếp hiệu quả trong môi trường làm việc quốc tế. (Communicate effectively in an international environment).
8. Hiểu được sự ảnh hưởng của các giải pháp công nghệ trong ngữ cảnh môi trường, kinh tế, xã hội toàn cầu. (Understand the impact of engineering solutions in a global, economic, environmental, and societal context).
9. Thể hiện được tri thức và năng lực làm việc với các vấn đề đương đại. (Demonstrate a working knowledge of contemporary issues).
10. Áp dụng các kỹ thuật, kỹ năng và công cụ công nghệ hiện đại vào thực hành. (Apply the techniques, skills, and modern engineering tools necessary for engineering practice).
11. Chuyển đổi các lý thuyết và khái niệm kỹ thuật vào các ứng dụng thực tế. (Transition from engineering concepts and theory to real engineering applications).

Sau khi tốt nghiệp sinh viên có thể đảm nhận tốt các vị trí công tác sau:

Có thể cán bộ kỹ thuật, quản lý, điều hành trong lĩnh vực công nghệ thông tin;

Có thể trở thành các lập trình viên, các nhà quản trị hệ thống, quản trị bảo mật hệ thống công nghệ thông tin trong bất kỳ doanh nghiệp nào;

Có thể làm việc trong các dự án với vai trò là người quản trị dự án về công nghệ thông tin;

Có thể trở thành cán bộ nghiên cứu, cán bộ giảng dạy về công nghệ thông tin tại các viện, trung tâm nghiên cứu và các cơ sở đào tạo;

Có thể tiếp tục học tiếp lên trình độ sau đại học ở trong nước và nước ngoài.

Tiếng Anh:

Sau khi tốt nghiệp, sinh viên có năng lực tiếng Anh tương đương với trình độ IELTS 6.0.

2.2 Kiến thức và kỹ năng chuyên ngành (Specialization knowledge and skills)

Chương trình đào tạo gồm ba chuyên ngành: 1) Công nghệ phần mềm; 2) Trí tuệ nhân tạo; và 3) An toàn thông tin. Tùy vào chương trình đào tạo cụ thể, sinh viên tốt nghiệp sẽ có thêm các kỹ năng chuyên ngành sau. (There are three specializations in the program: 1) Software Engineering; 2) Artificial Intelligence; and 3) Information Security. Graduates of each specialization are expected to have respective additional learning outcomes.)

Công nghệ phần mềm (Software Engineering)

Sinh viên tốt nghiệp chuyên ngành Công nghệ phần mềm có những kiến thức và kỹ năng sau (The graduates of Software Engineering specialization will be able to):

- Thu thập và phân tích yêu cầu chi tiết của người dùng (Capture and analyze in detail user requirements).
- Thiết kế và cài đặt hệ thống phần mềm đáp ứng yêu cầu thực tế. (Design and develop a software system that meets the real requirements).
- Lập kế hoạch và ước lượng dự án phần mềm (Estimate and plan a software project).
- Lên kế hoạch kiểm thử và chạy kiểm thử, đảm bảo chất lượng phần mềm cũng như quản lý tài liệu dự án phần mềm. (Build a test plan, run a test plan and assure the quality as well as manage the documents of a software project).
- Áp dụng sáng tạo các tri thức học được vào giải quyết các bài toán trong lĩnh vực phát triển phần mềm. (Creatively apply the learned knowledge to resolve the main issues in the software development domain).

Trí tuệ nhân tạo (Artificial Intelligence)

Sinh viên tốt nghiệp chuyên ngành Trí tuệ nhân tạo có những kiến thức và kỹ năng sau (The graduates of Artificial Intelligence specialization will be able to):

- Tiến hành thu thập dữ liệu, các thông tin liên quan cho việc xây dựng các hệ thống thông minh (Enhance data collection procedures to include information that is relevant for building intelligent systems)
- Tiến hành tiền xử lý dữ liệu, làm sạch dữ liệu, và trực quan hóa dữ liệu (Conduct data preprocessing, data cleaning, and data visualization)
- Lựa chọn đặc trưng, xây dựng và tối ưu các mô hình phân tích dữ liệu sử dụng các kỹ thuật học máy (Select features, build, and optimize data analysis models using machine learning techniques)

- Lựa chọn các thuật toán học máy/khai phá dữ liệu phù hợp để xây dựng các hệ thống thông minh (Select suitable data mining/machine learning algorithms to build intelligent systems)
- Áp dụng các tri thức đã học để phát triển và giải quyết các vấn đề chính trong các dự án trí tuệ nhân tạo (Apply the learned knowledge to develop and resolve the main issues in artificial intelligence projects)

An toàn thông tin (Information Security)

Người tốt nghiệp chuyên ngành An toàn thông tin có những kiến thức và kỹ năng sau (The graduates of Information Security specialization will be able to):

- Áp dụng các kiến thức, kỹ năng để nhận biết, phân tích, giải quyết các vấn đề liên quan đến an toàn, bảo mật thông tin, hệ thống và mạng (Apply the learned knowledge to detect, analyze and resolve security issues of information, systems and networks);
- Thu thập, phân tích tìm hiểu và tổng hợp các yêu cầu về an ninh, bảo mật từ hệ thống thông tin để phục vụ công tác nghiên cứu, xây dựng và phát triển hệ thống an toàn, an ninh thông tin (Collect, analyze and aggregate security requirements of existing information systems in order to research and develop secure information systems);
- Thiết kế và triển khai các ứng dụng đảm bảo an toàn thông tin đáp ứng các yêu cầu kỹ thuật đặt ra trong điều kiện thực tế (Design and deploy information security applications to meet technical requirements in practice);
- Tìm kiếm, tiếp cận, ứng dụng hiệu quả và sáng tạo các kỹ thuật và công cụ hiện đại để giải quyết những vấn đề thực tế của lĩnh vực An toàn thông tin (Search, approach and apply efficiently and creatively modern techniques and tools to solve practical problems the information security field).

3. KHỐI LƯỢNG KIẾN THỨC TOÀN KHÓA: 153 tín chỉ (không bao gồm Giáo dục thể chất, Giáo dục quốc phòng và các môn kỹ năng mềm)

4. ĐỐI TƯỢNG TUYỂN SINH

Sinh viên trúng tuyển vào hệ đào tạo chất lượng cao công nghệ thông tin theo đề án tuyển sinh của Học viện Công nghệ Bưu chính Viễn thông hoặc sinh viên đã trúng tuyển đại học chính quy vào Học viện công nghệ Bưu chính Viễn thông các ngành Kỹ thuật (CNTT, ATTT, ĐTVT, Đ-ĐT) có nguyện vọng đăng ký theo học chương trình đào tạo ngành công nghệ thông tin chất lượng cao.

5. QUY TRÌNH ĐÀO TẠO, ĐIỀU KIỆN TỐT NGHIỆP

Quy trình đào tạo

Chương trình đào tạo được thực hiện trong 4,5 năm gồm 9 học kỳ, trong đó 8 học kỳ tích lũy kiến thức tại Học viện và 1 kỳ thực tập tại cơ sở thực tế và thực hiện đồ án tốt nghiệp. Khuyến khích sinh viên làm đồ án tốt nghiệp bằng tiếng Anh.

Sinh viên đào tạo theo học chế tín chỉ (Theo quy định đào tạo tín chỉ của Học viện)

Công nhận tốt nghiệp

Kết thúc khóa học, sinh viên được công nhận tốt nghiệp khi hội đủ các tiêu chuẩn theo Quy chế số 43/2007/QĐ-BGDĐT ngày 15 tháng 8 năm 2007 của Bộ trưởng Bộ Giáo dục và Đào tạo. Văn bằng tốt nghiệp được ghi là Kỹ sư CNTT hệ đào tạo chất lượng cao và Bảng điểm (song ngữ Việt – Anh)

6. THANG ĐIỂM: Theo thang điểm tín chỉ

7. NỘI DUNG CHƯƠNG TRÌNH

7.1. Cấu trúc chương trình

STT	Khối kiến thức	Số tín chỉ
1	Kiến thức chung	40
2	Kiến thức giáo dục chuyên nghiệp Trong đó: <u>Kiến thức cơ bản nhóm ngành</u> Trong đó: + Bắt buộc + Tự chọn <u>Kiến thức cơ sở ngành và ngành</u> Trong đó: + Bắt buộc + Tự chọn <u>Kiến thức chuyên ngành</u> Trong đó: + Bắt buộc + Tự chọn	93 19 19 53 53 21 12 9
4	Thực tập và tốt nghiệp	20 (12 và 8)
Tổng cộng		153

7.2. Nội dung khung chương trình

Các môn học được giảng dạy bằng Tiếng Anh

7.2.1. Kiến thức chung

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	Triết học Mác-Lênin	BAS1150	3						Theo

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
2	Kinh tế chính trị Mác-Lênin	BAS1151	2						quy định mới
3	Tư tưởng Hồ Chí Minh	BAS1122	2	24	6				
4	Lịch sử Đảng cộng sản Việt Nam	BAS1153	2						
5	Chủ nghĩa xã hội Mác-Lênin	BAS1152	2						
6	Nhập môn tin học và lập trình (Introduction to Computing and Programming)	INT11117_CLC	3	30	8	7			
7	Tiếng Anh (Course 1)_CLC	BAS1162_CLC	8						Kế hoạch riêng
8	Tiếng Anh (Course 2)_CLC	BAS1163_CLC	8						
9	Tiếng Anh (Course 3)_CLC	BAS1164_CLC	8						
13	Phương pháp luận nghiên cứu khoa học (Scientific Research Methodologies)	SKD1108	2	18	6		6		
	Tổng cộng		40						
Giáo dục thể chất và giáo dục quốc phòng (*)									
1	Giáo dục thể chất 1 Physical Education 1	BAS1106	2	2		26	2		Kế hoạch riêng
2	Giáo dục thể chất 2 Physical Education 2	BAS1107	2	2		26	2		
3	Giáo dục Quốc phòng Military Education	BAS1105	7,5						
Kiến thức các môn kỹ năng (*)									
1	Kỹ năng tạo lập văn bản Document-writing skills	SKD1103	1	6	8		1		Kế hoạch riêng
2	Kỹ năng thuyết trình Presentation skills	SKD1101	1	6	8		1		
3	Kỹ năng làm việc nhóm Teamwork skills	SKD1102	1	6	8		1		

7.2.2. Kiến thức giáo dục chuyên nghiệp

7.2.2.1. Kiến thức cơ bản nhóm ngành

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	<i>Calculus 1</i> (Giải tích 1)	BAS1203_CLC	3	36	8		1		
2	<i>Calculus 2</i> (Giải tích 2)	BAS1204_CLC	3	36	8		1		

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
3	Algebra (Đại số)	BAS1201_CLC	3	36	8		1		
4	Physics 1 (Vật lý 1 và thí nghiệm)	BAS1224_CLC	4	42	6	8	4		
5	Physics 3 (Vật lý 3 và thí nghiệm)	BAS1227_CLC	4	36	8	4	12		
6	Probability and Statistics (Xác suất thống kê)	BAS1226_CLC	2	24	6				
	Tổng cộng		19						

7.2.2.2. Kiến thức cơ sở ngành và ngành

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	Digital Electronics (Điện tử số)	ELE1309_CLC	3	32	8	4	1		
2	Microprocessors (Vi xử lý)	INT1330_CLC	3	36	8		1		
3	Discrete Mathematics 1 (Toán rời rạc 1)	INT1358_CLC	3	36	8		1		
4	Discrete Mathematics 2 (Toán rời rạc 2)	INT1359_CLC	3	36	8		1		
5	Programming with C++ (Ngôn ngữ lập trình C++)	INT1339_CLC	3	30	8	7			
6	Data Structures and Algorithms (Cấu trúc dữ liệu và giải thuật)	INT1306_CLC	3	30	8	7			
7	Databases (Cơ sở dữ liệu)	INT1313_CLC	3	32	9	4			
8	Distributed Databases (Cơ sở dữ liệu phân tán)	INT1414_CLC	2	24	6				
9	Computer Architecture (Kiến trúc máy tính)	INT1323_CLC	3	30	15				
10	Operating Systems (Hệ điều hành)	INT1319_CLC	3	34	10		1		
11	Object-Oriented Programming (Lập trình hướng đối tượng)	INT1332_CLC	3	30	8	7			
12	Computer Networks (Mạng máy tính)	INT1336_CLC	3	36	5	4			
13	Introduction to Software Engineering (Nhập môn công nghệ phần mềm)	INT1340_CLC	3	36	8		1		

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
14	Introduction to Artificial Intelligence (Nhập môn trí tuệ nhân tạo)	INT1341_CLC	3	32	12		1		
15	Analysis and Design of Information Systems (Phân tích và thiết kế hệ thống thông tin)	INT1342_CLC	3	36	8		1		
16	Web Programming (Lập trình Web)	INT1434_CLC	3	30	9	6			
17	Fundamentals of Information Security (Cơ sở an toàn thông tin)	INT1472_CLC	3	30	8	7			
18	Mobile Application Development (Phát triển ứng dụng cho các thiết bị di động)	INT1449_CLC	3	30	8	7			
	Tổng cộng		53						

7.2.2.3. Kiến thức chuyên ngành

Chuyên ngành Công nghệ phần mềm

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	Software Project Management (Quản lý dự án phần mềm)	INT1450_CLC	3	36	9				
2	Network Programming (Lập trình mạng)	INT1433_CLC	3	30	8	7			
3	Software Architecture and Design (Kiến trúc và thiết kế phần mềm)	INT1427_CLC	3	36	8		1		
4	Software Quality Assurance (Đảm bảo chất lượng phần mềm)	INT1416_CLC	3	36	8		1		
Môn học tự chọn (chọn 3/5) Elective Courses (select 3/5)									
5	Service-oriented Software Development (Phát triển phần mềm hướng dịch vụ)	INT1448_CLC	3	36	8		1		
6	Distributed Systems (Các hệ thống phân tán)	INT1405_CLC	3	36	9				
7	Human - Computer Interaction (Tương tác người máy)	INT1460_CLC	3	36	8		1		
8	Embedded System Development (Xây dựng các hệ thống nhúng)	INT1461_CLC	3	32	8	4	1		

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
	nhúng)								
9	Secure Software Development (Phát triển phần mềm an toàn)	INT1463_CLC	3	34	6	5			
Học phần thay thế tốt nghiệp (Graduation module)									
10	Software engineering graduation module 1 (Học phần thay thế tốt nghiệp 1 ngành CNPM)	INT14139_CLC	4	20	30	10			
11	Software engineering graduation module 2 (Học phần thay thế tốt nghiệp 2 ngành CNPM)	INT14140_CLC	4	20	40				
	Tổng cộng		21						

Chuyên ngành Trí tuệ nhân tạo

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	Python Programming (Lập trình Python)	INT14119_CLC	3	32	12		1		
2	Introduction to Data Science (Nhập môn Khoa học dữ liệu)	INT14120_CLC	3	32	12		1		
3	Machine Learning (Học máy)	INT14121_CLC	3	32	12		1		
4	Introduction to Deep Learning (Nhập môn học sâu)	INT14122_CLC	3	32	8	4	1		
Môn học tự chọn (chọn 3/5) Optional Courses (select 3/5)									
5	Image Processing (Xử lý ảnh)	INT14123_CLC	3	32	8	4	1		
6	Natural Language Processing (Xử lý ngôn ngữ tự nhiên)	INT14124_CLC	3	32	12		1		
7	Information Retrieval (Truy xuất thông tin)	INT14125_CLC	3	34	10		1		
8	Mining Massive Data Sets (Khai phá dữ liệu lớn)	INT14126_CLC	3	32	8	4	1		
9	Text Mining and Analytics (Phân tích và khai phá dữ liệu văn bản)	INT14127_CLC	3	32	12		1		
Học phần thay thế tốt nghiệp (Graduation module)									
10	Artificial Intelligence graduation module 1 (Học phần thay thế tốt nghiệp 1	INT14141_CLC	4	34	26				

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
	ngành TTNT)								
11	Artificial Intelligence graduation module 2 (Học phần thay thế tốt nghiệp 2 ngành TTNT)	INT14142_CLC	4	40	16	4			
	Tổng cộng		21						

Chuyên ngành An toàn thông tin

TT	Tên môn học	Mã số môn học	Số tín chỉ	Lên lớp (tiết)		Thí nghiệm /Thực hành (tiết)	Tự học (tiết)	Mã số môn học tiên quyết	Ghi chú
				Lý thuyết	Bài tập				
1	Mật mã học cơ sở (Introduction to Cryptography)	INT1344_CLC	3	30	8	7			
2	An toàn mạng (Network Security)	INT1482_CLC	3	30	8	7			
3	An toàn ứng dụng web và CSDL (Web and Database security)	INT14105_CLC	3	30	8	7			
4	Hệ điều hành Windows và Linux/Unix (Windows and Linux/Unix Administration)	INT1487_CLC	3	30	8	7			
Môn học tự chọn (chọn 3/5) Optional Courses (select 3/5)									
5	Kiểm thử xâm nhập (Penetration Testing)	INT14107_CLC	3	30	8	7			
6	Quản lý an toàn thông tin (Management of Information Security)	INT14106_CLC	3	32	8	5			
7	Lập trình Python (Programming with Python)	INT14119_CLC	3	32	12		1		
8	Học máy (Machine Learning)	INT14121_CLC	3	32	12		1		
9	An toàn mạng nâng cao (Advanced Network Security)	INT1483_CLC	3	30	8	7			
Học phần thay thế tốt nghiệp (Graduation module)									
10	Information security graduation module 1 (Học phần thay thế tốt nghiệp 1 ngành ATTT)	INT14143_CLC	4	20	40				
11	Information security graduation module 2 (Học phần thay thế tốt nghiệp 2 ngành ATTT)	INT14144_CLC	4	20	40				
	Tổng cộng		21						

7.2.4. Thực tập và Đồ án tốt nghiệp : 20 (12 và 8)

Thực tập cơ sở: 4

Thực tập tốt nghiệp: 8

Đồ án tốt nghiệp/học phần thay thế tốt nghiệp: 8
Khuyến cáo viết và bảo vệ đồ án tốt nghiệp bằng tiếng Anh.

8. TIẾN TRÌNH HỌC TẬP (*Chi tiết kèm theo*)

Ghi chú:

(*) : Các môn học không tính điểm trung bình về kết quả học tập chung

**KT.GIÁM ĐỐC
PHÓ GIÁM ĐỐC**

TS. Vũ Tuấn Lâm

LEARNING PROGRESS

No	Subject	Subject Id	credit	Year									Pre subject id
				1		2		3		4		5	
				s1	s2	s3	s4	s5	s6	s7	s8	s9	
1	Nhập môn tin học và lập trình (<i>Introduction to Computing and Programming</i>)		3	1									
2	Algebra (Đại số)		3	1									
3	Calculus 1 (Giải tích 1)		3	1									
4	Tiếng Anh		4	1									
5	Tiếng Anh		4	1									
6	Physics 1 (Vật lý 1 và thí nghiệm)		4		2								
7	Tiếng Anh		4		2								
8	Tiếng Anh		4		2								
9	Calculus 2 (Giải tích 2)		3		2								
10	Programming with C++ (Ngôn ngữ lập trình C++)		3		2								
11	Physics 3 (Vật lý 3 và thí nghiệm)		4			3							
12	Tiếng Anh		4			3							
13	Tiếng Anh		4			3							
14	Discrete Mathematics 1 (Toán rời rạc 1)		3			3							
15	Digital Electronics (Điện tử số)		3			3							
16	Scientific Research Methodology (Phương pháp luận nghiên cứu khoa học)		2				4						
17	Probability and Statistics (Xác suất thống kê)		2				4						
18	Data Structures and Algorithms (Cấu trúc dữ liệu và giải thuật)		3				4						
19	Triết học Mác-Lênin		3				4						
20	Discrete Mathematics 2 (Toán rời rạc 2)		3				4						

No	Subject	Subject Id	credit	Year									Pre subject id
				1		2		3		4		5	
				s1	s2	s3	s4	s5	s6	s7	s8	s9	
21	Computer Architecture (Kiến trúc máy tính)		3				4						
22	Microprocessors (Vi xử lý)		3					5					
23	Kinh tế chính trị Mác-Lênin		2					5					
24	Object-Oriented Programming (Lập trình hướng đối tượng)		3					5					
25	Databases (Cơ sở dữ liệu)		3					5					
26	Operating Systems (Hệ điều hành)		3					5					
27	Computer Networks (Mạng máy tính)		3					5					
28	Đường lối cách mạng Hồ Chí Minh		2						6				
29	Introduction to Artificial Intelligence (Nhập môn trí tuệ nhân tạo)		3						6				
30	Distributed Databases (Cơ sở dữ liệu phân tán)		2						6				
31	Introduction to Software Engineering (Nhập môn công nghệ phần mềm)		3						6				
32	Cơ sở an toàn thông tin (Fundamentals of information security)		3						6				
33	Web Programming (Lập trình Web)		3						6				
34	Analysis and Design of Information Systems (Phân tích và thiết kế hệ thống thông tin)		3							7			
35	Lịch sử Đảng cộng sản Việt Nam		2							7			
36	Mobile Application Development (Phát triển ứng dụng cho các thiết bị di động)		3							7			
37	Thực tập cơ sở		4							7			
38	Chủ nghĩa xã hội Mác-Lênin		2								8		
Software Engineering													
39	Software Project Management (Quản lý dự án phần mềm)		3							7			
40	Network Programming (Lập trình mạng)		3							7			

No	Subject	Subject Id	credit	Year									Pre subject id
				1		2		3		4		5	
				s1	s2	s3	s4	s5	s6	s7	s8	s9	
41	Software Architecture and Design (Kiến trúc và thiết kế phần mềm)		3								8		
42	Software Quality Assurance (Đảm bảo chất lượng phần mềm)		3								8		
43	Tự chọn CNPM1		3								8		
44	Tự chọn CNPM2		3								8		
45	Tự chọn CNPM3		3								8		
Artificial Intelligence													
39	Python Programming (Lập trình Python)		3							7			
40	Introduction to Data Science (Nhập môn Khoa học dữ liệu)		3							7			
41	Machine Learning (Học máy)		3								8		
42	Introduction to Deep Learning (Nhập môn học sâu)		3								8		
43	Tự chọn TTNT1		3								8		
44	Tự chọn TTNT2		3								8		
45	Tự chọn TTNT3		3								8		
39	Mật mã học cơ sở (Introduction to cryptography)		3							7			
40	Hệ điều hành Windows và Linux/Unix (Windows and Linux/Unix Administration)		3							7			
41	An toàn ứng dụng web và CSDL (Web and database security)		3								8		
42	An toàn mạng (Network security)		3								8		
43	Tự chọn ATTT1		3								8		
44	Tự chọn ATTT2		3								8		
45	Tự chọn ATTT3		3								8		
On the job training and Graduation thesis													
46	Thực tập tốt nghiệp		8									9	
47	Đồ án tốt nghiệp/Học phần thay thế tốt nghiệp		8									9	
Total				16	17	17	16	17	16	18	17	16	

CALCULUS 1

Course Syllabus

1. General Information

Course name: Calculus 1

Course code: BAS1203

Number of credits: 3

2. Objectives

- Knowledge:

- Equip students with basic knowledge of the differential and integral calculus of functions of one variable as a basis for further learning Calculus 2, Physics, Probability and Statistics, Engineering mathematics and other subjects.
- Including the main contents as follows: Real numbers, complex numbers, the limit of sequences and functions, the continuity of functions, differential and integral calculus, series of numbers, series of functions, power series and Fourier series.

- Skills:

- Critical thinking and analytical thinking.
- Skills of the differential calculation of one variable such as finding the limit of a sequence of numbers (or the convergence of iteration sequences in optimization algorithms), of functions, finding the derivative and integral of one variable, applying derivatives and integrals, computing series of numbers, series of functions, power series, Fourier series and the convergent domain of power series.
- Applying analytical tools to their professional issues.

- Attitude:

- Prepare lessons seriously before going to class, listen to lectures actively in class, practice above skills consciously.
- Complete exercises, midterm tests, and assignments.

3. Abstract

Provide students with basic knowledge about the set of numbers, sequences of numbers, functions, the differential and integral calculus of functions of one variable and the theory of series.

4. Teaching and learning methods

Lectures: 34h

Classroom guidance: 8h

Class discussion: 00h

Midterm test: 02h

Group activities: 00h

Self-study: 01h

5. Prerequisites

Elementary mathematics

6. Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Understand the differential and integral calculus of functions;
2. Use calculus tools to solve problems.

7. Assessment Criteria

Learning outcomes Upon successful completion of the course, a learner will	Assessment criteria for pass
LO1: Understand the differential and integral calculus of functions	- Real numbers, complex numbers - the limit of sequences and functions, the continuity of functions, differential and integral calculus, - series of numbers, series of functions, power series and Fourier series.
LO2: Use calculus 1 tools to solve problems	- computing series of numbers, series of functions, power series, Fourier series and the convergent domain of power series. - finding the derivative and integral of one variable - applying derivatives and integrals.

8. Outlines

Chapter 1 The limit and continuity of functions of one variable

- 1.1. The set of real and complex numbers
- 1.2. Definition of functions of one variable, function composition, inverse functions, elementary functions.
- 1.3. Definition of the limit, properties of the limit, operations of the limit.
- 1.4. Infinitesimal calculus
- 1.5. Indeterminate form
- 1.6. Continuous functions: Definition and properties

Chapter 2 Differential calculus of functions of one variable

- 2.1 Concept of derivative.
 - 2.1.1 Definition of derivative. The mechanical and geometrical meaning of derivative
 - 2.1.2 Derivative of elementary functions

- 2.1.3 Basic derivative rules
- 2.2 Concept of differentiation. Use the differential to approximate the value of functions
- 2.3 Higher-order derivatives and differentiations. Leibniz's formula
- 2.4 Mean value theorems
 - 2.4.1 Rolle's theorem
 - 2.4.2 Lagrange's theorem
 - 2.4.3 Cauchy's theorem
- 2.5 Taylor's formula. Maclaurin's formula
- 2.6 Applications of derivative
 - 2.6.1 L'Hospital's rule
 - 2.6.2 Extreme value of functions

Chapter 3 Integral calculus of functions of one variable

- 3.1. Indefinite integrals
 - 3.1.1. Antiderivative of elementary functions
 - 3.1.2. Integration by parts and change of variables
 - 3.1.3. Integration of rational functions and some related integrals
- 3.2. Definite integral
 - 3.2.1. Definition of definite integrals and integrability conditions.
 - 3.2.2. The basic properties of definite integrals
 - 3.2.3. Newton-Leibniz's formula
 - 3.2.4. Determining integral calculus.
- 3.3 Applications of definite integrals
 - 3.3.1 Application in finding areas
 - 3.3.2 Application in finding volumes
 - 3.3.3 Application in finding arc length
 - 3.3.4 Application in finding the surface area of a surface of revolution.
- 3.4 Improper integrals
 - 3.4.1 Type 1
 - 3.4.2 Type 2

Chapter 4 Series theory

- 4.1 Series of number.
 - 4.1.1. Necessary and sufficient conditions of convergence
 - 4.1.2 Positive sequence. Convergent criteria: Comparative criterion, D'Alembert's criterion, Cauchy's criterion, integration criterion.
 - 4.1.3 Alternating series. Leibniz's criterion.
 - 4.1.4 Absolute and conditional convergence
- 4.2 Power series. Taylor's series. MacLaurin's series
- 4.3 Fourier series.

9. Required textbooks

[1] P.N. Anh, *Lectures on Analysis 1*; Posts and Telecommunications institute of Technology, 2009.

10. Suggested textbooks

[2] N.D. Tri et al., *Advanced mathematics 2*, Vietnam Education Publishing House, 1996.

[3] N.D. Tri et al., *Exercises in advanced mathematics*, Vietnam Education Publishing House, 1997.

[4] N. D. Tri et al., *Advanced mathematics 1*, Vietnam Education Publishing House, 2003.

[5] D. Trim; *Calculus for engineers*, Springer, 2001.

[6] J. Stewart; *Mathematical analysis*, (2006a) Cambridge: Cambridge University Press.

11. Grading policy:

- Attendance: 10%
- Exercise: 10%
- Mid-term test: 10%
- Final examination: 70%

Lecturer

Head of Department of Mathematics

Assoc. Prof. Dr. Pham Ngoc Anh

Assoc. Prof. Dr. Pham Ngoc Anh

CALCULUS 2

Course Syllabus

1. General Information

Course name: Calculus 2

Course code: BAS1203

Number of credits: 3

2. Objectives of the subject

- Knowledge:

- Equip students with basic knowledge of the differential and integral calculus of functions of several variables as a basis for further learning Calculus 2, Physics, Probability and Statistics, Engineering math and other subjects.
- Including the main contents as follows:

- Differential calculus of functions of several variables.

- Integral calculus of functions of several variables: Integrals depend on parameters, double integrals, multiple integrals, line integrals, surface integrals.

- Differential equations and systems of differential equations.

- Skills:

- Critical thinking and analytical thinking.
- Skills of the differential and integral calculus of functions of several variables:

- Finding the differential and integral calculus of functions of several variables.

- Applying derivatives and integrals

- Computing line integral, surface integral,

- Solving first-order and second-order differential and systems of differential equations.

- Attitude:

- Prepare lessons seriously before going to class, listen to lectures actively in class, practice above skills consciously.
- Complete exercises, midterm tests, and assignments.

3. Abstract

Provide students with basic knowledge about differential and integral calculus of functions of several variables, integral depends on parameters, double integrals, multiple integrals, line integrals, surface integrals, differential equations and systems of differential equations

4. Teaching and learning methods

Lectures: 34h

Classroom guidance: 8h

Class discussion: 00h

Midterm test: 02h

Group activities: 00h

Self-study: 01h

5. Prerequisites

Elementary mathematics

6. Learning Outcomes

Upon successful completion of the course, students will be able to:

1. Understand the differential and integral calculus of functions of several variables;
2. Use calculus 2 tools to solve problems;

7. Assessment Criteria

Learning outcomes Upon successful completion of the course, a learner will	Assessment criteria for pass
LO1: Understand the differential and integral calculus of functions	- Differential calculus of functions of several variables. - Integral calculus of functions of several variables: Integrals depend on parameters, double integrals, multiple integrals, line integrals, surface integrals. - Differential equations and systems of differential equations.
LO2: Use calculus 2 tools to solve problems	- Finding the differential and integral calculus of functions of several variables. - Computing line integral, surface integral, - Solving first-order and second-order differential and systems of differential equations. - Applying derivatives and integrals

8. Outlines

Chapter 1 Differential calculus of functions of several variables

1.1 Space $\mathbb{R}^n$, concept of distance, neighborhood, domain

1.2 Limits and continuity of functions of several variables

1.2.1 Concept of functions of several variables, domain of a function, graphs of function of two variables.

1.2.2 The Limits of functions of several variables

1.2.3 The continuity of functions of several variables

1.3 Partial derivatives and total differentials of functions of several variables

1.3.1. Partial derivatives and total differentials

1.3.2. Total differentials and higher-order differentials

- 1.3.3. Partial derivatives and differential of function composition
- 1.3.4 Partial derivatives of the implicit function
- 1.3.5. Directional derivatives and the Gradient vector
- 1.4 Extremum, maximum and minimum values of functions of several variables
 - 1.4.1 Taylor's formula of functions of several variables
 - 1.4.2 Unconstrained extrema of functions of several variables
 - 1.4.3 Constrained extrema of functions of several variables
 - 1.4.4 Maximum and minimum values of functions of several variables
- 1.5 Scalar fields, vector fields, Rôta, Dive

Chapter 2: Multiple integrals

- 2.1 Integrals depend on parameters
 - 2.1.1 Definite integrals depend on parameters
 - 2.1.2 Improper integrals depend on parameters
- 2.2 Double integrals
 - 2.2.1 Definition of double integrals
 - 2.2.2 Properties of double integrals
 - 2.2.3 Methods for calculating double integrals
 - 2.2.4 Change of variables in double integrals, double integrals in polar coordinates
- 2.3 Triple integrals
 - 2.2.1 Definition of triple integrals
 - 2.2.2 Properties of triple integrals
 - 2.2.3 Methods for calculating triple integrals
 - 2.2.4 Change of variables in triple integrals, triple integrals in cylindrical and spherical coordinates
- 2.4 Applications of multiple integrals

Chapter 3: Line integrals and surface integrals

- 3.1 Line integral of a scalar field
 - 3.1.1 Definition of line integral of a scalar field
 - 3.1.2 Methods for calculating of line integral of a scalar field
- 3.2 Line Integral of a vector field
 - 3.2.1 Definition of line integral of a vector field
 - 3.2.2 Methods for calculating of line integral of a vector field
- 3.3 Green's Formula and equivalent conditions
- 3.4 Surface integral of a scalar field
 - 3.4.1 Definition of surface integral of a scalar field
 - 3.4.2 Methods for calculating of surface integral of a scalar field
- 3.5 Surface integral type 2

3.5.1 Oriented surface

3.5.2 Definition of surface integral of a scalar field

3.5.3 Methods for calculating of surface integral of a scalar field

3.6 Stokes's formula, Ostrogradsky's formula

Chapter 4: Differential equations and systems of differential equations

4.1 Concept of differential equations

4.1.1 Definition of differential equations

4.1.2. Solution of differential equations

4.2 First-order differential equations

4.2.1 Definition of first-order differential equations and Cauchy-Peano existence theorem

4.2.2 Separable differential equations

4.2.3 Linear differential equations

4.2.4 Bernoulli's equation

4.2.5 Total differential equations

4.3 Second-order differential equations

4.3.1 Definition of second-order differential equations

4.3.2 Linear differential equations

4.3.3 Linear equation with constant coefficients

4.4 Systems of differential equations

4.4.1 Definition of systems of differential equations

4.4.2 Methods for solving systems of differential equations

4.4.3 Systems of differential equations with constant coefficients

9. Required Textbooks

[1] Pham Ngoc Anh, *Lectures on Analysis 2*; Posts and Telecommunications institute of Technology, 2009.

10. Suggested Textbooks

[1] N.D. Tri et al., *Advanced mathematics 3*, Vietnam Education Publishing House, 1996.

[2] N.D. Tri et al., *Exercises in advanced mathematics 3*, Vietnam Education Publishing House, 1997.

[3] D. Trim, *Calculus for engineers*, Springer, 2001.

[4] J. Stewart, *Mathematical analysis*, (2006b) Cambridge: Cambridge University Press.

11. Grading policy:

- Attendance: 10%

- Exercise: 10%

- Mid-term test: 10%

- Final examination: 70%

Lecturer

Head of Department of Mathematics

Assoc. Prof. Dr. Pham Ngoc Anh

Assoc. Prof. Dr. Pham Ngoc Anh

ALGEBRA

Course Syllabus

1. General Information

Course name: Algebra

Course code: BAS1201

Number of credits: 3

2. Objectives

Algebra provides students with the techniques and methods of linear algebra as follows:

- **Knowledge:**

- Formal logic;
- Modern mathematical languages: The set theory, mappings;
- Boolean algebra;
- Methods of linear algebra.

- **Skills:**

- Critical and analytical thinking;
- Computational skills of linear algebra: Determinants, matrix operations, solving systems of linear equations, diagonalization of matrices, Gram-Schmidt process,...
- Using algebraic tools to study specific problems.

- **Attitude:**

- Prepare lessons before class and pay attention to lectures;
- Doing homework, midterm tests, assignments.

3. Abstract

- Provide students with the mathematical logic and help students to get critical and analytical thinking;
- Overview of Boolean algebra, a structure is used in Electronics and Telecommunications and Information technology;
- Provide students with methods of linear algebra: Vector spaces, matrices, determinant, systems of linear equations, linear transformations, scalar products, Euclidean spaces and quadratic forms. They help learners to solve problems of linear models in Electronics and Telecommunications and Information technology.

4. Teaching and learning methods

Lectures: 36h

Project & practice: 8h

Self-study: 1h

5. Prerequisites

Elementary mathematics, high school algebra.

6. Learning Outcomes

On successful completion of the course, students will be able to:

1. Understand the basic terms in Boolean and linear algebra;
2. Use algebraic tools to solve problems;
3. Apply methods of linear algebra to problems of linear models in Electronics and Telecommunications and Information Technology.

7. Assessment Criteria

Learning outcomes On successful completion of the course, a learner will	Assessment criteria for pass
LO1: Understand the basic terms in Boolean and linear algebra	- Boolean algebra - Switching circuit design - Vector spaces, matrix operations, determinants, systems of linear equations - Euclidean spaces, Gram-Schmidt process, quadratic forms
LO2: Use algebraic tools to solve problems	- Solve problems of switching circuits - Solve problems by systems of linear equations
LO3: Apply methods of linear algebra to problems of linear models in Electronics and Telecommunications and Information technology	- Analyse problems - Analyse mathematical models - Analyse linear models - Critical and analytical thinking - Solving problems

8. Outlines

Chapter 1: Survey on propositional logic, sets, mappings and Boolean algebra

1.1 Propositional logic

1.1.1 Notion of proposition

1.1.2 Logical connectives

1.2 Sets

1.2.1 Notion of set, descriptions. Sets of numbers

1.2.2 Subsets. Operations of sets

1.2.3 Universal quantifier, existential quantifier. Extended union and intersection

1.2.4 Cartesian product

1.3 Mappings

1.3.1 Definition of mapping, classification of mappings

1.3.2 Inverse mappings. Composition of mappings

1.4 Boolean algebra and applications

- 1.4.1 Definition and basic properties of Boolean algebra
- 1.4.2 Boolean formulas, Boolean functions and duality principle
- 1.4.3 Methods generating Boolean functions with given values
- 1.4.4 Applications of Boolean algebras to switching circuits

Chapter 2: Vector spaces

- 2.1 Introduction to vector spaces
- 2.2 Subspace
 - 2.2.1 Definition, examples, properties
 - 2.2.2 Subspace spanned by a set of vectors
 - 2.2.3 Sum of subspaces. Direct sum
- 2.3 Linear dependence, linear independence
- 2.4 Maximal linearly independent set of vectors. Rank of a set of vectors
- 2.5 Basis and dimension of a vector space. Coordinates of a vector

Chapter 3: Matrices and determinants

- 3.1 Matrices
- 3.2 Matrix operations
 - 3.2.1 Sum of matrices
 - 3.2.2 Scalar multiplication
 - 3.2.3 Matrix multiplication
 - 3.2.4 Matrix polynomials
 - 3.2.5 Transpose of a matrix
- 3.3 Matrix of a set of vectors
 - 3.3.1 Matrix of a set of vectors in a given basis
 - 3.3.2 Change of basis matrix
 - 3.3.3 Change of coordinates
- 3.4 Rank of a matrix
 - 3.4.1 Definition and computation of rank of a matrix by elimination
 - 3.4.2 Matrices correspond to eliminations
- 3.5 Definition of determinant
- 3.6 Computation of determinants
- 3.7 Applications of determinant

Chapter 4: Systems of linear equations

- 4.1 Systems of linear equations
 - 4.1.1 General form
 - 4.1.2 Matrix form
 - 4.1.3 Vector form

- 4.2 Theorem of existence of solutions
- 4.3 Some methods of solving linear systems
 - 4.3.1 Cramer's method
 - 4.3.2 Inverse matrix method
 - 4.3.3 Gaussian elimination
- 4.4 Homogeneous linear systems
 - 4.4.1 Set of solutions of homogeneous linear systems
 - 4.4.2 The relation between the set of solutions of general linear system and respective homogeneous linear system

Chapter 5: Linear transformations

- 5.1 Notion and properties of linear transformations
- 5.2 Kernel and image of a linear transformation. Rank of linear transformations
- 5.3 Surjective, injective and isomorphism
- 5.4 Matrix of linear transformation
- 5.5 Coordinates formula of linear transformation. The relation between linear transformation and linear system
- 5.6 Diagonalization
 - 5.6.1 Eigenvalues. Eigenvectors. Eigenspaces
 - 5.6.2 Characteristic polynomials
 - 5.6.3 Diagonalizable condition of endomorphisms and matrices
 - 5.6.4 Diagonalization algorithm

Chapter 6: Quadratic forms. Euclidean spaces

- 6.1 Bilinear forms
 - 6.1.1 Definition of bilinear forms
 - 6.1.2 Matrix and coordinates of a bilinear form
 - 6.1.3 Coordinates of the bilinear form in other basis
- 6.2 Quadratic forms
 - 6.2.1 Definition of quadratic form. Polar form of the quadratic form
 - 6.2.2 Matrix and coordinates of a quadratic form
 - 6.2.3 Expression of coordinates of canonical forms of a quadratic form
 - 6.2.4 Lagrange's method
 - 6.2.5 Jacobi's method
 - 6.2.6 Sylvester's law of inertia
- 6.3 Inner product. Euclidean space
 - 6.3.1 Definition of inner product and properties
 - 6.3.2 Orthogonal. Gram-Schmidt
 - 6.3.3 Orthonormal basis
- 6.4 Orthogonal matrices. Orthogonal diagonalization matrices

6.4.1 Orthogonal matrices

6.4.2 Orthogonal diagonalization algorithm

6.4.3 Change coordinates of quadratic forms to canonical forms by orthogonal diagonalization

9. Required Textbooks

1. L. B. Long, *Algebra*, Information and Telecommunications Publishing House, 2008 (Vietnamese).

2. D. P. Nga, *Lectures on Algebra*, Posts and Telecommunications Institute of Technology, 2010.

10. Suggested Textbooks

1. N. D. Tri et al., *Advanced Mathematics*, Vol. 1, Vietnam Education Publishing House, 1996.

2. J. P. Monier, *Algebra*, Vol. 1 and 2, Vietnam Education Publishing House, 2000.

3. S. Lipschutz, M. Lipson, *Theory and problems of Linear Algebra*, Schaum's Outline Series, Mc Graw-Hill, 2009.

4. D. Lay, *Linear algebra and Its applications*, Addison-Wesley, 2012.

5. G. Strang, *Introduction to linear algebra*, Wellesley-Cambridge Press, 2009.

11. Grading Policy

Attendance:	10%
Average of mini midterm tests:	10%
Assignments:	10%
Final exam:	70%

Lecturer

Head of Department of Mathematics

Assoc. Prof. Dr. Le Ba Long

Assoc. Prof. Dr. Pham Ngoc Anh

Probability THEORY& statistics

Course Syllabus

1. General Information

Course name: Probability Theory & Statistics

Course code: BAS1226

Number of credits: 2

2. Objectives

- **Knowledge:** Providing students with the background necessary to understand probability theory and mathematical statistics. Helping students to obtain methods and tools to study, research and solve problems in the fields of electronics, telecommunications and information technology, including the following topics:

- Probability Theory: Random experiments, events, probability of events, random variables, multiple random variables, the characteristics of random variables and multiple random variables,...
- Statistics: Sampling theory, estimation theory and hypothesis testing.

- **Skills:** Students can apply mathematical tools from probability theory and statistics to study related problems in electronics, telecommunications & information technology, specifically:

- Applying probability theory and statistics to study other subjects.
- Applying probability theory and statistics to solve practical problems of electronics, telecommunications & information technology.

- **Attitude:**

- Make the effort to the lessons and prepare for these ones before attending class.
- Complete all homeworks and assignments.

3. Abstract

The course has two parts that are relatively independent in structure but closely related in contents:

- Probability theory: Studying the rules of random phenomena: events, probability of events, random variables, multiple random variables, the characteristics of random variables and multiple random variables, the law of large numbers and the central limit theorem.
- Statistics: Sampling theory, estimation theory and hypothesis testing.

4. Teaching and learning methods

Lectures: 24 h

Project & practice: 6 h

Individual reading: 0 h

5. Prerequisites

Calculus 1&Calculus 2

6. Learning Outcomes

On successful completion of the course, students will be able to:

1. understand the basic terms in probability theory and statistics;
2. obtain methods and tools to study, research and solve problems in the fields of electronics, telecommunications and information technology;
3. apply mathematical tools from probability theory and statistics to study related problems in electronics, telecommunications & information technology.

7. Assessment Criteria

Learning outcomes Upon successful completion of the course, a learner will	Assessment criteria for pass
LO1: Understand the basic terminology in probability theory and statistics.	- Basic probability concepts - Random variables, multiple random variables - Discrete, continuous probability distributions - Convergence in probability and convergence in distribution - Law of large numbers, the central limit theorem - Point estimation, interval estimation - Hypothesis testing
LO2: Apply mathematical tools from probability theory and statistics to study related problems in electronics, telecommunications and information technology.	- Analyse practical problems - Analyse mathematical models - Critical and analytical thinking - Solving practical problems

8. Outlines

Chapter 1: Events and the notion of probability

- 1.1. Sample space and events
- 1.2. Basic probability concepts and rules of probability
- 1.3. Joint and conditional probabilities
- 1.4. Total probability theorem and Bayes' rule
- 1.5. Independent events
- 1.6. Bernoulli trials

Chapter 2: Random variables

- 2.1. Concept of random variables and probability distribution functions
- 2.2. Discrete random variables and probability mass functions
- 2.3. Continuous random variables and probability density functions
- 2.4. The characteristics of random variables: Expectation, variance and standard deviation
- 2.5. Some probability distributions
 - 2.5.1. Bernoulli distribution
 - 2.5.2. Binomial distribution
 - 2.5.3. Poisson distribution
 - 2.5.4. Uniform distribution
 - 2.5.5. Exponential distribution
 - 2.5.6. Normal (or Gaussian) distribution

Chapter 3: Multiple random variables

- 3.1. Concept of multiple random variables, joint distribution functions, marginal distribution functions
- 3.2. Multiple discrete random variables
 - 3.2.1. Joint probability mass functions
 - 3.2.2. Marginal probability mass functions
- 3.3. Multiple continuous random variables
 - 3.3.1. Joint probability density functions
 - 3.3.2. Marginal probability density functions
- 3.4. Independent random variables
- 3.5. The characteristics of multiple random variables
 - 3.5.1. Expectation and variance
 - 3.5.2. Covariance and correlation coefficient
- 3.6. Conditional distributions, conditional probability mass functions, conditional probability density functions, conditional expectation and conditional variance
- 3.7. The law of large numbers and the central limit theorem

Chapter 4: Sampling theory

- 4.1. On the necessity of sampling
- 4.2. Random sampling
 - 4.2.1. Concept of random sampling
 - 4.2.2. Random sampling model
 - 4.2.3. Representation the experimental value of the random sampling by table and chart
- 4.3. Statistics and characteristic statistics of random sampling
 - 4.3.1. Concept of statistics
 - 4.3.2. Sample mean
 - 4.3.3. Sample variance and sample standard deviation
 - 4.3.4. Sample frequency
 - 4.3.5. Calculate the concrete value of sample mean and sample variance
- 4.4. Statistical distribution laws of random sampling

- 4.5.1. Case 1: The original variance has normal distribution
- 4.5.2. Case 2: The original variance has binomial distribution

Chapter 5: Estimation theory and hypothesis testing

5.1. Parameter estimation

5.1.1. Point estimation: unbiased estimators, efficient estimators, consistent estimators

5.1.2. Interval estimation:

- General concepts of interval estimation
- Interval estimation of the mean of a normal distribution
- Interval estimation of the mean of a Bernoulli distribution

5.2. Hypothesis testing

5.2.1. General concepts of the Neyman–Pearson theory of hypothesis testing

- Hypothesis testing: Null hypothesis, alternative hypothesis
- The critical region and types of errors in hypothesis testing

5.2.2. Decision testing:

- Testing the expectation of a normal distribution
- Testing the parameter of a Bernoulli distribution

9. Required Textbooks

1. L. B. Long; *Probability Theory and Statistics*; The Information and Communications Publishing House, 2008.
2. D. P. Bertsekas; J. N. Tsitsiklis; *Introduction to Probability*; Athena Scientifics, 2000.

10. Suggested Textbooks

1. Peyton Z. Peebles, Jr.; *Probability, Random variables, and Random signal principles*; McGraw-Hill, Inc. 1987.
2. H.P. Hsu; *Theory and Problems of Probability, Random Variables, and Random Processes*; Schaum's Outline series. Copyright © 1997 by The McGraw-Hill Companies.

11. Grading Policy

Attendance:	10%
Average of mini midterm tests:	10%
Assignments:	10%
Final exam:	70%

Lecturer

Head of Department of Mathematics

Assoc. Prof. Dr. Le Ba Long

Assoc. Prof. Dr. Pham Ngoc Anh

PHYSICS 1 AND EXPERIMENT

Course Syllabus

1. General Information

Course name: Physics 1 and Experiment

Course code: BAS 1 2 24

Number of credits: 4

2. Objectives

The aim of this course will provide basic knowledge about the motions and matter interactions in order for student to get better understanding about basic technical and major subjects, to form scientific thinking and worldview.

3. Abstract

Understanding the the notions and definitions of general physics, applying physics techniques and skills with basic and modern equipments to measure some basic Physics quantities

On completion of this course students will be able to solve their major problems, analyse their experimental data, compare with theory and able to describe the problem solution strategy.

4. Teaching and learning methods

Lectures: 42 (hours)

Solving problem: 6 (hours)

Experiment: 8 (hours)

Self-study : 4 (hours)

5. Prerequisites

Calculus 1 and 2, Algebra

6. Learning Outcomes

On successful completion of this course a student will:

1. To understand the notions and definitions of general physics
2. To grasp the contents of general physics
3. Can apply the object-oriented finding, writing, solving, analysis, practicing and understanding the problems of physics

7. Assessment Criteria

Learning outcomes On successful completion of this course a learner will:	Assessment criteria for pass The learner can:
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Learning outcomes On successful completion of this course a learner will:	Assessment criteria for pass The learner can:
LO1 To understand the notions and definitions of general physics	- Velocity, acceleration and momentum - Center of mass, translational and rotational motions - Work, power, energy, kinetic energy and potential energy - Gravitational field - Temperature, internal energy, work and heat - Heat engines, refrigerators, and entropy - Electric field, electric field strength, electric flux and electric potential - Conductor, capacitor and capacitance - Dielectrics and bound charges - Magnetic field, magnetic field strength, and magnetic flux - the phenomenon of electromagnetic induction - Ferromagnetism, paramagnetism and diamagnetism - Electromagnetic field, electromagnetic oscillations and electromagnetic wave
LO2 To grasp the contents of general physics	- Newton's laws of motion - Conservation laws of energy and mechanical energy in conservative force field - The conservation laws of energy and mechanical energy in conservative force field - Newton's law of universal gravitation - The first law of thermodynamics - The second law of thermodynamics, the increasing principle of entropy - Coulomb's law and O-G's law, and the relation between electric field and electric potential - Induced electricity and electric field energy - Dielectric polarization, properties of special dielectrics - Ampere's law, O-G's law, Ampere's principle on total current - Laws of electromagnetic induction and self-inductance - Special properties of ferromagnetism and explain

Learning outcomes On successful completion of this course a learner will:	Assessment criteria for pass The learner can:
	- Two Maxwell's viewpoints and Maxwell's equations
LO3 Can apply the object-oriented finding, writing, solution, analysis, practice and understanding the problems of physics	- The relative motion and Galileo's relative principle - Equation of rotational motion in particular problems - The mechanical problems by using conservation law of energy - The escape velocities (I and II levels) - The cons of the first law of thermodynamics - Heat engine and refrigerator - The electric field and electric potential of symmetrically charged objects - Many connected conductors - Bound charge density in particular problems - The effect of magnetic field on electric current and moving charged particle - Particular electric circuit - The special properties of ferromagnetism in practical uses - The transmission of electromagnetic wave

8. Outlines

Part 1 MECHANICS

Chapter 1: Dynamics of a single particle

1.1 Kinetics of a single particle

1.1.1 Basic concepts

1.1.2 Velocity and acceleration

1.2 Dynamics of a single particle

1.2.1 Newton's laws of motion

1.2.2 Linear momentum

1.2.3 Angular momentum

1.2.4 Relative motion and Galileo's principle of relativity

Chapter 2: Dynamics of a system of particles – rigid body

2.1 Centre of mass

2.2 Law of conservation of linear momentum

2.3 Rotational equation of motion of rigid body

2.4 Law of conservation of angular momentum

Chapter 3: Mechanical Energy

3.1 Work and power

3.2 Mechanical Energy and law of conservation of mechanical energy

3.3 Kinetic energy

3.4 Potential energy

Chapter 4: Gravitational field

4.1 Newton's law of universal gravitational force

4.2 Gravitational field

Part II: THERMOLOGY

Chapter 5: Principle I of thermodynamics (*self study*)

5.1 Some basic concepts

5.2 Internal energy of a thermodynamic system. Work and heat.

5.3 Principle I of thermodynamics

Chapter 6: Principle II of thermodynamics (*self study*)

6.1 Thermal engines and refrigerators. Principle II of thermodynamics

6.2 Carnot cycle and Carnot theorem. Expression of principle II.

6.3 The entropy and the principle of increase of entropy. Nernst heat theorem.

Part III: Electricity – Electromagnetism

Chapter 7: Electrostatic field

7.1 Basic concepts

7.2 Coulomb's law

7.3 Electric field and vector of electric field strength

7.4 Electric flux and Gauss's theorem for electric field

7.5 Electric potential and equipotential surface

7.6 Relation between vector of electric field strength and electric potential

Chapter 8: Conductor

8.1 Conditions and properties of conductors in electrostatic equilibrium

8.2 Phenomenon of electrostatic induction

8.3 Capacitance of an isolated conductor, Capacitor

8.4 Electric energy

Chapter 9: Dielectrics

9.1 Dielectric polarization

9.2 Polarization vector of dielectrics

9.3 Composite electric field in dielectrics

9.4 Special dielectrics

Chapter 10: Magnetic field of a direct current

10.1 Ampere's law of magnetic interaction of electric current.

10.2 Magnetic field and magnetic induction vector

10.3 Magnetic flux and O-G's theorem for magnetic field

10.4 Ampere's theorem of total electric current

10.5 Effect of magnetic field on an electric current and a moving electric charge

Chapter 11: The phenomenon of electromagnetic induction

11.1 Laws of electromagnetic induction phenomenon

11.2 Self induction phenomenon

11.3 Mutual induction phenomenon

11.4 Magnetic energy

Chapter 12: Magnetic materials (*self study*)

12.1 Atoms in external magnetic field

12.2 Diamagnetic and paramagnetic materials

12.3 Ferromagnetic materials

Chapter 13: Electromagnetic field

13.1 Maxwell's viewpoint I

13.2 Maxwell's viewpoint II

13.3 Electromagnetic field and Maxwell's equations

13.4 Electromagnetic oscillations and waves

Part IV UNITS OF PHYSICS EXPERIMENTS

Unit 1. Explore the change of electric field in time

Unit 2. Explore the magnetic field in current-carrying straight solenoid

Unit 3. Explore electron in electromagnetic field

Unit 4. Explore circuit of electromagnetic oscillations

9. Required Textbooks

1. Le Minh Thanh, Hoang Lan Huong, Vu Hong Nga, Lectures of Physics 1 and experiment, 2010, Library of the PTIT.

2. Physics experiments of the Institute of Post and Telecommunication Technology, 2011, Library of the PTIT.

10. Suggested Textbooks

1. Luong Duy Binh, General physics episode I, II. Education Publishing House, 1995, Library of the PTIT.

2. Luong Duyen Binh, General physics exercises episode I, II. Education Publishing House, 1995, Library of the PTIT.

3. Physics experiments of Hanoi University of Science and Technology, Department of Physics

4. Nguyen Xuan Chi, Dang Quang Khang. General physics episode I, II. Publisher of Hanoi University of Science and Technology, 2001.
5. Halliday, Resnick, Walker, Fundamentals of Physics I,II,III,IV,V, Education Publishing House, 1998, Library of the PTIT.
6. Halliday, Resnick, Walker, Fundamentals of Physics, John Wiley & Sons, Inc, 9th edition.

12. Grading Policy

Attendance:	10 %
Average of mini mid term tests (ind):	10 %
Practical experiments	20 %
Final exam :	60 %

Lecturer

Head of Department of Physic

Dr. Lê Minh Thanh

Dr. Lê Minh Thanh

PHYSICS 3 AND PHYSICAL EXPERIMENT

1. General Information

Course name: PHYSICS 3 AND PHYSICAL EXPERIMENT

Course ID: BAS 1227

The number of credits: 4

2. Objectives

- **Knowledge:** Physics 3 and Physical Experiments provides ICT students with fundamental knowledge about:

- The wave- particle nature of light
- Relativistic Mechanics
- Quantum mechanics
- Atomic physics
- Solids and semiconductors

- **Skills:** Through this course, students can have these following skills:

- Logical thinking
- Applying the provided knowledge in order to study specialized issues
- Through the experiments, students will be provided with a multitude of helpful skills such as carefulness and persistence, as well as a chance to be familiar with researching methods.

- **Attitude and Diligence**

- Students must prepare the lesson before attending the class, actively listen to the lectures and practice those given skills.
- Completely finish all the exercises and exams.

- **Detailed objectives for each content of the course**

Objective Content	Level 1	Level 2	Level 3
Chapter 1: Oscillation and wave	Understand the definitions of: - Mechanical oscillation - Electromagnetic oscillation - Mechanical waves - Electromagnetic waves	Know about: - Harmonic, damped and forced electromagnetic oscillation, resonance phenomenon. - Synthesis of two oscillations with the same frequency. - The properties of electromagnetic waves	- Be able to analyze phenomena related to oscillations and waves. - Be able to do exercises about oscillations and waves.

Chapter 2: Light interference	Understand the definition of light interference.	Understand: - The fundamentals of wave optics: Maxwell's electromagnetic theorem about light; Optical path; Light wave function; Principle of wave superposition; The Huygens-Fresnel principle - Study light interference through 2 slits and light interference caused by reflection.	- Be able to analyze light interference phenomena and the applications of light interference. - Be able to do exercises about light interference - Be able to do experiments on light interference in the laboratory.
Chapter 3: Light diffraction	Understand: - The definition of light diffraction - The Fresnel spherical segment method - The definition of diffraction grating.	- Understand the Fresnel spherical segment properties. - Use the Fresnel spherical segment method to study light diffraction of spherical waves through circular hole and a small circular plate. - Study light diffraction caused by plane waves through a narrow slit and diffraction grating.	- Be able to analyze and compare light diffraction through a slit and diffraction grating. - Be able to do exercises about light diffraction. - Understand the applications of diffraction grating.
Chapter 4: Light dispersion, absorption and scattering	Understand the definitions of: - Light dispersion. - Light absorption. - Light scattering.	Understand these following phenomena: - Light dispersion caused by a prism - Dispersion curve and dispersion - Light absorption - Light dispersion and absorption	- Understand the meaning of dispersion curve and dispersion. Be able to differentiate between normal dispersion and abnormal dispersion. - Understand the Bouger-Lambert and Lamber-Beer laws about light absorption and their meaning

Chapter 5: Light polarization	Understand: - The definition of natural and polarized light. - Malus's law of light polarization.	- Be able to prove Malus's law of light polarization. - Be able to analyze light polarization caused by reflection and refraction, Polarization caused by birefringence and types of polarizing filter - Understand linear, elliptical and circular polarization, artificial birefringence and optical rotation.	- Be able to analyze light polarization, as well as do exercises about light polarization. - Understand the applications of light polarization.
Chapter 6: The special theory of relativity by Einstein	- Be able to state the two Einstein's axioms. - Be able to state the Lorentz transformation and Einstein's relation.	- Be able to write the consequences of Lorentz transformation. - Be able to state the momentum, energy and mass expressions of an object when travelling near the speed of light.	- Be able to explain length contraction and time dilation. - Analyzes the relativity of the concurrency of events and the cause-effect relation. - Proves that Newton mechanics is a limited case of Einstein's theory of relativity when $v \ll c$ or c is infinite. - Be able to do exercises about relativistic mechanics.

Chapter 7: Quantum optics	- Know the definitions of thermal radiation and balanced thermal radiation, the photoelectric phenomenon and Compton effect. - Be able to state absolute black-body radiation laws, Planck's quantum theory and Einstein's photon theory.	- State the expressions and meanings of characteristic quantities of balanced thermal radiation. - State the meaning of general function and draw the characteristic radiation spectrum line graph of the absolute blackbody - State the Planck formula and the successes of the theory about quantum energy. - Apply the photon theory to explain the three photoelectric laws - Explains the Compton effect.	- State the Rayleigh-Jeans formula and the limitations of it with thermal radiation phenomenon. - Explain that in the Compton effect, X-rays scatter on the bonding electron and the Compton effect is an empirical evidence that completely confirm the particle properties of light. - Be able to do exercises of quantum optics. - Be able to do experiments about photoelectric phenomena in the laboratories.
Chapter 8: Quantum mechanics	- States the de Broglie hypothesis about wave-particle duality of elementary particles. - States the Heisenberg's uncertainty principle about position and momentum. - States and gives the definitions of uncertainty principle about energy and time.	- Establish the Heisenberg's uncertainty principle for position and momentum. - State the wave function explanation for elementary particles and the statistic meaning of wave function. - State the Schrodinger's equation for free elementary particles and elementary particles moving in a force potential field. - Apply the Schrodinger's equation to find the expressions of wave function and the energy of elementary particles in an one-dimensional potential well with infinite depth.	- Explain why in quantum mechanics the definition of elementary particle orbit has no meanings and what definition will replace it. - Be able to do exercises in the quantum mechanics chapter.
Chapter 9: Atomic physics	- Know about the electron configuration of hydrogen and alkali	Understand: - The conclusions of quantum mechanics in	- State the difference between the energy of valence electrons in

	metal atoms. - Understand the definitions of angular and magnetic momentum and electron spin	the research into hydrogen atom. - The energy of valence electrons in alkali metal atoms - The emission spectrum of alkali metal atoms. - The existence of electron spin; the state and energy of electrons in atoms and the binary line structure of emission spectrum.	hydrogen and alkali metal atoms - State the selection rule for ℓ orbital quantum numbers. Applies this rule to state the primary and secondary spectral lines of lithium (Li) atoms. - State the orbital angular momentum from of the electrons orbiting the nuclei and their projections on the z axis. - Be able to do exercises in the atomic physics chapter.
Chapter 10: Solid-state physics and semiconductors	Understand the definitions of: - The crystal lattice structure of solids - Band diagram - Band structure - Conductive electron and electron hole - Intrinsic and extrinsic semiconductors	Know about: - Principles of energy bands formation and energy band diagram of semiconductors - The definition of p-n junction	Know about: - The band theory and the formation of valence band, band gap and conductive band in crystal materials. - The definitions of conductive electron and electron hole - The definitions of intrinsic, n and p semiconductors.

3. Abstract

Physics 3 and physical experiments includes 10 chapters and 2 experiments. The first chapter is about oscillation and waves as a base for wave optics. Chapters 2 to 5 show the phenomena characteristic of the wave properties of light, namely interference, diffraction, absorption, dispersion and polarization of light. Chapter 6 is about the dependency on the motion of space, time and the mass of an object when travelling near the speed of light. Chapter 7 shows the particle properties of light with thermal radiation, photoelectric phenomenon and Compton effect. Chapter 8 provides knowledge on the motion of elementary particles, helping to solve many problems related to the physical properties of matter in a deeper level. The next chapter uses the consequences of quantum mechanics to research into spectrum and properties of atoms. And the last chapter researches into solids and semiconductors.

4. Teaching and learning methods

Lectures:	36 (hours)
Project & practice:	4 (hours) & 8(hours)
Individual reading:	12 (hours)

5. Prerequisites

Previous subjects: Physics 1; Analytics 1,2 ; Algebra ; Probability statistics.

Course requirements: Theoretical classroom: Must have enough lighting, chalks, chalkboards, projector and a computer.

Physics laboratory: Must have enough lighting, fans, air conditioners, internet-enabled computers, projector, projector screen.

6. Learning Outcomes:

Students must have full component marks. If they either lack a component mark (attendance, mid-term exam or experiment) or do not attend over 20% of the course's total time, they cannot do the end-of-course exam.

7. Assessment Criteria

Types of exercises	Evaluation criteria
- Oscillation and waves exercises (electromagnetic oscillations, mechanical and electromagnetic waves)	- Fully understand oscillation and waves - Correctly answer questions and exercises
- Light's wave properties exercises (light interference, diffraction and polarization)	- Fully understand light interference, diffraction and polarization - Correctly answer questions and exercises
- Relativistic mechanics exercises (Lorentz transformations and its consequences. Relativistic dynamics)	- Fully understand relativistic mechanics - Correctly answer questions and exercises
- Quantum optics exercises (black-body thermal radiation, photoelectric phenomenon, Compton effect)	- Fully understand quantum optics - Correctly answer questions and exercises
- Quantum mechanics exercises (wave-particle duality of subatomic particles, Heisenberg's uncertainty principle, Schrodinger equation)	- Fully understand quantum mechanics - Correctly answer questions and exercises
- Atomic physics exercises (hydrogen and alkali metal atoms, angular and magnetic momentum in atoms)	- Fully understand atomic physics - Correctly answer questions and exercises
- Mid-term and end of term exams	- Understand the subject's knowledge - Correctly answer questions and exercises

8. Outlines

Chapter 1: OSCILLATIONS AND WAVES

1.1 Oscillations

1.1.1 Mechanical oscillations

1.1.2. Electromagnetic Oscillations

1.1.3. Synthesis of Oscillations

1.2. Waves

1.2.1. Mechanical waves, Sound waves and Doppler effect

1.2.2. Electromagnetic waves

Chapter 2: LIGHT INTERFERENCE

2. 1. The fundamentals of wave optics
 2. 1. 1. Maxwell's electromagnetic theorem about light
 2. 1. 2. Optical path
 2. 1. 3. Malus's theorem about Optical path
 2. 1. 4. Light wave function
 2. 1. 5. Luminous intensity
 2. 1. 6. Principle of superposition
 2. 1. 7. The Huygens-Fresnel principle
2. 2. The phenomenon of light interference
 2. 2. 1. The definition of light interference
 2. 2. 2. Study the phenomenon of light interference
2. 3. Interference caused by thin plates
 2. 3. 1. Lloyd's experiment
 2. 3. 2. Interference caused by thin plates
2. 4. Applications of interference phenomenon
 2. 4. 1. Checking plano-convex lenses
 2. 4. 2. Reducing reflection on lenses
 2. 4. 3. Rayleigh interferometers
 2. 4. 4. Michelson interferometers

Chapter 3 : LIGHT DIFFRACTION

3. 1. The phenomenon of light diffraction
3. 2. Light diffraction of spherical waves
 3. 2. 1. The Fresnel spherical segment method
 3. 2. 2. Diffraction through circular hole
 3. 2. 3. Diffraction through circular plate
3. 3. Diffraction caused by plane waves- Diffraction grating
 3. 3. 1. Diffraction of plane waves through narrow slit
 3. 3. 2. Diffraction of plane waves through multiple slits – Diffraction grating
 3. 3. 3. Diffraction on crystals

Chapter 4: LIGHT DISPERSION, ABSORPTION AND SCATTERING

4. 1. Light dispersion
 4. 1. 1. The phenomenon of light dispersion caused by prism
 4. 1. 2. Dispersion curve and dispersion
4. 2. Light absorption
4. 3. Theory of light dispersion and absorption
4. 4. Light Scattering

- 4. 4. 1. The phenomenon of light scattering
- 4. 4. 2. Tyndall scattering
- 4. 4. 3. Molecular scattering
- 4. 4. 4 . Raman Scattering
- 4. 4. 5. Mandelstam – Brillouin Scattering
- 4. 5. Rainbow

Chapter 5: LIGHT POLARIZATION

- 5.1. Light polarization
 - 5. 1. 1. Natural light
 - 5. 1. 2. Polarized light
 - 5. 1. 3. Malus's law of light polarization
 - 5. 1. 4. Light polarization caused by reflection and refraction
- 5. 2. Birefringent polarization
 - 5. 2. 1. Birefringence of crystals
 - 5. 2. 2. Wavefront in single axis crystal environment
 - 5. 2. 3. Polarizing filter types
- 5. 3. Elliptically polarized light and circular polarization
 - 5. 3. 1. Quarter-wave plate
 - 5. 3. 2. Half-wave plate
 - 5. 3. 3. Single-wave plate
- 5. 4. Artificial birefringence
 - 5. 4. 1. Birefringence caused by mechanical deformations
 - 5. 4. 2. Birefringence caused by electric field
- 5. 5. Optical rotation

Chapter 6: THE SPECIAL THEORY OF RELATIVITY BY EINSTEIN

- 6. 1. The two Einstein's axioms
 - 6. 1. 1. Absolute space and aether
 - 6. 1. 2. Michelson – Morley experiment
 - 6. 1. 3. Time and length measurement
 - 6. 1. 4. Einstein's axioms
- 6. 2. Lorentz transformation and its consequences
 - 6. 2. 1. Contradiction of Galileo transformation with Einstein's theory of relativity
 - 6. 2. 2. Lorentz transformation
 - 6. 2. 3. The consequences of Lorentz transformation
- 6. 3. Relativistic dynamics – Einstein's relation
 - 6.3.1.. Fundamental equation of material point's motion

6. 3. 2. Momentum and Energy

6. 3. 3. The consequences

Chapter 7: QUANTUM OPTICS

7. 1. Thermal radiation

7. 1. 1. Balanced thermal radiation

7. 1. 2. The characteristic quantities of balanced thermal radiation

7. 1. 3. Kirchhoff's law of thermal radiation

7. 2. Black-body radiation laws

7. 2. 1. Stefan-Boltzmann law

7. 2. 2. Wien's displacement law

7. 2. 3. Ultraviolet crisis

7. 3. Planck's quantum theory and Einstein's photon theory

7. 3. 1. Planck's theory on quantum energy

7. 3. 2. The success of the theory about quantum theory

7. 3. 3 Einstein's photon theory

7. 3. 4. Photon dynamics

7. 4. Photoelectric phenomenon

7. 4. 1. The definition of Photoelectric phenomenon

7. 4. 2. The laws of photoelectric and explanations

7. 5. Compton effect

7. 5. 1. Compton experiment

7. 5. 2. Explanation

Chapter 8: QUANTUM MECHANICS

8. 1. Wave-particle duality of elementary particles

8. 1. 1. Wave-particle duality of light

8. 1. 2. De - Broglie hypothesis

8. 1. 3. Experiment to verify the wave properties of subatomic particles

8. 2. Heisenberg's uncertainty principle

8. 3. Wave function

8. 3. 1. Wave function expression

8. 3. 2. Statistical meaning of wave function

8. 3. 3. Wave function conditions

8. 4. Schrodinger equation

8. 5. Applications of Schrodinger equation

8. 5. 1. Particles in potential well

8. 5. 2. Quantum tunnelling

8. 5. 3. Quantum harmonic oscillator

Chapter 9: ATOMIC PHYSICS

9. 1. Hydrogen atoms

9. 1. 1. The motion of electrons in hydrogen atoms

9. 1. 2. Conclusions

9. 2. Alkali metal atoms

9. 2. 1. The energy of valence electrons in alkali metal atoms

9. 2. 2. Spectrum of alkali metal atoms

9. 3. Angular and magnetic momentum of electrons

9. 3. 1. Orbital angular momentum

9. 3. 2. Magnetic momentum

9. 3. 3. Zeeman effect

9. 4. Electron spin

9. 4. 1. The existence of spin in electrons

9. 4. 2. State and energy of electrons in atoms

9. 4. 3. The binary line structure of emission spectrum.

9. 5. Mendeleev's periodic system

9. 6. Homogeneous particle system and Statistical quantum

9. 6. 1. Homogeneous particle system

9. 6. 2. Statistical quantum

Chapter 10: SOLID STATE PHYSICS AND SEMICONDUCTORS

10. 1. Solid-state Physics

10. 1. 1. Crystal lattice structure of solids

10. 1. 2. Band theory

10. 2. Semiconductor physics

10. 2. 1. Band diagram

10. 2. 2. Definition of conductive electron and electron hole

10. 2. 3. Fermi – Dirac distribution function

10. 2. 4. Intrinsic semiconductor

10. 2. 5. Extrinsic semiconductor

10. 2. 6. p-n junction. Diodes

10. 2. 7. Semiconductor laser diode

EXPERIMENTS

Experiment 1: Study the light interference

Experiment 2: Prove the photoelectric laws, determine the Planck constant

9. Required Textbooks

[1] Vo Thi Thanh Ha, Nguyen Thi Thuy Lieu, Physics 3 and Physical Experiment Lecture, Post and Telecommunication Institute of Technology, 2011.

[2] Physics Experiments, Post and Telecommunication Institute of Technology, 2011.

10. Suggested Textbooks

[1] General physics, part I, II, III ; Luong Duyen Binh, Vietnam Education Publishing House, 1995.

[2] General physics exercises, part I, II, III ; Luong Duyen Binh, Vietnam Education Publishing House, 1995.

[3] General physics, part III ; Nguyen Xuan Chi, Dang Quang Khang ; Hanoi University of Science and Technology, 2001.

[4] Fundamentals of Physics, part VI ; Halliday, Resnick, Walker ; Vietnam Education Publishing House, 1998.

[5] Optics; Nguyen The Binh, Vietnam National University Publishing House, 2007.

[6] Solid-state Physics, Nguyen Ngoc Long, Vietnam National University Publishing House, 2007.

11. Grading Policy

Attendance: fully attending the class and actively discussing	10 %
Average of mini mid term tests (ind)	10 %
Project (group): Experiment	20 %
Final exam (practice room)	60 %

Lecturer

Head of Department of Physic

Dr. Nguyen Thi Thuy Lieu

Dr. Lê Minh Thanh

INTRODUCTION TO COMPUTING AND PROGRAMMING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Introduction to Computing and Programming

Mã học phần (Course code):

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: Computer with C IDE, office

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- | | |
|--------------------------------|-----|
| - Lectures (lí thuyết): | 30h |
| - Exercises (bài tập): | 0h |
| - Projects (bài tập lớn): | 08h |
| - Lab (thực hành): | 07h |
| - Individual reading (tự đọc): | 0h |

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with basic knowledge computing and programming, including:

- computers and operating systems;
- proficient use of common software and programming languages

Learners use this knowledge as the foundation for the next subjects.

Kỹ năng (Skills)

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to operate the computers, and use some basic application software, such as MS-Word, MS-Excel, MS-Powerpoint.
- write basic computer programs using C programming language.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to operating principles of computers, operating systems,

office support systems, and programming languages that are considered to be the initial foundations of computer science. This course, provides learners with the most important knowledge about computer systems, MS-Office and C programming language. Learners use this knowledge to further study the subject matter, according to operating system, computer architecture, object-oriented programming and other subjects.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Computer basics

- 1.1. Introduction
- 1.2. Classification of computers
 - 1.2.1. Microcomputers
 - 1.2.2. Minicomputers
 - 1.2.3. Mainframes
 - 1.2.4. Supercomputers
- 1.3. Computer organization and architecture
 - 1.3.1. Central processing unit
 - 1.3.2. Communication among various units
 - 1.3.3. Instruction format
 - 1.3.4. Instruction cycle
 - 1.3.5. Instruction set
 - 1.3.6. Inside a computer
 - 1.3.7. Data representation in computers
- 1.4. Computer memory and storage
 - 1.4.1. Random access memory (RAM)
 - 1.4.2. Read only memory (ROM)
 - 1.4.3. RAM, ROM and CPU interaction
 - 1.4.4. Types of secondary storage devices
- 1.5. Input/Output media
 - 1.5.1. Types of input devices
 - 1.5.2. Types of output devices
 - 1.5.3. Computer terminals
- 1.6. Operating system
 - 1.6.1. Operating system: definition
 - 1.6.2. Evolution of operating system
 - 1.6.3. Types of operating systems
 - 1.6.4. Functions of an operating system
- 1.7. Summarization

Chapter 2. Working with Window operating systems

- 2.1. Introduction to Window operating system
- 2.2. Features of Windows
- 2.3. Starting Windows
- 2.4. The Desktop
 - 2.4.1. Taskbar
 - 2.4.2. Customizing taskbar
 - 2.4.3. Desktop icons
 - 2.4.4. Customizing the desktop
 - 2.4.5. My computer
 - 2.4.6. Working with files and folders
 - 2.4.7. Windows explorer
 - 2.4.8. Windows help and support centre
 - 2.4.9. Searching in Windows
 - 2.4.10. System utilities in Windows

- 2.4.11. Control panel
- 2.4.12. Windows accessories
- 2.5. The Internet tools
 - 2.5.1. Introduction
 - 2.5.2. Web browser
 - 2.5.3. Browsing internet using Internet Explorer
 - 2.5.4. Electronic mail (E-mail)
 - 2.5.5. E-mail client
 - 2.5.6. Instant messaging
 - 2.5.7. Mailing lists (Listserver)
- 2.6. Summarization

Chapter 3. Working with Microsoft Word

- 3.1. Introduction
- 3.2. Starting Microsoft Office Word
 - 3.2.1. Microsoft Word environment
 - 3.2.2. Getting help
- 3.3. Working with Word documents
 - 3.3.1. Creating a new document
 - 3.3.2. Opening an existing document
 - 3.3.3. Saving a document
 - 3.3.4. Closing a document and exiting Microsoft Word
- 3.4. Working with text
 - 3.4.1. Inserting text
 - 3.4.2. Selecting text
 - 3.4.3. Formatting the text
 - 3.4.4. Aligning and indenting text
 - 3.4.5. Formatting style
 - 3.4.6. Format painter
 - 3.4.7. Using cut, copy, and paste in Word
 - 3.4.8. Finding and replacing text
 - 3.4.9. Undo and redo
 - 3.4.10. Opening an existing document
 - 3.4.11. Bullets and numbering
 - 3.4.12. Header and footer
- 3.5. Working with tables
 - 3.5.1. Table properties
 - 3.5.2. Moving and resizing table
 - 3.5.3. Formatting text in table
 - 3.5.4. Adding and deleting rows and columns
 - 3.5.5. Converting text to table
 - 3.5.6. Converting table to text
- 3.6. Checking spelling and grammar
 - 3.6.1. Using the auto spell and auto grammar features
 - 3.6.2. Using spelling and grammar dialog box
 - 3.6.3. Using AutoCorrect options
 - 3.6.4. Using synonyms and thesaurus
- 3.7. Adding graphics to document
 - 3.7.1. Pictures
 - 3.7.2. Editing a picture
 - 3.7.3. Drawing objects
- 3.8. Printing a document
 - 3.8.1. Setting page margins

- 3.8.2. Print preview
- 3.8.3. Printing the document
- 3.9. Summarization

Chapter 4. Working with Microsoft Excel

- 4.1. Introduction
- 4.2. Starting Microsoft Office Excel
- 4.3. Working with Excel Workbook
 - 4.3.1. Creating an Excel Workbook
 - 4.3.2. Opening an Existing Workbook
 - 4.3.3. Saving Workbook
 - 4.3.4. Closing a Workbook
- 4.4. Working with Worksheet
 - 4.4.1. Entering data in cells
 - 4.4.2. Navigating through cells
 - 4.4.3. Naming of a range of cells
 - 4.4.4. Editing a Worksheet
 - 4.4.5. Using cut, copy, and paste in Excel
 - 4.4.6. Finding and replacing cells
 - 4.4.7. Undo and redo
- 4.5. Formulas and functions
 - 4.5.1. Functions
 - 4.5.2. Using AutoSum
 - 4.5.3. Formulas
- 4.6. Inserting charts
 - 4.6.1. Creating charts
 - 4.6.2. Using chart toolbar
 - 4.6.3. Saving a chart
- 4.7. Sorting
- 4.8. Printing in Excel
 - 4.8.1. Setting page layout
 - 4.8.2. Print preview
 - 4.8.3. Printing Worksheets
- 4.9. Summarization

Chapter 5. Working with Microsoft PowerPoint

- 5.1. Introduction
- 5.2. Starting Microsoft Office PowerPoint
- 5.3. Working with PowerPoint
 - 5.3.1. Creating a new presentation
 - 5.3.2. Opening a presentation
 - 5.3.3. Saving a presentation
 - 5.3.4. Closing a presentation
- 5.4. Working with different views
- 5.5. Designing presentation
 - 5.5.1. Choosing design template
 - 5.5.2. Using masters
 - 5.5.3. Working with slides
 - 5.5.4. Working with text
 - 5.5.5. Formatting the text
 - 5.5.6. Working with graphics
 - 5.5.7. Running slides
 - 5.5.8. Package for CD
- 5.6. Printing in PowerPoint

- 5.6.1. Setting page layout
- 5.6.2. Printing presentation
- 5.7. Summarization

Chapter 6. C programming language

- 6.1. Introduction
- 6.2. Types, operators, and expressions
 - 6.1. Variable names
 - 6.2. Data types and sizes
 - 6.3. Constants
 - 6.4. Arithmetic operators
 - 6.5. Relational and logical operators
 - 6.6. Increment and decrement operators
 - 6.7. Bitwise operators
 - 6.8. Assignment operators and expressions
 - 6.9. Conditional expressions
 - 6.10. Precedence and order of evaluation
- 6.3. Control flow
 - 6.3.1. Creating a new presentation
 - 6.3.2. If-else
 - 6.3.3. Else-if
 - 6.3.4. Switch
 - 6.3.5. Loops- while and for
 - 6.3.6. Loops- do-while
 - 6.3.6. Break and continue
- 6.4. Functions and program structure
 - 6.4.1. Basics of functions
 - 6.4.2. Functions returning non-integers
 - 6.4.3. External variables
 - 6.4.4. Static variables
 - 6.4.5. Register variables
 - 6.4.6. Scope rules
 - 6.4.7. Header files
 - 6.4.8. Recursion
- 6.5. Pointers and arrays
 - 6.5.1. Pointers and addresses
 - 6.5.2. Pointers and function arguments
 - 6.5.3. Pointers and arrays
 - 6.5.4. Pointers to pointers
 - 6.5.5. Pointers vs. multi-dimensional arrays
- 6.6. Structures
 - 6.6.1. Basics of structures
 - 6.6.2. Structures and functions
 - 6.6.3. Arrays of structures
 - 6.6.4. Pointers to structures
 - 6.6.5. Unions
 - 6.6.6. Bit-fields
- 6.7. Input and output
 - 6.7.1. Standard input and output
 - 6.7.2. Formatted output-printf
 - 6.7.3. Formatted input-scanf
 - 6.7.4. File access
 - 6.7.5. Line input and output
- 6.8. Summarization

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Brian W. Kernighan, Denis M. Ritchie. *The C Programming Language*. 2th edition, Prentice Hall, 2010.

[2] Devid Evans. *Introduction to Computing*, University of Virginia, 2011.

5.2. Học liệu tham khảo (Optional Textbooks)

[3] Emile Woolf International, *Introduction to Information Technology*, 2013.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Dương Trần Đức

DIGITAL ELECTRONICS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): DIGITAL ELECTRONICS

Mã học phần (Course code): ELE1309

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures: 32h
- Exercises: 6h
- Projects & Lab: 4h
- Mid-term exam: 2h
- Individual reading: 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Electronic Engineering 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: 024-33820866.

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about digital electronic circuits, including:

- Digital fundamentals, basic logic gate circuits, Boolean algebra.
- Analysis and design of combination logic circuits.
- Analysis and design of sequential logic circuits.
- Structure and operation principles of some common semiconductor memories.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- Be able to analyze and design combinational logic circuits and sequential logic circuits.
- Be able to use some simulation software to simulate the above circuits.

Thái độ, Chuyên cần (Attitude):

- Be committed to attend all lectures.
- Be active to participate in class activities.

3. Tóm tắt nội dung học phần (Description)

This course systematically introduces to students the basic concepts in digital electronics, presents them typical digital electronic circuits with fully explaining from basic digital logic gates to combinational and sequential circuits, also provides them with fundamental methods of digital electronic circuits analysis and design.

Students will understand basic principles of combinational and sequential logic design. And they will consolidate their skill of how to design a general-purpose computer, starting with simple logic gates to complex digital circuits.

4. Nội dung chi tiết học phần (Outlines)

CHAPTER 1. NUMBER SYSTEMS

- 1.1. Popular number systems
- 1.2. Number system conversion
- 1.3. Signed binary numbers
- 1.4. Binary codes

CHAPTER 2. BOOLEAN ALGEBRA AND LOGIC GATES

- 2.1. Introduction
- 2.2. Boolean functions representation
- 2.3. Boole functions minimization/optimization
- 2.4. Logic gates

CHAPTER 3. COMBINATIONAL LOGIC CIRCUITS

- 3.1. General concepts
- 3.2. Combinational logic circuit analysis
- 3.3. Combinational logic circuit design
- 3.4. Encoders and decoders
- 3.5. Multiplexers and demultiplexers
- 3.6. Arithmetic circuits
- 3.7. Comparators
- 3.8. Error detection and error correction circuits

CHAPTER 4. SEQUENTIAL LOGIC CIRCUITS

- 4.1. General concepts
- 4.2. Triggers
- 4.3. Sequential circuit analysis

4.4. Sequential circuit design

4.5. Popular sequential circuits

CHAPTERS 5. MEMORY DEVICES

4.1 Basic memory structures

4.2 ROM

4.3 RAM

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. Digital Electronics Lecture Notes.

5.2. Học liệu tham khảo (Optional Textbooks)

[2]. Logic and Computer Design Fundamentals, 5th Edition by M. Morris Mano and Charles R. Kime. Published by Prentice-Hall, 2015.

[3]. Digital Electronics Lecture Notes (from MIT, Illinois University, Manchester University...)

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Labs	10%	Individual
- Assignments	10%	Group
- Mid-term exams	10%	Individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Nguyễn Trung Hiếu

Giảng viên biên soạn
(Lecturer)

Nguyễn Ngọc Minh

MICROPROCESSORS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Microprocessors

Mã học phần (Course code): INT1330

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Computer Architecture (INT1323)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 36h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 0h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The course provides an introduction to microprocessors, which focusses on the understanding of the 8086/8088 architecture and components, assembly language and system programming, I/O interface. In addition, the course also provides an understanding of recent microprocessors and applications such as multicore processors, GPU/TPU, wearable computers, and the Internet-of-Things. The students will:

- gain the background of microprocessors.
- become familiar with system programming and toward the development of I/O interface systems and embedded systems.

Kỹ năng (Skills):

Upon successful completion of this source, the students will be able to:

- understand the 8086/8088 architecture and components.
- have assembly language and system programming skills.
- implement simple I/O interfacing and embedded systems.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course starts with the introduction to microprocessors: concepts, history, applications; then 8086/8088 architecture and components. Next, the course will provide the background of instruction set, assembly language and system programming to students. In addition, memory and I/O interface are introduced to students for understanding the hardware operation and interface programming. Finally, students will also explore some recent trends of microprocessors such as multi-core processors, GPU/TPU, wearable computers and IoT.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction to Microprocessors

- 1.1. Basic concepts
- 1.2. Microprocessor systems
- 1.3. History

Chapter 2: Intel 8086/8088 microprocessors

- 2.1 8086 architecture and components
 - 2.1.1 Architecture
 - 2.1.2 Components: BIU, EU, registers and internal bus
- 2.2 8086/8088 instruction set
 - 2.2.1 Instruction concept and encoding
 - 2.2.2 Addressing modes
 - 2.2.3 Common instructions
- 2.3 Instruction execution
- 2.4 Interruption

Chapter 3: Assembly language programming

- 3.1. How to create and run an assembler code
- 3.2 Emu8086 simulator
- 3.3 Sub-routines and macro
- 3.4 Examples

Chapter 4: Memory and I/O interfacing

- 4.1 CPU pin signals
- 4.2 CPU-memory interfacing & address decoding
- 4.3 CPU-I/O interfacing & data exchange methods
- 4.4 Simple I/O interface programming
 - 4.4.1 Traffic light
 - 4.4.2 Thermal
 - 4.4.3 Keyboard
 - 4.4.4 Robotics
- 4.5. Exercise

Chapter 5: Advanced topics

- 5.1 Microcontrollers and System-on-Chip (SoC)
- 5.2. Multi-core microprocessors
- 5.3. GPU/TPU
- 5.4. Wearable computers
- 5.5. The Internet-of-Things devices

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. M. Senthil Kumar, M. Saravanan, S. Reevananthan. *Microprocessors and Microcontrollers*. Oxford University Press, 2013.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Samir G. Pandya. *8085 Microprocessor Assembly Language Programming*, LAP Lambert Academic Publishing, 2017
- [3]. Walter A. Triebel, Avtar Singh. *8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications* - 4th edition, Prentice Hall, Inc. 2003

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Phạm Văn Cường

DISCRETE MATHEMATICS I

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Discrete Mathematics 1

Mã học phần (Course code): INT1358

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 36h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 0h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications
Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District,
Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to introduce students to ideas and techniques from discrete mathematics that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn:

- basic definitions of logic operations, sets, as well as algorithms and mathematical reasoning.
- how to solve fundamental problems in science and engineering: counting, listing, optimization as well as existence problems.

Kỹ năng (Skills):

Upon successful completion of this course, the students will be able to:

- apply knowledge of discrete mathematics in problem solving
- develop recursive algorithms to solve typical engineering problems related to counting, listing and optimization issues.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete course exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces students to basic concepts of discrete mathematics and its applications in computer science and engineering. The studying topics are involving problems of discrete mathematics, whenever objects are counted, when relationships between finite (or countable) sets are studied, and when processes involving a finite number of steps are analyzed. Students will learn different approaches to solve these counting, listing, optimization and existing problems, and their applications in computer science and engineering.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Logic and proofs

- 1.1. Propositional logic
 - 1.1.1. Definition
 - 1.1.2. Operations
 - 1.1.3. Translating English sentences into logical expression
 - 1.1.4. Logic and bit operations
 - 1.1.5. Propositional equivalences
- 1.2. Predicates and quantifiers
 - 1.2.1. Predicates
 - 1.2.2. Quantifiers
 - 1.2.3. Translating from English into logical expression
- 1.3. Sets
 - 1.3.1. Definition
 - 1.3.2. Set operations
 - 1.3.3. Set identities
 - 1.3.4. Computer representation of sets
- 1.4. Algorithm complexity
 - 1.4.1. Algorithm
 - 1.4.2. Growth function
 - 1.4.3. Complexity of algorithm

Chapter 2: Counting

- 2.1. Problem statement
 - 2.1.1. Statement
 - 2.1.2. Typical use cases
- 2.2. Basic counting principles
 - 2.1.1. Sum rule
 - 2.1.2. Product rule
 - 2.1.3. Inclusion–exclusion principle
 - 2.1.3. Dirichlet principle
- 2.3. Problem simplification
 - 2.3.1. Introduction
 - 2.3.2. Typical examples
- 2.4. Recurrence relation
 - 2.4.1. Definition
 - 2.4.2. Modelling with recurrence relations
 - 2.4.3. Solving linear recurrence relations
- 2.5. Generating functions
 - 2.5.1. Introduction
 - 2.5.2. Typical examples

Chapter 3: Listing

- 3.1. Problem definition
 - 3.1.1. Introduction
 - 3.1.2. Typical applications
- 3.2. Generating algorithm
 - 3.2.1. Definition
 - 3.2.2. Pseudo code
 - 3.2.3. Typical listing problems using generating algorithm
- 3.3. Backtrack algorithm
 - 3.3.1. Definition
 - 3.3.2. Pseudo code
 - 3.3.3. Typical listing problems using backtrack algorithm
- 3.4. Case study

Chapter 4: Optimization

- 4.1. Problem definition
 - 4.1.1. Introduction
 - 4.1.2. Typical applications
- 4.2. Brute-force algorithm
 - 4.2.1. Pseudo code
 - 4.2.2. Examples
- 4.3. Branch-and-bound algorithm
 - 4.3.1. Pseudo code
 - 4.3.2. Examples
- 3.4. Case study

Chapter 5: Existence

- 5.1. Problem statement
- 5.3. Dirichlet principle
- 5.4. Examples

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Rosen, Kenneth H., *Discrete Mathematics and its Applications*. 8th edition, McGraw Hill, 2018.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Susanna S. Epp, *Discrete Mathematics with Applications*. 5th edition, Cengage Learning, 2019
- [3]. Oscar Levin, *Discrete Mathematics: An Open Introduction*, 3rd Edition, 2019

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term exams	10%	Individual
- Final examination	70%	Individual

**Trưởng Bộ môn
(Head of Department)**

Ngô Xuân Bách

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Văn Thủy

DISCRETE MATHEMATICS II

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Discrete Mathematics 2

Mã học phần (Course code): INT1359

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 36h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 0h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to introduce students to ideas and techniques from advanced topics of discrete mathematics that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving graph-related problems. To achieve this goal, students will learn:

- basic definitions of graphs.
- searching algorithms based on graphs structures.
- special graphs such as Euler graphs and Hamilton graphs and their applications.
- how to build a spanning tree from a graph.
- how to find the shortest paths within the graphs.
- how to build the maximum network flow via graphs.

Kỹ năng (Skills):

Upon successful completion of this course, the students will be able to:

- think logically and mathematically and apply these techniques in solving graph-related problems
- know standard graph-based algorithms that are widely used in computer science.
- develop efficient algorithms to solve practical problems of graph-related applications.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete course exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces students to advanced topics of discrete mathematics and their applications in computer science and engineering. Studying topics include graph structures and their related algorithms to solve practical problems such as how to find the shortest route that links any two nodes in a graph; how to quickly search a special node in a graph; or how to design an optimized network flow via a network. In particular, students will learn a graph model and its representations in computer programming; different approaches to develop efficient algorithms based on graphs and to handle special graphs such as Euler and Hamilton graphs; and how to build spanning trees and the maximum network flow via a network.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Graph terminology and representation

- 1.1. Graph definition
 - 1.1.1. Graph definition
 - 1.1.2. Undirected graph
 - 1.1.3. Directed graph
 - 1.1.4. Single graph
 - 1.1.5. Multiple graph
- 1.2. Basic terminology
 - 1.2.1. Undirected graph
 - 1.2.2. Directed graph
- 1.3. Graph Types
 - 1.3.1. Complete graph
 - 1.3.2. Star graph
 - 1.3.3. Bipartite graph
 - 1.3.4. Other special graphs
- 1.4. Graph representations
 - 1.4.1. Adjacency matrix
 - 1.4.2. Incidence matrix
 - 1.4.3. Edge list
 - 1.4.4. Adjacency list
- 1.5. Case study

Chapter 2: Searching algorithms on graphs

- 2.1. Depth-first search algorithm
 - 2.1.1. Introduction
 - 2.1.2. Pseudo code
 - 2.1.3. Example
- 2.2. Breath-first search algorithm
 - 2.1.1. Introduction
 - 2.1.2. Pseudo code
 - 2.1.3. Example
- 2.3. Application of search algorithms

- 2.3.1. Listing all vertices of a graph
- 2.3.2. Determine the number of connected graph components
- 2.3.3. Finding a path between two vertices of a graph
- 2.3.4. Listing bridges in a graph
- 2.3.5. Listing cut vertices in a graph
- 2.3.6. Strong connectivity of a graph
- 2.3.7. Weak connectivity of a graph
- 2.3.8. Others
- 2.4. Case study
 - 2.4.1. Difference between DFS and BFS algorithms
 - 2.4.2. Several practical problems that can solved by graph searching algorithms

Chapter 3: Eulerian and Hamiltonian Graphs

- 3.1. Definition
 - 3.1.1. Eulerian and semi-Eulerian graphs
 - 3.1.2. Hamiltonian and semi-Hamiltonian graphs
- 3.2. Euler circuit and Euler path
 - 3.2.1. Finding a Eulerian circuit
 - 3.2.2. Finding a Eulerian path
- 3.3. Hamiltonian circuit and Hamiltonian path
 - 3.2.1. Finding a Hamiltonian circuit
 - 3.2.2. Finding a Hamiltonian path
- 3.4. Case study

Chapter 4: Trees and spanning trees

- 4.1. Basic definition
 - 4.1.1. Tree and properties
 - 4.1.2. Spanning tree
- 4.2. Building spanning tree
 - 4.2.1. Using DFS
 - 4.2.2. Using BFS
 - 4.2.3. Examples
- 4.3. Building the minimum spanning tree
 - 4.3.1. Kruskal algorithm
 - 4.3.2. Prim algorithm
 - 4.3.3. Examples
- 4.4. Case study

Chapter 5: The shortest path problem

- 5.1. Problem statement
- 5.2. Dijkstra algorithm
 - 5.2.1. Introduction
 - 5.2.2. Pseudo code
 - 5.2.3. Implementation example
- 5.3. Bellman-Ford algorithm
 - 5.3.1. Introduction
 - 5.3.2. Pseudo code
 - 5.3.3. Example
- 5.4. Floyd algorithm
 - 5.4.1. Introduction
 - 5.4.2. Pseudo code
 - 5.4.3. Example
- 5.5. Case study

Chapter 6: Maximum network flow problem

- 6.1. Problem statement
- 6.2. Max-flow min-cut theorem
- 6.3. Ford-Fulkerson
- 6.4. Case study

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Rosen, Kenneth H.. *Discrete Mathematics and its Applications*. 8th edition, McGraw Hill, 2018.

5.2. Học liệu tham khảo (Optional Textbooks)

[2] Susanna S. Epp, *Discrete Mathematics with Applications*. 5th edition, Cengage Learning, 2019

[3] Oscar Levin, *Discrete Mathematics: An Open Introduction*, 3rd Edition, 2019

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term exams	10%	Individual
- Final examination	70%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Nguyễn Văn Thủy

PROGRAMMING WITH C++

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Programming with C++

Mã học phần (Course code): INT1339

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: hardware: Desktop computer, software: C++ IDE

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 30h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 07h
- Individual reading (tự đọc): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The objective of this course is to provide learners with programming skills in the C ++ language. Learners can use C ++ programming language as an important tool to solve specific problems in computer science.

Kỹ năng (Skills):

On successful completion of this course a learner will:

- understand and have skills in structured programming methods of C ++ language
- understand and have skills in object-oriented programming methods of C ++ language
- understand and have skills in advanced C++ programming

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

C ++ programming language is one of the most popular languages used by programmers. In this course, learners are fully equipped with basic programming skills, object-oriented programming and advanced programming in the C ++ language. Proficient in programming C ++, learners can use it in solving real-world problems.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. C++ Basics

- 1.1. Introduction
- 1.2. C++ environment setup
- 1.3. C++ basic syntax
- 1.4. C++ data types
- 1.5. Variable scope in C++
- 1.6. C++ constants/literals
- 1.7. Operators in C++
- 1.8. C++ loop types
- 1.9. C++ functions
- 1.10. C++ arrays
- 1.11. C++ strings
- 1.12. C++ pointers
- 1.13. C++ references
- 1.14. C++ basic input/output
- 1.15. C++ structure
- 1.16. Summarization

Chapter 2. C++ object oriented

- 2.1. C++ classes and objects
 - 2.1.1. C++ class definitions
 - 2.1.2. Define C++ objects
 - 2.1.3. C++ class member functions
 - 2.1.4. C++ class access modifiers
 - 2.1.5. C++ class constructor and destructor
 - 2.1.6. C++ friend functions
 - 2.1.7. C++ inline functions
 - 2.1.8. C++ this pointer
 - 2.1.9. Pointer to C++ classes
 - 2.1.10. Static members of a C++ class
- 2.2. C++ Inheritance
 - 2.2.1. Base and derived classes
 - 2.2.2. Access control and inheritance
 - 2.2.3. Type of inheritance
 - 2.2.4. Multiple inheritance
- 2.3. C++ Overloading
 - 2.3.1. Function overloading in C++
 - 2.3.2. Operators overloading in C++
 - 2.3.3. Overloadable/non-overloadable operators
- 2.4. Polymorphism in C++
- 2.5. Data abstraction in C++
- 2.6. Data encapsulation in C++
- 2.7. Interfaces in C++ (Abstract classes)
- 2.8. Summarization

Chapter 3. C++ advanced

- 3.1. C++ Files and streams
 - 3.1.1. Ofstream
 - 3.1.2. Ifstream

- 3.1.3. Fstream
- 3.2. C++ Exception handling
 - 3.2.1. Throwing exceptions
 - 3.2.2. Catching exceptions
 - 3.2.3. C++ standard exceptions
- 3.3. C++ Dynamic memory
 - 3.3.1. new and delete operators
 - 3.3.2. Dynamic memory allocation for arrays
 - 3.3.3. Dynamic memory allocation for objects
- 3.4. STL library
- 3.5. Summarization

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Bjarne Stroustrup, The C++ Programming Language, 4th Edition, 2014.
- [2]. Nicolai M Josuttis, The C++ Standard Library: A Tutorial and Reference, 2017.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. Deitel, Paul J, C++ *How to program*. Pearson, 10th editon, 2017.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Đỗ Thị Bích Ngọc

DATA STRUCTURES & ALGORITHMS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): DATA STRUCTURES & ALGORITHMS

Mã học phần (Course code): INT13064

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: Computer with C/C++ or Java IDE, internet/intranet connection to online submit

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 30h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 07h
- Individual reading (tự đọc): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge data structures and algorithms, including:

- knowledge of algorithm analysis, design and evaluation
- knowledge of traditional algorithmic models
- knowledge of abstract data structures

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the knowledge learned to solve specific problems of computer science
- the complexity of the proposed algorithm to solve the specific problem

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course introduces students to the basic knowledge of algorithms and data structures. For each algorithm, the subject provides learners with knowledge of representation, complexity evaluation, experiment and implementation. For each data structure, the course provides learners with concepts, definitions, representations, operations and implementation. Learners can use the knowledge learned in solving specific problems of computer science.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Analysis of algorithms

- 1.1. Introduction
- 1.2. Worst, average and best cases
- 1.3. Asymptotic notations
- 1.4. Little o and little omega notations
- 1.5. Lower and upper bound theory
- 1.6. Analysis of loops
- 1.7. Solving recurrences
- 1.8. NP, NP-Completeness introduction
- 1.9. Summarization

Chapter 2. Searching techniques

- 2.1. Introduction
- 2.2. Linear search algorithm
- 2.3. Binary search algorithm
- 2.4. Interpolation search algorithm
- 2.5. Hash table

Chapter 3. Sorting techniques

- 3.1. Introduction
- 3.2. Selection sort algorithm
- 3.3. Bubble sort algorithm
- 3.4. Insertion sort algorithm
- 3.5. Quick sort algorithm
- 3.6. Merge sort algorithm
- 3.7. Shell sort algorithm
- 3.8. Heap sort algorithm

Chapter 4. Linked list data structure

- 4.1. Single linked list
 - 4.1.1. Single linked list representation
 - 4.1.2. Single linked list operations
 - 4.1.3. Single linked list applications
- 4.2. Doubly linked list
 - 4.2.1. Doubly linked list representation
 - 4.2.2. Doubly linked list operations
 - 4.2.3. Doubly linked list applications
- 4.3. Curcular linked list
 - 4.3.1. Curcular linked list representation
 - 4.3.2. Curcular linked list operations
 - 4.3.3. Curcular linked list applications
- 4.4. Sorted linked list
 - 4.4.1. Sorted linked list representation
 - 4.4.2. Sorted linked list operations
 - 4.4.3. Sorted linked list applications

Chapter 5. Stack data structure

- 5.1. Introduction
- 5.2. Stack based on array

- 5.2.1. Stack representation
- 5.2.2. Stack operations
- 5.3. Stack based on linked list
 - 5.3.1. Stack representation
 - 5.3.2. Stack operations
- 5.4. Stack applications
 - 4.4.1. Computed application
 - 4.4.2. Sorted linked list operations
 - 4.4.3. Sorted linked list applications

Chapter 6. Queue data structure

- 6.1. Queue
 - 6.2.1. Introduction
 - 6.2.2. Queue representation
 - 6.2.3. Queue operations
 - 6.2.4. Queue applications
- 6.2. Curcular queue
 - 6.3.1. Introduction
 - 6.3.2. Curcular queue representation
 - 6.3.3. Curcular queue operations
 - 6.3.4. Curcular queue applications
- 6.3. Priority Queue
 - 6.3.1. Introduction
 - 6.3.2. Priority queue representation
 - 6.3.3. Priority queue operations
 - 6.3.4. Priority queue applications
- 6.4. Double ended queue (Dqueue)
 - 6.5.1. Introduction
 - 6.5.2. Dqueue representation
 - 6.5.3. Dqueue operations
 - 6.5.4. Dqueue applications

Chapter 7. Binary tree data structure

- 7.1. Introduction
- 7.2. Simple binary tree
 - 7.2.1. Simple binary tree representation
 - 7.2.2. Simple binary tree operations
 - 7.2.3. Simple binary tree applications
- 7.3. Binary search tree (BST)
 - 7.3.1. BST representation
 - 7.3.2. BST operations
 - 7.3.3. BST applications
- 7.4. AVL tree
 - 7.4.1. AVL representation
 - 7.4.2. AVL operations
 - 7.4.3. AVL applications
- 7.5. Heap data structure
 - 7.5.1. Heap representation
 - 7.5.2. Min heap operations
 - 7.5.3. Min heap operations
 - 7.5.4. Heap applications

Chapter 8. Graph data structure

- 8.1. Introduction
- 8.2. Graph representation
 - 8.2.1. Adjacency matrix
 - 8.2.2. Edge list

- 8.2.2. Adjacency list
- 8.3. Depth first search algorithm (DFS)
 - 8.3.1. DFS representation algorithm
 - 8.3.2. DFS complexity
 - 8.3.3. DFS applications
- 8.4. Breadth first search algorithm (BFS)
 - 8.3.1. BFS representation algorithm
 - 8.3.2. BFS complexity
 - 8.3.3. BFS applications
- 8.5. Euler cycles algorithm
 - 8.3.1. Representation algorithm
 - 8.3.2. Complexity algorithm
 - 8.3.3. Euler applications
- 8.6. Shortest path algorithms
 - 8.6.1. Dijkstra algorithm
 - 8.6.2. Bellman-Ford algorithm
 - 8.6.3. Floyd algorithm
- 8.7. Minimum spanning tree
 - 8.7.1. Kruskal algorithm
 - 8.7.2. Prim algorithm
 - 8.7.3. Bruvka algorithm

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. M. Main, W. Savitch, Data Structures and Other Objects Using C++, 4th Edition, 2010.
- [2]. Donald E. Knuth, The Art of Programming, Vol 1, 2, 3, 4, the 4rd Edition, Addison-Wesley Publishing Company, 2005.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 3rd Edition, the MIT Press, 2009.
- [4]. Bradley N. Miller, Problem Solving with Algorithms and Data Structures Using Python, 2nd Edition, 2011

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Nguyễn Duy Phương

DATABASES

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Databases

Mã học phần (Course code): INT1313

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner, Chalkboard or Whiteboard.

- Laboratory: Computer with Internet connection and Database Management System, Projector, microphone and speaker, air conditioner, Chalkboard or Whiteboard.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 9h
- Thực hành (Lab): 4h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course aims to provide learners with important knowledge about database systems, including:

- basic concepts necessary for a good understanding of database models, systems, and languages,
- the relational data model, the SQL standard, and the formal relational languages,
- the operations of the relational algebra and introduces the relational calculus,
- conceptual database modeling and database design,
- the normalization theory: the formalisms, theories, and algorithms developed for relational database design by normalization.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- analyzing the data and data organization needs of organizations;
- applying the Entity-Relationship (E-R) Model for building information systems' data models;
- transforming an E-R diagram into a relational model, and use normalization to create a relational database schema;
- formulating queries in relational algebra by using projection, selection, product, and join operations;
- using SQL for database creation, manipulation, and control.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course introduces the fundamental concepts necessary for designing, using, and implementing database systems and database applications to learners. The course emphasizes on database modeling and design, the SQL language and normal forms. Besides, computer laboratory exercises and mini-projects based training are parts of the course to help students improving real-world database manipulation skills.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Databases and database users

- 1.1 Introduction
- 1.2 An example
- 1.3 Characteristics of the database approach
- 1.4 Actors on the Scene
- 1.5 Workers behind the Scene
- 1.6 Advantages of using the DBMS Approach
- 1.7 A brief history of database applications
- 1.8 When not to use a DBMS

Chapter 2 Database system concepts and architecture

- 2.1 Data models, schemas, and instances
- 2.2 Three-schema architecture and data independence
- 2.3 Database languages and interfaces
- 2.4 Database system environments
- 2.5 Centralized and client/server architectures for DBMSs
- 2.6 Classification of database management systems

Chapter 3 Relational data model and relational database constraints

- 3.1 Relational model concepts
- 3.2 Relational model constraints and relational database schemas
- 3.3 Update operations, transactions, and dealing with constraint violations

Chapter 4 Basic SQL

- 4.1 SQL data definition and data types
- 4.2 Specifying constraints in SQL
- 4.3 Basic retrieval queries in SQL
- 4.4 INSERT, DELETE, and UPDATE statements in SQL
- 4.5 Additional features of SQL

Chapter 5 More SQL: complex queries, triggers, views, and schema modification

- 5.1 More complex sql retrieval queries
- 5.2 Specifying constraints as assertions and actions as triggers
- 5.3 Views (virtual tables) in SQL
- 5.4 Schema change statements in SQL

Chapter 6 Relational algebra and relational calculus

- 6.1 Unary relational operations: SELECT and PROJECT
- 6.2 Relational algebra operations from set theory
- 6.3 Binary relational operations: JOIN and DIVISION
- 6.4 Additional relational operations
- 6.5 Examples of queries in relational algebra
- 6.6 Tuple relational calculus
- 6.7 Domain relational calculus

Chapter 7 Data modeling using the entity-relationship (ER) model

- 7.1 Using high-level conceptual data models for database design
- 7.2 A sample database application
- 7.3 Entity types, entity sets, attributes, and keys
- 7.4 Relationship types, relationship sets, roles, and structural constraints
- 7.5 Weak entity types
- 7.6 ER diagrams, naming conventions, and design issues
- 7.7 Example of other notation: uml class diagrams
- 7.8 Relationship types of degree higher than two

Chapter 8 Enhanced entity-relationship (EER) model

- 8.1 Subclasses, superclasses, and inheritance
- 8.2 Specialization and generalization
- 8.3 Constraints and characteristics of specialization and generalization hierarchies
- 8.4 Modeling of UNION types using categories
- 8.5 A example: EER schema, design choices, and formal definitions
- 8.6 Example of other notation: representing specialization and generalization in UML

class diagrams

Chapter 9 Relational database design by ER and EER-to-relational mapping

- 9.1 Relational database design using ER-to-relational mapping
- 9.2 Mapping EER model constructs to relations

Chapter 10 Basics of functional dependencies and normalization for relational Databases

- 10.1 Informal design guidelines for relational schemas
- 10.2 Functional dependencies
- 10.3 Normal forms based on primary keys
- 10.4 General definitions of second and third normal forms
- 10.5 Boyce-Codd normal form

Chapter 11 Relational database design algorithms and further dependencies

- 11.1 Further topics in functional dependencies: inference rules, equivalence, and minimal cover
- 11.2 Properties of relational decompositions
- 11.3 Algorithms for relational database schema design

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Ramez Elmasri and Shamkant B. Navathe “Fundamentals of Database Systems”, Fourth Edition. Pearson Addison Wesley, 2004.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2] Hector Garcia-Molina, Jeffrey D. Ullman, Jenifer Widom. “Database Systems: The complete book”, Pearson Prentice Hall, Upper Saddle River, NJ 07458.
- [3]. Abraham Silberschatz, Henry Korth, Sudarshan S. Database system concepts. 7th Edition. New York: McGraw-Hill, 2019.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Phạm Văn Cường

Nguyễn Văn Tới

DISTRIBUTED DATABASES

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Distributed databases

Mã học phần (Course code): INT1414

Số tín chỉ (Number of credits): 2

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Databases (INT1313)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 24h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 6h
- Thực hành (Lab): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about distributed database systems, including:

- Basic concepts and fundamentals in distributed databases
- Applications of a distributed database system.
- Methods to design a distributed database system.

Kỹ năng (Skills):

The aims of this course are to equip learners with skills in:

- Designing a distributed database system.
- Implementation of a distributed database system in real world.

Thái độ, Chuyên cần (Attitude):

3. Tóm tắt nội dung học phần (Description)

This course provides learners with backgrounds on distributed database systems, including

basic concepts and fundamentals of distributed databases, design process and query processing, and applications of distributed databases. In addition, the course provides knowledge on distributed and concurrent transactions to the learners as well as advanced topics on distributed database systems.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction

- 1.1. Distributed database concepts
- 1.2. Applications of distributed database systems
- 1.3. Architecture of distributed database systems
- 1.4. Transactions in distributed database systems.
- 1.5. Examples of distributed databases

Chapter 2: Distributed database design

- 2.1. Top-down design process
- 2.2. Distributed database design issues
- 2.3. Fragmentation
 - 2.3.1. Horizontal fragmentation
 - 2.3.2. Vertical fragmentation
 - 2.3.3. Hybrid fragmentation
- 2.4. Allocation
- 2.5. Bottom-up design methodology
- 2.6. Data and access control
 - 2.6.1. View management
 - 2.6.2. Data security
 - 2.6.3. Semantic integrity control

Chapter 3: Query processing

- 3.1. Query processing problems and objectives
- 3.2. Complexity of relational algebra operations
- 3.3. Characterization of query processors
- 3.4. Layers of query processing
 - 3.4.1. Query decomposition
 - 3.4.2. Data localization
 - 3.4.3. Global query optimization
 - 3.4.4. Distributed query optimization
 - 3.4.4. Distributed query execution
- 3.5. Multidatabase query processing

Chapter 4: Transaction management and concurrency control

- 4.1. Concepts and properties of transactions
- 4.2. Types of transactions
- 4.3. Distributed concurrency control
 - 4.3.1. Taxonomy of concurrency control mechanism
 - 4.3.2. Concurrency control algorithms
 - 4.3.3. Deadlock management

Chapter 5: Advanced topics on distributed databases

- 5.1. Reliability of distributed database management systems
- 5.2. Data replication
- 5.3. Parallel database systems
- 5.4. Distributed object database management
- 5.5. Peer-to-peer data management
- 5.6. Streaming data and cloud computing

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. M.Tamer Ozsü and Patrice Valduriez. *Principles of Distributed Database Systems*. Prentice Hall, 3rd edition, 2010.

5.2. Học liệu tham khảo (Optional Textbooks)

[2]. S.K Rahimi and F.S Houg. *Distributed Database Management Systems – A Practical Approach*. John Wiley & Sons, 2010.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Phạm Văn Cường

Nguyễn Đình Hoá

COMPUTER ARCHITECTURE

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Computer Architecture

Mã học phần (Course code): INT1323

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 7h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the fundamental knowledge of computer architectures and organizations, including:

- CPU and CPU components, computer instruction sets, CPU pipeline;
- memory system and its components (ROM, RAM, Cache, external storage);
- computer bus system and peripherals;
- modern computer architectures (multi-processors and multicores).

Kỹ năng (Skills):

The aim of this course is to equip students with the capability in:

- analyzing architectures of computer systems in practice;
- selecting suitable types and configurations of computer systems for practical needs.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned exercises & projects and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

This course provides students with the fundamental knowledge of computer architectures and organizations, including the general computer architecture, CPU and CPU components, computer instruction sets, the CPU pipeline; the memory system and its components of ROM, RAM, cache, disks, RAID, NAS and SAN; the computer bus system and peripherals; modern computer architectures, such as multi-processors and multicores.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction

- 1.1. Computer architecture and computer organization
- 1.2. Computer structure and component functions
- 1.3. History of computers
- 1.4. Von-Neumann and Harvard architectures
- 1.5. x86, x64 and ARM architectures
- 1.6. Numbering systems and data organization in computers

Chapter 2: Central Processing Unit (CPU)

- 2.1. General block diagram and functional units
- 2.2. Registers
- 2.3. Control Unit (CU)
- 2.4. Arithmetic and Logic Unit (ALU)
- 2.5. Internal bus system

Chapter 3: Computer Instruction Sets

- 3.1. Basic concepts
- 3.2. Instruction cycle and execution phases
- 3.3. Types of operands
- 3.4. Addressing modes
- 3.5. Common types of instructions
- 3.6. CPU Pipeline

Chapter 4: Memory System

- 4.1. Introduction to memory system
 - 4.1.1. Overview
 - 4.1.2. Memory system classification
 - 4.1.3. Memory system hierarchical structure
- 4.2. ROM and RAM
 - 4.2.1. ROM
 - 4.2.2. RAM
- 4.3. Cache memory
 - 4.3.1. What is cache?
 - 4.3.2. Cache roles and working principles
 - 4.3.3. Cache architectures
 - 4.3.4. Cache mapping methods
 - 4.3.5. Read/write methods and replacement policies
 - 4.3.6. Cache performance and affected factors
- 4.4. External memory
 - 4.4.1. Magnetic disks
 - 4.4.2. Optical disks
 - 4.4.3. SSD
 - 4.4.4. RAID
 - 4.4.5. NAS
 - 4.4.6. SAN

Chapter 5: Bus System and Peripherals

- 5.1. Bus system
 - 5.1.1. Overview
 - 5.1.2. Common types of buses
- 5.2. Computer peripherals
 - 5.2.1. Overview
 - 5.2.2. Keyboards
 - 5.2.3. Mice
 - 5.2.4. Monitors
 - 5.2.5. Printers

Chapter 6: Modern Computer Architectures

- 6.1. Multiple processor architectures
- 6.2. Multicore processor architectures
- 6.3. Intel multicore processors
- 6.4. ARM Cortex multicore processors

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] William Stallings, Computer Organization and Architecture: Designing for Performance, 10th Edition, Prentice – Hall, 2016.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2] Hoàng Xuân Dậu, Bài giảng Kiến trúc máy tính, Học viện Công nghệ Bưu chính viễn thông, 2010.
- [3] Hennesy J.L. and Patterson D.A., Computer Architecture. A Quantitative Approach, Morgan Kaufmann, 6th Edition, 2017.
- [4] Mostafa Abd-El-Barr and Hesham El-Rewini, Fundamentals of Computer Organization and Architecture, John Wiley & Sons, Inc, 2005.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/ exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Hoàng Xuân Dậu

OPERATING SYSTEMS

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Operating systems

Mã học phần (Course code): INT1319

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector
- Phòng thực hành (Laboratory): Virtual machine running DOS

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 34h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 2h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The course provides the knowledge of principles and concepts of OS and operations of computer systems in general. In particular, the course investigates common structures and characteristics of OS, its roles in computer systems, process management techniques, memory management including physical memory and virtual memory, file-related problems and file management systems.

Kỹ năng (Skills):

During the course, students will get familiar with some components of OS and identify critical requirements of those components. Students can design and build some simple OS modules.

Thái độ, Chuyên cần (Attitude):

Students are required to attend at least 80% of lectures during the course and actively participated in discussions on given topics. Also, students must fulfill lab exercises and project at the end of the course.

3. Tóm tắt nội dung học phần (Description)

The operating system course is a compulsory and fundamental which equips students with knowledge of principles and concepts of OS and operations of computer systems in general. The course does not focus on a specific operating system nor OS usage but presents to students common structures and characteristics of OS, its roles in computer systems, process management techniques, memory management including physical memory and virtual memory, file-related problems and file management systems. In addition, students will get familiar with some components of OS and can build some simple OS modules.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction to OS

- 1.1. Components of computer systems
- 1.2. OS concepts
- 1.3. OS services
- 1.4. History of OS development and OS structures

Chapter 2. Process management

- 2.1. Process & Thread concepts
- 2.2. CPU scheduling
 - 2.2.1. Scheduling criteria
 - 2.2.2. Scheduling algorithms
- 2.3. Synchronization of concurrent processes
 - 2.3.1. Critical-section problem
 - 2.3.2. Dead-lock
 - 2.3.3. Peterson's Solution
 - 2.3.4. Hardware Support
 - 2.3.5. Semaphores
 - 2.3.6. Monitors
 - 2.3.7. Evaluation

Chapter 3. File systems

- 3.1. I/O principles and access methods
- 3.2. Files & directories concepts
- 3.3. Files & directories organizations
- 3.4. File allocation methods
 - 3.4.1. Contiguous allocation
 - 3.4.2. Linked-list allocation
 - 3.4.3. Indexed allocation
 - 3.4.4. Free-space management
- 3.5. Security for file systems
- 3.6. File system examples
 - 3.6.1. Linux system
 - 3.6.2. Windows system

Chapter 4. Memory management

- 4.1. Memory addressing and program memory
- 4.2. Allocation methods
 - 4.2.1. Contiguous allocation

- 4.2.2. Paging
- 4.2.3. Segmentation
- 4.3. Virtual memory
- 4.4. Page replacement
- 4.5. Frame allocation

Project and assignment. Students are assigned a small project and work with a group of 4 persons

1. Project requirements and guidelines is presented at the beginning of the course
2. Project outcomes are revised in the middle of the course
3. Project results are presented and graded at the end of the course

Lab exercise.

Students are required to complete Lab exercises under the provision and guidance of the lecturer

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Abraham Silberschatz, Greg Gagne, Peter B Galvin - Operating System Concepts (2018, Wiley)

5.2. Học liệu tham khảo (Reference Textbooks)

- [2] Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts Essentials, 2nd Edition Wiley
- [3] Andrew S. Tanenbaum , Modern Operating Systems, 4th Edition Pearson
- [4] Từ Minh Phương, Giáo trình hệ điều hành, Học viện CN BCVT 2013
- [5] William Stallings , Operating Systems - Internals and Design Principles (2018, Pearson Education Limited)

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Project and Assignment	20%	Individual
- Mid-term exams	10%	Individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Ngô Xuân Bách

Phạm Hoàng Duy

OBJECT ORIENTED PROGRAMMING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Object Oriented Programming

Mã học phần (Course code): INT1332

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Introduction to computing and programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone, speaker, and air conditioner.
- Laboratory: Computers with NetBeans or Eclipse, JDK

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 30h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 07h
- Individual reading (tự đọc): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

On completion of this course, students will be able to develop a program with object-oriented specifications such as classes, objects, interface and so on. The advanced knowledge is about programming with graphical user interface and I/O. Students are also able to solve a real problem with the Java programming language.

Kỹ năng (Skills):

On successful completion of this course, students will:

- understand of the basic characteristics of object-oriented methodology;
- have basic object-oriented programming skills with Java language;
- be able to apply object-oriented programming method with Java to solve the practical problems.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course provides fundamental knowledge of object-oriented programming and advanced programming skills with the Java programming language. Students will be equipped with object-oriented methodology such as concept formulation, class modelling and fundamentals of object modelling technique. This course also provides students with basic to advanced skills of Java programming language.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Introduction to Java programming

- 1.1. Introduction to Java
- 1.2. Java programming steps
- 1.3. Compile and run
- 1.4. Java terminology and syntax
- 1.5. Java program template
- 1.6. Output via System.out.println() and System.out.print()
- 1.7. A simple program
- 1.8. Java program
- 1.9. Variables and operations
 - 1.9.1. Variables
 - 1.9.2. Data types
 - 1.9.3. Constants
 - 1.9.4. Type conversion
 - 1.9.5. Assignment
 - 1.9.6. Basic arithmetic operations
- 1.10. Questions and exercises

Chapter 2 Java basics

- 2.1. Basic syntaxes
 - 2.1.1. Steps in writing a Java program
 - 2.1.2. Java program template
 - 2.1.3. A sample program illustrating sequential, decision and loop constructs
 - 2.1.4. Comments
 - 2.1.5. Statements and blocks
 - 2.1.6. White spaces and formatting source code
- 2.2. Variables and types
 - 2.2.1. Variables - name, type and value
 - 2.2.2. Identifiers (or names)
 - 2.2.3. Variable declaration
 - 2.2.4. Constants (final variables)
 - 2.2.5. Expressions
 - 2.2.6. Assignment (=)
- 2.3. Primitive types and string
 - 2.3.1. Built-in primitive types
 - 2.3.2. Integers vs. floating-point numbers
 - 2.3.3. Data representation
 - 2.3.4. Maximum/minimum values of primitive number types
 - 2.3.5. One more important type - string
 - 2.3.6. Choice of data types for variables
 - 2.3.7. Literals for primitive types and string

- 2.3.8. var - local variable type inference (JDK 10)
- 2.4. Basic operations
 - 2.4.1. Arithmetic operators
 - 2.4.2. Arithmetic expressions
 - 2.4.3. Type conversion in arithmetic operations
 - 2.4.4. More on arithmetic operators
 - 2.4.5. Overflow/underflow
 - 2.4.6. More on integer vs. floating-point numbers
 - 2.4.7. Type casting
 - 2.4.8. Compound assignment operators
 - 2.4.9. Increment/decrement
 - 2.4.10. Relational and logical operators
 - 2.4.11. String and '+' concatenation operator
- 2.5. Flow control
 - 2.5.1. Sequential flow control
 - 2.5.2. Conditional flow control
 - 2.5.3. Exercises on getting started and conditional
 - 2.5.4. Loop flow control
 - 2.5.5. Terminating program
 - 2.5.6. Exercises on decision and loop
- 2.6. Input/output
 - 2.6.1. Formatted output via “printf()” (JDK 5)
 - 2.6.2. Input from keyboard via “Scanner” (JDK 5)
 - 2.6.3. Code examples
 - 2.6.4. Exercises on decision/loop with input
 - 2.6.5. Input from text file via “Scanner” (JDK 5)
 - 2.6.6. Formatted output to text file
 - 2.6.7. Input via a dialog box
 - 2.6.8. java.io.console (JDK 1.6)
- 2.7. Writing correct and good programs
 - 2.7.1. Programming errors: compilation, runtime and logical errors
 - 2.7.2. Debugging programs
 - 2.7.3. Exercises on decision/loop with input
 - 2.7.4. Testing your program for correctness
- 2.8. More on loops - nested-loops, break & continue
 - 2.8.1. Nested loops
 - 2.8.2. break and continue - interrupting loop flow
- 2.9. Questions and exercises

Chapter 3 Strings, arrays and methods

- 3.1. String and char operations
 - 3.1.1. char arithmetic operations
 - 3.1.2. Converting char to int
 - 3.1.3. String operations
 - 3.1.4. Converting string to primitive
 - 3.1.5. Converting primitive to string
 - 3.1.6. Formatting strings - string.format()
 - 3.1.7. The StringBuilder, StringBuffer and StringTokenizer classes
 - 3.1.8. Java Regex
- 3.2. Arrays
 - 3.2.1. Array index
 - 3.2.2. Array's length
 - 3.2.3. Array and loop
 - 3.2.4. Enhanced for-loop (or “for-each” Loop) (JDK 5)

- 3.2.5. Code examples: Read and print array
- 3.2.6. Multi-dimensional array
- 3.3. Methods (Functions)
 - 3.3.1. Why methods?
 - 3.3.2. Using methods
 - 3.3.3. The "return" statement
 - 3.3.4. The "void" return-type
 - 3.3.5. Actual parameters vs. formal parameters
 - 3.3.6. Pass-by-value for primitive-type parameters
 - 3.3.7. Pass-by-reference for arrays and objects
 - 3.3.8. Method overloading
 - 3.3.9. "boolean" methods
 - 3.3.10. Mathematical methods
- 3.4. Command-line arguments
 - 3.4.1. Code example: arithmetic
 - 3.4.2. Exercises on command-line arguments
- 3.5. Bitwise operations
 - 3.5.1. Bitwise logical operations
 - 3.5.2. Bit-shift operations
 - 3.5.3. Types and bitwise operations
- 3.6. Questions and exercises

Chapter 4 Introduction to object-oriented programming

- 4.1. Why OOP?
- 4.2. OOP in Java
 - 2.1. Class & instances
 - 2.2. A Class is a 3-compartment box encapsulating data and operations
 - 2.3. Class definition in java
 - 2.4. Creating instances of a class
 - 2.5. Dot (.) operator
 - 2.6. Member variables
 - 2.7. Member methods
 - 2.8. Putting them together: An OOP example
 - 2.9. Constructors
 - 2.10. Revisit method overloading
 - 2.11. The access control modifiers: public/private
 - 2.12. Information hiding and encapsulation
 - 2.13. The public getters/setters for private variables
 - 2.14. Keyword "this"
 - 2.15. Method toString()
 - 2.16. Constants (final)
 - 2.17. Putting them together in the finalized circle class
- 4.3. Examples on classes
- 4.4. Abstraction - thinking in object
- 4.5. Encapsulation
- 4.6. Class relationship
- 4.7. Questions and exercises

Chapter 5 Composition, inheritance and polymorphism

- 5.1. Composition
- 5.2. Inheritance
 - 5.2.1. Inheritance EG. 1: The circle and cylinder classes
 - 5.2.2. Method overriding & variable hiding
 - 5.2.3. Annotation @Override (JDK 1.5)

- 5.2.4. Keyword "super"
- 5.2.5. More on constructors
- 5.2.6. Default no-arg constructor
- 5.2.7. Single inheritance
- 5.2.8. Common root class - java.lang.Object
- 5.2.9. Examples
- 5.3. Composition vs. inheritance
- 5.4. Polymorphism
 - 5.4.1. Substitutability
 - 5.4.2. Polymorphism examples
 - 5.4.3. Upcasting & downcasting
 - 5.4.4. The "instanceOf" operator
 - 5.4.5. Summary of polymorphism
- 5.5. Abstract classes & interfaces
 - 5.5.1. The abstract method and abstract class
 - 5.5.2. Abstract class examples
 - 5.5.3. The Java's interface
 - 5.5.4. Interface examples
 - 5.5.5. Implementing multiple interfaces
 - 5.5.6. Interface formal syntax
 - 5.5.7. Why interfaces?
 - 5.5.8. Interface vs. abstract superclass
 - 5.5.9. Dynamic binding or late binding
- 5.6. Additional object-oriented design issues
 - 5.6.1. Encapsulation, coupling & cohesion
 - 5.6.2. "is-a" vs. "has-a" relationships
 - 5.6.3. Program at the interface specification, not the implementation
- 5.7. Questions and exercises

Chapter 6 Exception handling and I/O

- 6.1. Exception handling
 - 6.1.1. Introduction to exception handling
 - 6.1.2. Method call stack
 - 6.1.3. Exception & call stack
 - 6.1.4. Exception classes - Throwable, Error, Exception & RuntimeException
 - 6.1.5. Checked vs. unchecked Exceptions
 - 6.1.6. Exception handling operations
 - 6.1.7. try-catch-finally
 - 6.1.8. Common exception classes
 - 6.1.9. Creating your own exception classes
- 6.2. Assertion (JDK 1.4)
- 6.3. Java I/O
 - 6.3.1. The file class
 - 6.3.2. File input and output
 - 6.3.3. Character stream
 - 6.3.4. Binary stream
- 6.4. Questions and exercises

Chapter 7. Programming Graphical User Interface (GUI)

- 7.1. Introduction
- 7.2. Programming GUI with AWT
 - 7.2.1. AWT packages
 - 7.2.2. Containers and components
 - 7.2.3. AWT container classes

- 7.2.4. AWT component classes
- 7.2.5. AWT examples
- 7.3. AWT event-handling
- 7.4. Nested (Inner) classes
- 7.5. Event listener's adapter classes
- 7.6. Layout managers and panel
 - 7.6.1. FlowLayout
 - 7.6.2. GridLayout
 - 7.6.3. BorderLayout
 - 7.6.4. Using Panels as sub-container to organize components
 - 7.6.5. BoxLayout
- 7.7. Swing
 - 7.7.1. Introduction
 - 7.7.2. Swing's features
 - 7.7.3. Using swing API
 - 7.7.4. Swing program template
 - 7.7.5. Swing examples
- 7.8. Using visual GUI builder - NetBeans/Eclipse
 - 7.8.1. NetBeans
 - 7.8.2. Eclipse
- 7.9. Questions and exercises

Chapter 8 Generics and collections

- 8.1. Generic types and methods
- 8.2. Bounded type Parameters
- 8.3. Generics, inheritance, and subtypes
- 8.4. Wildcards
 - 8.5.1. Upper bounded wildcards
 - 8.5.2. Unbounded wildcards
 - 8.5.3. Lower bounded wildcards
 - 8.5.4. Wildcards and subtyping
 - 8.5.5. Wildcard capture and helper methods
- 8.5. Java collections framework overview
- 8.6. List, stack, queue
- 8.7. Sets and maps
- 8.8. Algorithms
- 8.9. Questions and exercises

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. 1. Y. Daniel Liang. Introduction to Java Programming. 10th edition, Prentice Hall, 2015.

5.2. Học liệu tham khảo (Optional Textbooks)

[2]. H. Schildt. Java: The Complete Reference. 11th edition, McGraw-Hill, 2018. Education.

[3]. The Java Tutorials, Oracle Java Documentation (<https://docs.oracle.com/javase/tutorial/>).

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual

- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination (lab)	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Hoàng Hữu Hạnh

COMPUTER NETWORKS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Computer Networks

Mã học phần (Course code): INT1336

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

C++ Programming (INT1339)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board, microphone and speaker
- Laboratory: Computers with Internet access

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures: 36h
- Exercises: 0h
- Projects: 5h
- Lab: 4h
- Individual reading: 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about computer networks, including:

- basic concepts and applications of computer networks
- the Internet's layered-architecture: application, transport, network, link and physical layers.
- design and implementation of basic network communication scenarios.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- practising with computer network tools
- designing network communication scenarios
- implementing simple network communication scenarios by using socket programming.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course provides fundamental knowledge of computer networks and focuses on the Internet. By top-down approach of the Internet's layered-architecture, the course provides important knowledge to help learners understanding how complex components of the Internet can work well together. The course's content is structured consisting five chapters as follows. Chapter 1 introduces fundamental concepts of computer networks and the Internet. Chapter 2 presents network application architectures and several popular applications on the Internet. Chapter 3 describes transport layer services with 2 protocols TCP and UDP. Chapter 4 presents network layer service models with 2 important tasks which are routing and forwarding. And final, chapter 5 presents link layer services and physical layer, consisting of multiple access links and switching in local area networks. Assignments and practice's contents are provided at the end of each chapter, in which including practical tools as well as programming several simple communication scenarios on the network.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction to computer networks

- 1.1. Basic concepts
 - 1.1.1. The Internet
 - 1.1.2. Protocol
 - 1.1.3. The network edge: access networks, physical media
 - 1.1.4. The network core: packet switching, circuit switching, a network of networks
- 1.2. Delay, Packet loss and Throughput in Packet-switched networks
- 1.3. Protocol layers and Service models
 - 1.3.1. Layered architecture
 - 1.3.2. Data encapsulation
- 1.4. Network security
- 1.5. History of Computer networks and the Internet

Chapter 2. Application layer

- 2.1. Principles of network applications
 - 2.1.1. Network application architectures
 - 2.1.2. Communicating between processes
 - 2.1.3. Transport services
- 2.2. The Web and HTTP
- 2.3. Electronic mail
- 2.4. DNS (Domain Name Systems)
- 2.5. Peer-to-peer applications
- 2.6. Video streaming and content distribution networks
- 2.7. Creating simple network applications by Socket programming

Chapter 3. Transport layer

- 3.1. Transport layer services
- 3.2. Multiplexing and demultiplexing
- 3.3. UDP: connectionless transport
- 3.4. Principles of Reliable data transfer
 - 3.4.1. Building a Reliable data transfer protocol
 - 3.4.2. Pipeline protocols: Go-Back-N and Selective repeat
- 3.5. TCP: connection-oriented transport
 - 3.5.1. The TCP connection

- 3.5.2. Structure of TCP segment
- 3.5.3. Estimating Round-trip-time and Timeout
- 3.5.4. Reliable data transfer
- 3.5.5. Flow control
- 3.5.6. TCP connection management
- 3.6. Principles of Congestion control and TCP congestion control
 - 3.6.1. Principles of Congestion control
 - 3.6.2. TCP congestion control

Chapter 4. Network layer

- 4.1. Network layer service models
- 4.2. Routing and Forwarding
- 4.3. Architecture of a Router
- 4.4. The Internet protocol (IP): IPv4 and IPv6
 - 4.4.1. Structure of IPv4 datagram
 - 4.4.2. IPv4 Addressing
 - 4.4.3. NAT: Network address translation
 - 4.4.4. IPv6
- 4.5. Routing algorithms
 - 4.5.1. Link-state
 - 4.5.2. Distance-vector
- 4.6. Routing on the Internet
 - 4.6.1. Intra-AS routing: OSPF
 - 4.6.2. Inter-AS routing: BGP
- 4.7. ICMP: Internet control message protocol
- 4.8. Network management and SNMP

Chapter 5. Link layer and physical layer

- 5.1. Link layer services
- 5.2. Error-detection and Error-correlation techniques
 - 5.3.1. Parity checks
 - 5.3.2. Checksumming methods
 - 5.3.3. CRC: Cyclic redundancy check
- 5.3. Multiple access links and protocols
 - 5.3.1. Channel partitioning protocols
 - 5.3.2. Random access protocols
 - 5.3.3. Taking-turns protocols
- 5.4. Switched local area networks
 - 5.4.1. Link layer addressing and ARP
 - 5.4.2. Ethernet
 - 5.4.3. Link layer switches
- 5.5. Data center networking
- 5.6. Summary: A cycle of a Web page request

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. J. F. Kurose & K. W. Ross. *Computer Networking: A Top-down Approach*. 7th edition, Hoboken, New Jersey: Pearson, 2017.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Andrew S. Tanenbaum and David J. Wetherall. *Computer Networks*. 5th Edition, Pearson Education, Inc., publishing as Prentice Hall, 2011.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading

Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Practice	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

PGS.TS. Phạm Văn Cường

Nguyễn Thị Thanh Thủy

SOFTWARE ENGINEERING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Software Engineering

Mã học phần (Course code): INT1340

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Introduction to computing and programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 36h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 0h
- Individual reading (tự đọc): 01h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with the understanding and skills for understanding and applying the techniques and method along the software development process, including software process, software life-cycle models, object-oriented software analysis and design tools. Learners will put this into practice by developing software from scratch.

Kỹ năng (Skills):

On successful completion of this course, a learner will be able to:

- use tools in software engineering
- apply the object-oriented analysis, design, implementation and testing technique into the development of a software

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

On completion of this course, learners will be able to understand the software process and apply it to develop a software is some basic knowledge and skills for every software engineer.

Learners will be able to follow a software project as well as to develop a software in a right way based on the software process, from requirement to analysis, design, implementation, and testing.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Scope of software engineering

- 1.1. Basic concepts
 - 1.1.1. Software
 - 1.1.2. Software engineering
 - 1.1.3. Software development
- 1.2. Scope of software engineering
 - 1.2.1. Historic aspect
 - 1.2.2. Economic aspect
 - 1.2.3. Maintenance aspect
 - 1.2.4. Team aspect
 - 1.2.5. Analysis and design aspect
 - 1.2.6. Testing aspect

Chapter 2 Software process

- 2.1. Technical view
 - 2.1.1. Requirement workflow
 - 2.1.2. Analysis workflow
 - 2.1.3. Design workflow
 - 2.1.4. Implementation workflow
 - 2.1.5. Testing workflow
- 2.2. Unified process
 - 2.2.1. Inception
 - 2.2.2. Elaboration
 - 2.2.3. Construction
 - 2.2.4. Transition
- 2.3. CMM
 - 2.3.1. CMM level 1
 - 2.3.2. CMM level 2
 - 2.3.3. CMM level 3
 - 2.3.4. CMM level 4
 - 2.3.5. CMM level 5

Chapter 3 Software life-cycle models

- 3.1. Software life-cycle model in theory
- 3.2. Software life-cycle models
 - 3.2.1. Code and fixed
 - 3.2.2. Iteration and increment
 - 3.2.3. Waterfall
 - 3.2.4. Rapid prototype
 - 3.2.5. Agile processing
 - 3.2.6. Spiral

Chapter 4 Testing, planning and estimating

- 4.1. Testing
 - 4.1.1. SQA
 - 4.1.2. Non-execution testing
 - 4.1.3. Execution-based testing
- 4.2. Planning and estimating

- 4.2.1. LOC
- 4.2.2. FFP
- 4.2.3. Function point
- 4.2.4. CoCoMo

Chapter 5 Requirement

- 5.1. Concept exploration
- 5.2. Business model
 - 5.3.1. Description in natural language
 - 5.3.2. Build general use case for the system
 - 5.3.3. Build detail use case for module
- 5.3. Case study: student project in requirement phase

Chapter 6 Analysis

- 6.1. MVC model
 - 6.1.1. Entity class
 - 6.1.2. Control class
 - 6.1.3. View class
- 6.2. Writing scenarios
 - 6.2.1. Standard scenario
 - 6.2.2. Exception scenario
- 6.3. Extracting classes
 - 6.3.1. Extracting entity classes
 - 6.3.2. Control and view classes
 - 6.3.3. Class diagram
 - 6.3.4. Sequence/collaboration diagram
- 6.4. Case study: student project in analysis phase

Chapter 7 Design

- 7.1. Database design
- 7.2. Architecture design
 - 7.2.1. MVC design
 - 7.2.2. Using CRC card
 - 7.2.3. Class candidate
- 7.3. Detail design
 - 7.3.1. Attribute and method design
 - 7.3.2. Algorithm design (SFM)
- 7.4. Case study: student project in design phase

Chapter 8 Implementation and testing

- 8.1. Code convention
 - 8.1.1. Comment
 - 8.1.2. Naming of variable, method
 - 8.1.3. Code block
 - 8.1.5. Modulo
- 8.2. Unit test
 - 8.2.1. Boundary input variable testing
 - 8.2.3. Unit test tutorial
- 8.3. Functional test
 - 8.3.1. Test case component
 - 8.3.2. Functional test plan
 - 8.3.3. Test case writing
- 8.4. Case study: student project in implementation and testing

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Stephen R. Schach. Object-Oriented and Classical Software Engineering. 8th edition,

McGraw Hill, 2010.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Brahma Dathan, Sarnath Ramnath. Object-Oriented Analysis, Design and Implementation: An Integrated Approach. 2nd edition. Springer, 2015.
- [3]. Martin Fowler. UML Distilled: A Brief Guide to the Standard Object Modeling Language. 3rd edition, Addison-Wesley Professional, 2018.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Nguyễn Mạnh Hùng

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Introduction to Artificial Intelligence

Mã học phần (Course code): INT1341

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to provide an introduction to artificial intelligence with focus on areas that have practical applications. Emphasis will be placed on learning principles, techniques and applications of artificial intelligence, not on mastering specific programming languages or software tools. The students will:

- Gain a historical perspective of AI and its objectives and functions.
- Become familiar with basic principles of AI toward problem solving, knowledge representation, probabilistic inference, and machine learning.

Kỹ năng (Skills):

Upon successful completion of this source, the students will be able to:

- Demonstrate the understanding of AI fundamentals and objectives.
- Understand and implement algorithm for search and problem solving.
- Understand basic knowledge representation and inference methods and how they can be used in AI applications.

- Understand and implement basic machine learning algorithms and apply them in solutions for machine learning applications.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces students to the basic knowledge representation, search and problem solving, and learning methods of artificial intelligence. The search and problem-solving methods are applicable throughout a large range of industrial, civil, medical, financial, robotic, and information systems. Students will study questions about AI systems such as: how to represent knowledge, how to effectively generate appropriate sequences of actions and how to search among alternatives to find optimal or near-optimal solutions. Students will also explore how to deal with uncertainty in the world and how to learn from data and experience.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction

- 1.1. Artificial intelligence definition and concepts
- 1.2. History of AI
- 1.3. Main research and application areas
- 1.4. Achievements and unsolved problems

Chapter 2. Search and problem solving

- 2.1. Solving problems by searching
- 2.2. Problem formulation
- 2.3. Uninformed search
- 2.4. Informed search
- 2.5. Local search
- 2.6. Project and exercises

Chapter 3. Knowledge representation and reasoning

- 3.1. Knowledge based systems
- 3.2. Propositional logic
- 3.3. First-order logic
- 3.4. Inference using FOL
- 3.5. Resolution refutation
- 3.6. Logic reasoning systems
- 3.7. Exercises

Chapter 4. Probabilistic reasoning

- 4.1. Knowledge representation and reasoning under uncertainty
- 4.2. Bayes rule and basics of probability
- 4.3. Bayesian networks
- 4.4. Inference with Bayesian networks
- 4.5. Project and exercises

Chapter 5. Machine learning

- 5.1. Definition and concepts of machine learning
- 5.2. Decision tree learning
- 5.3. Naive Bayes classification
- 5.4. K-nearest neighbor
- 5.5. Other machine learning algorithms

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Stuart Russell and Peter Norvig. 2009. *Artificial Intelligence: A Modern Approach* (3rd ed.). Prentice Hall Press, Upper Saddle River, NJ, USA.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Thomas M. Mitchell. 1997. *Machine Learning* (1 ed.). McGraw-Hill, Inc., New York, NY, USA.
- [3]. A. Ng. *Lecture notes for Machine learning*. <http://cs229.stanford.edu/materials.html>

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	10%	Group or individual
- Final examination	70%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Từ Minh Phương

INFORMATION SYSTEM ANALYSIS AND DESIGN

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Information System analysis and Design

Mã học phần (Course code): INT1342

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Software Engineering (INT1340)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 36h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 0h
- Individual reading (tự đọc): 01h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with knowledge and skills for object oriented software analysis and design. They include classes and relationships, software models with UML, requirement determination, analysis and design in object oriented approach. Learners will apply these skills and knowledge and make use of tools for developing software projects.

Kỹ năng (Skills):

On successful completion of this course, a learner will be able to:

- use UML diagrams for modeling software systems
- make use of tools such as VP in representing UML diagrams
- apply knowledge and skills of analysis, design and implementation for developing of software projects technique into the development of a software.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

On completion of this course, learners are able to understand and apply knowledge and skills of object-oriented paradigm to develop large scale software systems. They include classes and relationships, software models with UML, requirement determination, analysis and design in object-oriented approach.

Learners are also able to take part in software projects as well as in develop software phases from requirement determination, analysis and design as well as implementation.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Foundations for developing information systems

- 1.1. Types of information systems
- 1.2. Approaches for developing information systems
 - 1.2.1 Basic components of information system
 - 1.2.2 Principles of software development
 - 1.2.3 From structure programming to object-oriented software development
- 1.3. Basic concepts of object-oriented software systems
 - 1.3.1 Class and objects
 - 1.3.2 Methods and message
 - 1.3.3 Encapsulation
 - 1.3.3 Inheritance
 - 1.3.4 Relationship among classes
- 1.4. Reuse
- 1.5. Methodology for object-oriented software development
 - 1.5.1 Concept of methodology
 - 1.5.2 Phases of software development
 - 1.5.3 Object oriented methodology
 - 1.5.4 Unified process (UP) methodology and its variances

Chapter 2 Modeling object-oriented information systems

- 2.1. Introduction to UML
 - 2.1.1. Features of unified modeling language (UML)
 - 2.1.2. Views in UML
 - 2.1.3. Basic concepts in UML
- 2.2. Diagrams in UML
 - 2.2.1. Hierarchy of UML diagrams
 - 2.2.2. Use case
 - 2.2.3. Class and relationship
 - 2.2.4. Sequence diagram
 - 2.2.5. Communication diagram
 - 2.2.6. Activity diagram
 - 2.2.7. Package and deployment diagram
- 2.3. Tools and technologies for information development
- 2.4. Case study

Chapter 3 Requirement Determination

- 3.1. Steps in requirement determination
- 3.2. Business perspective
 - 3.2.1. Identifying business actors and use cases
 - 3.2.2. Writing glossary
 - 3.2.3. Illustrating use cases on activity and sequence diagrams
- 3.3. Developer perspective
 - 3.3.4. Specializing actors
 - 3.3.5. Use case relationships

- 3.3.6. Scenarios
- 3.3.7. Prioritizing use cases
- 3.3.8. User interface sketches
- 3.4. Case study
- Chapter 4 Requirement analysis**
- 4.1. Analysis process
- 4.2. Static analysis
 - 4.2.1. Finding classes
 - 4.2.2. Identifying class relationships
 - 4.2.3. Drawing class diagrams
 - 4.2.4. Attributes
- 4.3. Dynamic analysis
 - 4.3.1. Identifying boundary, controller and entity classes
 - 4.3.2. Drawing sequence diagrams
 - 4.3.3. Adding operations/methods to classes
 - 4.3.4. Identifying methods based on responsibility
 - 4.3.5. State diagram
- 4.4. Case study

Chapter 5 Designing System Architecture

- 5.1. Steps in system design
- 5.2. Network technology/topology selection
 - 5.2.1. Distributed architecture types
 - 5.2.2. Technologies of tiers for system development
- 5.3. Partitioning software system
- 5.4. Package and deployment diagrams for system architecture
- 5.5. Case study

Chapter 6 Designing Subsystems

- 6.1. Steps in subsystem design
- 6.2. Mapping the analysis class model into the design class model
 - 6.2.1. Mapping operations
 - 6.2.2. Types and visibility of attributes
 - 6.2.3. Mapping classes, attributes and relationships
- 6.3. Mapping class diagram into database schema
 - 6.3.1. Database management systems
 - 6.3.2. Relational model
 - 6.3.3. Mapping entity classes
 - 6.3.4. Mapping relationships
- 6.4. Designing user interfaces
- 6.5. Case study

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Mike O'Docherty, Object-Oriented Analysis and Design: Understanding System Development with UML 2.0, Publisher John Wiley & Sons, 2005

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. A. Dennis, B. Wixom and D. Tegarden, System Analysis Design UML 2.0: an object-oriented approach, Publisher John Wiley & Sons, Fourth Edition, 2012

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual

- Mid-term exercises/exams	10%	Individual
- Projects	20%	Group
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Nguyễn Mạnh Hùng

WEB PROGRAMMING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Web Programming

Mã học phần (Course code): INT1434

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites): Object-Oriented Programming (INT1332)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: computers, network, internet

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 9h
- Thực hành (Lab): 6h
- Individual reading: 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with knowledge in web programming, including:

- developing web applications in both client-side and server-side using the languages such as HTML/JavaScript/Java/Servlet/JSP;
- being familiar with Java-based framework such as STRUTS, SPRING.

Kỹ năng (Skills)

The aim of this course is to equip learners with skills in:

- using the popular languages such as HTML, JavaScript, Java/Servlet/JSP to develop a web application.
- developing small/medium web applications or join web application projects with developer's role.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

The aim of this course is to provide learners with the knowledge/skills about developing web-based applications, including the client-side (HTML, CSS, JavaScript) as well as server-side (Java Servlet, JSP, JDBC). Students also will be familiar with Java-based frameworks such as STRUTS and SPRING.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Web programming outline

- 1.1. WWW and basic concepts
- 1.2. Overview of web programming
 - 1.2.1. Web programming languages
 - 1.2.2. Web programming support technologies
 - 1.2.3. Web application deployment
- 1.3. HTML language
- 1.4. Client-side programming
- 1.5. Server-side programming
- 1.6. In-out in Java review
- 1.7. Case-study: Student groups propose the selected web application project.

Chapter 2 Client-side programming with HTML/CSS and JavaScript

- 2.1. Introduction to HTML/CSS
- 2.2. CSS syntax and how to insert CSS into HTML
- 2.3. Components of CSS
- 2.4. JavaScript language
 - 2.4.1. Variable declaration in JavaScript
 - 2.4.2. Function and Class in JavaScript
 - 2.4.3. Objects in JavaScript
- 2.5. Events in JavaScript
- 2.6. Form processing in JavaScript
- 2.7. DOM HTML processing in JavaScript
- 2.8. Web page designing with Dreamweaver
- 2.9. Case-study: Student groups create the web interfaces for project using HTML/CSS and JavaScript

Chapter 3 Server-side programming with Servlet/JSP and JDBC

- 3.1. Introduction to Servlet and JSP
- 3.2. Basic syntax in JSP
 - 3.2.1. Basic JSP tags
 - 3.2.2. include direction
 - 3.2.3. import direction
 - 3.2.4. Create and comlile website with Tomcat
- 3.3. Session and cookies
- 3.4. JSP custom tags
- 3.5. JDBC
 - 3.5.1. JDBC driver and connect to DB
 - 3.5.2. java.sql library
- 3.6. MVC application model
- 3.7. Web application development based on MVC
- 3.8. Case-study: Student groups develop project functions using JSP/JDBC/MVC

Chapter 4 J2EE web application development framework

- 4.1. J2EE overview
- 4.2. Introduction to XML
- 4.3. J2EE web application development framework overview
- 4.4. SPRING
 - 4.4.1. Introduction to SPRING
 - 4.4.2. Main components of SPRING

- 4.4.3. Web application development with SPRING
- 4.4.4. Case-study: Student groups implement the project functions using SPRING
- 4.5. STRUTS
 - 4.5.1. Introduction to STRUTS
 - 4.5.2. Main components of STRUTS
 - 4.5.3. Web application development with STRUTS
 - 4.5.4. Case-study: Student groups implement the project functions using STRUTS

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] H. M. Deitel, P. J. Deitel, T. R. Nieto. *Internet - World Wide Web How To Program*, 5th Edition 2011.
- [2] J. Murach, M. Urban. *Murach's Java Servlet and JSP*. 3rd Edition, 2014.

5.2. Học liệu tham khảo (Optional Textbooks)

- [1] Nicholas S. Williams. *Professional Java for Web Applications*. Wrox, 1st edition, 2014.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term test	20%	individual
- Projects	20%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Phạm Văn Cường

Dương Trần Đức

FUNDAMENTALS OF INFORMATION SECURITY

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Fundamentals of Information Security

Mã học phần (Course code): INT1472

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Computer Networks (INT1336)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory: LAN computers with internet connection.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the basic knowledge about information security and information systems security, including:

- security requirements, general security model, security threats, common computer/network attacks and malwares;
- techniques and technologies to secure information and systems;
- information security management, laws and policies.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- analyzing of security threats and risks to information and information systems;
- selecting suitable security measures to protect information and information systems in practice.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

This course provides students with basic knowledge about information security and information systems security, including security requirements, general protection model of information systems, security threats, common computer/network attacks and malwares; Techniques and technologies to secure information and systems, such as information security based on cryptographic techniques, access control and user authentication, firewalls, intrusion detection and prevention systems; Information security management, laws and policies.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Introduction

- 1.1. Overview of information security
 - 1.1.1. What is information security?
 - 1.1.2. Components of information security
- 1.2. Overview of information systems security
 - 1.2.1. Components of an information system
 - 1.2.2. What is information systems security?
- 1.3. Requirements of information systems security
 - 1.3.1. Confidentiality
 - 1.3.2. Integrity
 - 1.3.3. Availability
- 1.4. Areas of information technology infrastructure and security threats
 - 1.4.1. Sven areas of information technology infrastructure
 - 1.4.2. Security threats
- 1.5. General model for information systems security
 - 1.5.1. Defense in Depth model
 - 1.5.2. Protection layers of Defense in Depth model

Chapter 2 Common Attacks and Malwares

- 2.1. Introduction to security threats, weaknesses, vulnerabilities and attacks
 - 2.1.1. Concepts of security threats, weaknesses, vulnerabilities and attacks
 - 2.1.2. Types of common security threats
 - 2.1.3. Common vulnerabilities in operating systems and software applications
 - 2.1.4. Types of attacks
- 2.2. Attacking support tools
 - 2.2.1. Weakness and vulnerability scanners
 - 2.2.2. Service port scanners
 - 2.2.3. Sniffing tools
 - 2.2.4. Key-loggers
- 2.3. Common computer and network attacks
 - 2.3.1. Overview
 - 2.3.2. Common attacks
- 2.4. Common computer and network malwares
 - 2.4.1. Overview
 - 2.4.2. Common malwares

Chapter 3 Cryptographic Techniques for Information Security

- 3.1. Introduction to cryptography and its applications
 - 3.1.1. Common concepts
 - 3.1.2. Elements of a cryptosystem
 - 3.1.3. History of cryptography
 - 3.1.4. Stream ciphers and block ciphers

- 3.1.5. Applications of cryptography
- 3.2. Cryptographic methods
- 3.3. Cryptographic algorithms
 - 3.3.1. Symmetric key ciphers
 - 3.3.2. Asymmetric key ciphers
 - 3.3.3. Hash functions
- 3.4. Digital signatures, public key certificates and PKI
 - 3.4.1. Digital signatures
 - 3.4.2. Public key certificates
 - 3.4.3. PKI
- 3.5. Key management and key distribution
 - 3.5.1. Overview
 - 3.5.2. Secret key distribution
 - 3.5.3. Public key distribution
- 3.6. Secure communication protocols based on cryptographic techniques
 - 3.6.1. SSL/TLS
 - 3.6.2. SET
 - 3.6.3. PGP

Chapter 4 Techniques and Technologies for Information Security

- 4.1. Access control
 - 4.1.1. Overview
 - 4.1.2. Access control models
 - 4.1.3. Access control technologies
- 4.2. Firewalls
- 4.3. IDS and IPS
 - 4.3.1. Overview
 - 4.3.2. IDS/IPS classification
 - 4.3.3. Intrusion detection techniques
- 4.4. Anti-malware tools

Chapter 5 Information security management, laws and policies

- 5.1. Information security management
 - 5.1.1. Overview
 - 5.1.2. Risk assessment
 - 5.1.3. Detailed risk analysis
 - 5.1.4. Implementation of information security management
- 5.2. Information security management standards
- 5.3. Laws and Policies in information security
 - 5.3.1. Overview of information security laws and policies
 - 5.3.2. International information security laws
 - 5.3.3. Vietnamese information security laws
- 5.4. Ethics in information security

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Michael E. Whitman, Herbert J. Mattord, Principles of information security, 4th edition, Course Technology, Cengage Learning, 2012.
- [2] David Kim, Michael G. Solomon, Fundamentals of Information Systems Security, Jones & Bartlett learning, 2012.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3] Hoàng Xuân Dâu, Bài giảng An toàn bảo mật hệ thống thông tin, Học viện Công nghệ Bưu chính viễn thông, 2017.

[4] Matt Bishop, Introduction to Computer Security, Prentice Hall, 2004.

[5] Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, October 1996.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Hoàng Xuân Dậu

Hoàng Xuân Dậu

MOBILE APPLICATION DEVELOPMENT

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Mobile Application Development

Mã học phần (Course code): INT1449

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

- Databases (INT1313)
- Object-Oriented Programming (INT1332)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: Desktop Computer, Android Studio Installed, Android Devices

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 30h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 07h
- Individual reading (tự đọc): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about the characteristics of programming environments on mobile devices, understand programming languages compatible with mobile devices with different operating systems and to equip the ability to build applications and services on mobile devices.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned processes and techniques for developing a mobile application for Android and for mobile Cross Platform.
- developing and delivery a mobile application.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to basic knowledge about the basic concepts, classification, history, basic characteristics of mobile devices, mobile programming environment and the process & techniques of development of mobile application. On completion of this course learners will be able to follow the mobile application project as well as to develop a mobile application from requirement to delivery.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Overview of mobile application development

- 1.1. Introduction to mobile device
 - 1.1.1. Concept of mobile device
 - 1.1.2. Classification of mobile device
 - 1.1.3. History of formation and development of mobile device
 - 1.1.4. Basic characteristics of mobile device
- 1.2. Introduction to mobile eco-system
 - 1.2.1. Operators
 - 1.2.2. Networks
 - 1.2.3. Devices
 - 1.2.4. Platforms
 - 1.2.5. Operating systems
 - 1.2.6. Application frameworks
 - 1.2.7. Applications
 - 1.2.8. Services
- 1.3. Introduction to Process of mobile application development
 - 1.3.1. Concept
 - 1.3.2. Requirement analysis
 - 1.3.3. Planning
 - 1.3.4. Development
 - 1.3.5. Testing
 - 1.3.6. Delivery
- 1.4. Introduction to mobile operating system
 - 1.4.1. Concept
 - 1.4.2. Classification
 - 1.4.3. Basic characteristics
- 1.5. Introduction to programming languages for mobile applications
 - 1.5.1. C++
 - 1.5.2. Java
 - 1.5.3. C#
- 1.6. Set up a mobile application programming environment (Android)
 - 1.6.1. Concept of Android operating system
 - 1.6.2. Basic characteristics of Android operating system
 - 1.6.3. Architecture of the Android operating system
 - 1.6.4. Android application components
- 1.7. Basic knowledge of mobile application programming language (Java)
 - 1.7.1. Character set, keywords, names
 - 1.7.2. General structure
 - 1.7.3. Concept, classification of data types
 - 1.7.4. Variables, constants, operations
 - 1.7.5. Input, output and control
 - 1.7.6. Class, object
 - 1.7.7. Inheritance and polymorphism

- 1.7.8. Standard library
- 1.8. Process of programming mobile applications
 - 1.8.1. Initialize the application
 - 1.8.2. Write a program
 - 1.8.3. Build a program
 - 1.8.4. Run a program and debug

Chapter 2: Basic Android application programming

- 2.1. Programming mobile application lifecycle management
 - 2.1.1. Mobile application lifecycle
 - 2.1.2. Programming mobile application lifecycle management
- 2.2. Activities and Intents
 - 2.2.1. Understanding Activities
 - 2.2.2. Linking Activities using Intents
 - 2.2.3. Calling Built-in Applications using Intents
 - 2.2.4. Displaying notification
- 2.3. Interface programming
 - 2.3.1. Understanding Android User Interface
 - 2.3.2. Design Interface with Views and ViewGroup
 - 2.3.3. Displaying pictures and menu with View
- 2.4. Data management
 - 2.4.1. Shared Preferences
 - 2.4.2. Read and write with file
 - 2.4.3. Relational database
 - 2.4.4. Content providers
- 2.5. Case Study: Create basic Android app

Chapter 3: Advanced Android application programming

- 3.1. Messaging and networking
 - 3.1.1. SMS messaging
 - 3.1.2. Sending email
 - 3.1.3. Wifi
 - 3.1.4. Bluetooth
- 3.2. Location – based services
 - 3.2.1. Displaying map
 - 3.2.2. Getting location data
- 3.3. Audio, video, and using the camera
 - 3.3.1. Audio
 - 3.3.2. Video
 - 3.3.3. Camera
- 3.4. Hardware sensors
 - 3.4.1. Sensors manager
 - 3.4.2. Monitoring device's movement and orientation
- 3.5. Developing Android service
 - 3.5.1. Creating your own services
 - 3.5.2. Communicating between a service and an activity
 - 3.5.3. Binding activities to services
- 3.6. Publishing Android application
 - 3.6.1. Preparing for publishing
 - 3.6.2. Deploying APK files
- 3.7. Case Study: Create Android application with advanced features

Chapter 4: Developing cross-platform applications

- 4.1. Concept, classification of multi-platform mobile applications
- 4.2. Introduction to cross-platform mobile application development frameworks
- 4.3. Build a cross-platform mobile application using a framework

- 4.3.1. Set up multi-platform mobile application programming environment
- 4.3.2. Multi-platform source sharing techniques
- 4.3.3. Multi-platform mobile application programming
- 4.4. Case Study: Create cross-platform application

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Wei-Meng Lee. *Beginning Android 4 Application Development*. John Wiley & Sons, Inc, 2012.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Brian Fling. *Mobile design and development*. O'Reilly Media, 2009.
- [3]. Reto Meier. *Professional Android 4 Application Development*. John Wiley & Sons, Inc, 2012.
- [4]. Scott Olson, John Hunter, Ben Horgen, Kenny Goers. *Professional Cross-Platform Mobile Development in C#*. John Wiley & Sons, Inc, 2012

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Hoàng Hữu Hạnh

SOFTWARE PROJECT MANAGEMENT

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Software Project Management

Mã học phần (Course code): INT1450

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 36h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 9h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide knowledge of software project management, including software development processes, roles of members and groups as well as responsibility in organizing, managing and developing a software project to learners.

Kỹ năng (Skills)

The aims of this course are to equip learners with skills in:

- Teamwork
- Problem solving
- Presentation
- Management

Thái độ, Chuyên cần (Attitude):

3. Tóm tắt nội dung học phần (Description)

The course provides learners the knowledge of software project management and applications that is an essential knowledge for software engineers. The course includes the first chapter of overview, followed by 9 chapters relating to knowledge areas of software management: role of project manager, planning and project integration management, project

scope management, project scheduling management, project cost management, project risk and change management, project resource management, project communication management and control, project quality management, and ends up with the final phase in the chapter 11st.

On completion of this course learners will be able to manage development processes of software as well as toward be able go further to get a project management professional (PMP) certification if the learners will have experienced more real projects after the course.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Overview

- 1.1 Course Introduction
- 1.2 Project Management (PM) Fundamentals
- 1.3 The PM field and job market
- 1.4 People, process, product, technology
- 1.5 Classic mistakes
- 1.6 PMI processes
- 1.7 Software project phases
- 1.8 Organizational structures

Chapter 2 Role of the project manager

- 2.1. Overview of project manager
- 2.2. Role of project manager
- 2.3. Project manager's skill and influence

Chapter 3 Planning and project integration management

- 3.1. Development lifecycle to projects
- 3.2. Initiation and planning
- 3.3. Project integration management
- 3.4. Project charter and statement of work

Chapter 4 Project scope management

- 4.1. Overview of scope management
- 4.2. Work breakdown structure
- 4.3. Estimation

Chapter 5 Project scheduling management

- 5.1. Project scheduling fundamentals
- 5.2. Scheduling techniques including network diagram
- 5.3. Compression techniques

Chapter 6 Project cost management

- 6.1. Budgeting
- 6.2. Project selection
- 6.3. NPV, ROI, payback analysis models

Chapter 7 Project risk and change management

- 7.1. Risk management
- 7.2. Change control
- 7.3. Configuration management

Chapter 8 Project resource management

- 8.1. Roles in project team
- 8.2. Team models
- 8.3. Team development

8.4. Leadership

Chapter 9 Project communication management and control

9.1. Project stakeholder management

9.2. Status reporting

9.3. Project metrics

9.4. Earning value analysis

9.5. Communication Techniques

Chapter 10 Project quality management

10.1. Quality management by project testing

10.2. Quality management by quality assurance officers activities

Chapter 11 Final phases and other issues

11.1. Project success

11.2. Documentation

11.3. Migration to new systems

11.4. Post project reviews and closing

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] A guide to the project management body of knowledge (PMBOK® Guide), Sixth Edition, Project Management Institute, 2017

[2] Lecture Note in software project management, version 1.2, Nguyen Quynh Chi, Posts and Telecommunications Institute of Technology, 2018

5.2. Học liệu tham khảo (Optional Textbooks)

[3] Mulcahy, Rita. PMP Exam Prep (9th Edition), RMC Publishing, 2019

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
Attendance	10%	Individual
Projects	30%	Group
Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Phạm Văn Cường

Nguyễn Quỳnh Chi

NETWORK PROGRAMMING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Network Programming

Mã học phần (Course code): INT1433

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Introduction to computing and programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: computer with Java IDE, internet/intranet connection

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- | | |
|--------------------------------|-----|
| - Lectures (lí thuyết): | 30h |
| - Exercises (bài tập): | 0h |
| - Projects (bài tập lớn): | 08h |
| - Lab (thực hành): | 07h |
| - Individual reading (tự đọc): | 0h |

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about network programming including:

- basic concepts and fundamental tasks in Network Programming
- implement different important network protocol, such as HTTP, SMTP, FTP

- applications in Network Programming with TCP, UDP

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to build network applications using different models, like Client/Server, System distributed

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

The aim of this course is to provide learners with the knowledge and skills related to network programming. The learners will study about Socket, RMI, JDBC, how to implement different network protocols and so on. Learners will put this into practice by developing an application. On completion of this course learners will be able to understand how a network-based application work and how to develop such applications from low level, without using ready-to-use libraries.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Basic Network Programming concepts

1.1. Computer Networks

1.1.1. OSI model

1.1.2. TCP/IP model

1.2. Network Application Architecture

1.2.1. Standalone architecture

1.2.2. Client – server architecture

1.2.3. Distributed application

1.2.4. Peer-to-peer architecture

1.2.5. Multi-tier architecture

1.3. Multithread in Network Application

1.4. Overview of Java (Python) language

1.5. Case Study: Group discussion to determine the objective of final project

Chapter 2 Socket

2.1. Socket Overview

2.2. Socket TCP and Socket UDP

2.3. Socket TCP programming for Server

2.4. Socket TCP programming for Client

2.5. Socket UDP programming

2.6. Secure Sockets

2.7. Case Study: Building application with Socket TCP and UDP

Chapter 3 Working with Database

3.1. Overview

3.1.1. Database Connection

3.1.2. SQL Driver

3.2. Query and Statement

3.2.1. Statement and ResultSet

3.2.2. PreparedStatement

3.2.3. Other classes

3.3. Case study: Building an application following MVC using JDBC to connect Database

Chapter 4 Application layer programming

4.1 Application protocols, HTTP

4.2. FTP, SMTP, DNS

4.3. Case study: Building an application implement a protocol in the application layer

Chapter 5 Nonblocking I/O

5.1. An Example Client and Server

5.2. Buffers

5.2.1. Creating Buffers

5.2.2. Filling and Draining

5.2.3. Bulk Methods

5.2.4 Data Conversion

5.2.5. View Buffers

5.2.6. Compacting Buffers

5.2.7 Object Methods

5.3. Channels

5.3.1. SocketChannel

5.3.2. ServerSocketChannel

5.3.3. The Channels Class

5.3.4. Asynchronous Channels

5.3.5. Socket Options

Chapter 6 Broadcast and Multicast

6.1 Multicasting

- 6.1.1. Multicast Addresses and Groups
- 6.1.2. Clients and Servers
- 6.1.3. Routers and Routing
- 6.2. Working with Multicast Sockets
 - 6.2.1. The Constructors
 - 6.2.2. Communicating with a Multicast Group
- 6.3. Case study: Building application with Multicast

Chapter 7 Remote Procedure Call

- 7.1. Distributed programming
- 7.2 RMI techniques
 - 7.2.1. Architecture
 - 7.2.2. RMI for Server
 - 7.2.3. RMI for Client
 - 7.2.4. Registration and look up remote object
- 7.3. Case Study: Building application with RMI and DB

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

1. E. R. Harold, “Java Network Programming”, 4th edition, O’Reilly, 2013

5.2. Học liệu tham khảo (Suggested Textbooks)

2. G.Reese. *Database Programming with JDBC and Java*. O’Reilly, 2003.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần – (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

SOFTWARE ARCHITECTURE AND DESIGN

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Software Architecture and Design

Mã học phần (Course code): INT1427

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Information System analysis and Design (INT1342)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 36h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 0h
- Individual reading (tự đọc): 01h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with advanced knowledge and skills of software architecture and design patterns. They include types of component based software architecture and technology, design patterns and representation of patterns in UML. Learners will be able to apply these skills and knowledge to developing large scaled software projects and improve their quality. In addition, learners are able to enhance skills of team working and understand documents of software designs.

Kỹ năng (Skills):

On successful completion of this course a learner will be able to:

- represent architecture and design patterns in UML
- apply knowledge, technology and skills of component based architecture and patterns for developing software and improving quality

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

On completion of this course, learners are be able to understand and apply advanced knowledge, skills and technologies of architecture and design patterns in developing large-scale software systems.

Learners are also able to understand component-based software architecture and technologies and design patterns in constructing as well as in improving software quality in reality.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Introduction

- 1.1. Complexity of software
- 1.2. Software architecture
- 1.3. Architecture and design patterns
 - 1.3.1 Architecture
 - 1.3.2 Design patterns
- 1.3. Technologies for constructing architecture & patterns

Chapter 2 Architecture design and modeling

- 2.1. Architecture design process
- 2.2. Principles of architecture design
- 2.3. Architecture types
 - 2.3.1. Client-server architecture type
 - 2.3.2. Component-based architecture type
 - 2.3.3. Domain-oriented architecture type
 - 2.3.4. N-Layer architecture type
 - 2.3.5. Service-oriented architecture type
- 2.4. Architecture modeling
 - 2.4.1. Architecture type and modeling
 - 2.4.2. Techniques of architecture modeling
 - 2.4.3. Architecture type modeling with UML
- 2.5. Case study

Chapter 3 Architecture and technology based on component

- 3.1. Introduction to component-oriented software development
- 3.2. Component architecture with UML
 - 3.2.1. Component model
 - 3.2.2. Connection model
 - 3.2.3. Deployment model
- 3.3. Component technology with J2EE
 - 3.3.1. EJB and J2EE architecture
 - 3.3.2. Component model of EJB
 - 3.3.3. Connection model of EJB
 - 3.3.4. Deployment model of EJB
- 3.4. Case study

Chapter 4 Architecture & design pattern

- 4.1. What are design patterns?
- 4.2. Categorization of design patterns
 - 4.2.1. Creational patterns
 - 4.2.2. Structural patterns
 - 4.2.3. Behavioral patterns
- 4.3. Creational patterns
 - 4.3.1. Factory method
 - 4.3.2. Abstract factory
 - 4.3.3. Builder

- 4.3.4. Prototype
- 4.3.5. Singleton
- 4.4. Structural patterns
 - 4.4.1. Adapter
 - 4.4.2. Bridge
 - 4.4.3. Decorator
 - 4.4.4. Chain of responsibility
 - 4.4.5. Façade
- 4.5. Behavioral patterns
 - 4.5.1. Command
 - 4.5.2. Strategy
 - 4.5.3. State
 - 4.5.4. Mediator
 - 4.5.5. Observer

4.6. Case study

Chapter 5 Application architecture design

- 5.1. Winform application architecture design
 - 5.1.1. Characteristics of winform application
 - 5.1.2. MVC for winform application
- 5.2. Webform application architecture design
 - 5.2.1. Characteristics of webform application
 - 5.2.2. MVC for webform application
- 5.3. Application architecture design for mobile device
 - 5.3.1. Characteristics of mobile device application
 - 5.3.2. MVC for application on mobile device
- 5.4. Case study

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. L. Bass et al., Software architecture in practice, Third Edition, Edison Wesley, 2013

[2] P. Kuchana, Software architecture Design Patterns in Java, Auerbach Publisher, 2004

5.2. Học liệu tham khảo (Optional Textbooks)

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Mạnh Hùng

Nguyễn Mạnh Hùng

SOFTWARE QUALITY ASSURANCE

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Software quality assurance

Mã học phần (Course code): INT1416

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Software Engineering (INT1340)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 36h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 08h
- Lab (thực hành): 0h
- Individual reading (tự đọc): 01h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with background of software quality assurance and applying reviewing and testing techniques during software development process.

On completion of this course, learners will be able to follow software quality assurance activities for the software development process, from review requirement to review analysis, review design, review source code, and testing.

Kỹ năng (Skills):

On successful completion of this course a learner will:

1. Understand concepts related to software quality assurance, software development process quality standards.
2. Understand the reviewing, testing technologies in each stage of the software development process.
3. Apply the learned knowledge to execute reviewing, testing during software development.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

The aim of this course is to provide learners the background of software quality assurance, the process of software quality assurance and testing, the techniques of important activities in software quality assurance, including: reviewing, testing. Besides, the course provides the standards of software quality assurance.

On completion of this course, learners will be able to follow a software quality assurance and testing process for a software project as well as to execute reviewing, testing activity during develop a software in a right way based on the software quality assurance process, from requirement to analysis, design, implementation, and testing.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction of software quality assurance

- 1.1. What is software?
- 1.2. Classification of the causes of software errors
- 1.3. Software quality assurance – definition and objective
- 1.4. Software quality factors.
- 1.5. Factors affecting intensity of quality assurance

Chapter 2: Integrating quality activities in the project life cycle

- 2.1. Software development methodologies
- 2.2. Testing level
 - 2.2.1. Introduction
 - 2.2.2. Unit test
 - 2.2.3. Integration test
 - 2.2.4. System test
 - 2.2.5. Acceptance test
- 2.3. A model of SQA defect removal effectiveness and cost.
- 2.4. Create SQA plan

Chapter 3: Reviews

- 3.1. Review objectives
- 3.2. Formal review
- 3.3. Peer reviews
- 3.4. Implementation of reviews activity in projects
 - 3.4.1. Reviewing requirement specification
 - 3.4.2. Reviewing design document
 - 3.4.3. Reviewing development plan and SQA plan
- 3.4 Excercise

Chapter 4: Blackbox testing

- 4.1. Definition and objectives
- 4.2. Software testing process
- 4.3. Blackbox testing techniques
 - 4.3.1. Equivalence partitioning technique
 - 4.3.2. Boundary value analysis technique
 - 4.3.3. Decision table technique
 - 4.3.4. State transition testing technique
 - 4.3.5. Pairwise testing technique
- 4.4. Exercice

Chapter 5: Whitebox testing

5.1. Objectives

5.2. Whitebox testing technique

5.2.1. Control flow testing technique

5.2.2. Data flow testing technique

5.3. Automation unit test

5.4. Exercise

Chapter 6: SQA tools

6.1. SQA management tools

6.2. Unit testing tool

6.3. Automated functional testing tool

6.4. Performance testing tool

6.5. Security testing tool

6.6. Applying SQA tools in projects

Chapter 7: Standards in SQA management

7.1. The scope of quality management standards

7.2. SQA in ISO standard

7.3. SQA in CMM, CMMI standard

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Murali Chemuturi. *Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers*. J. Ross Publication Inc., 2011.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Neil Walkinshaw, *Software Quality Assurance Consistency in the Face of Complexity and Change*, Springer Nature, 2017.
- [3] Stephen Vance. *Quality Code: Software Testing Principles, Practices, and Patterns*. Addison-Wesley Professional, 2013.
- [4]. Paul Ammann and Jeff Offutt. *Introduction to Software Testing*. Cambridge University Press, 2016.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Đỗ Thị Bích Ngọc

SERVICE ORIENTED SOFTWARE DEVELOPMENT

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Service-oriented Software Development

Mã học phần (Course code): INT1448

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.

- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 36h

- Exercises (bài tập): 0h

- Projects (bài tập lớn): 08h

- Lab (thực hành): 0h

- Individual reading (tự đọc): 01h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications
Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course discusses the basic concepts, theories, and techniques for service-oriented computing, standards related to Web services, approaches for the description, discovery, and composition of Web services. The course includes introduction of two main approaches in development/deployment of web services (SOAP and RESTful), the different between the approaches will also be detailed. The course aims to formulate the foundational concepts of services, to evaluate existing approaches, and to present existing techniques from other areas that can be adopted for services. Emerging techniques for addressing challenges that are unique to services will be discussed in this course.

Kỹ năng (Skills):

On completion of this course learners will be able to develop a service oriented software based on SOAP or REST approaches.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

Service-oriented Computing (SOC) is the new promising cross-disciplinary area of distributed computing that represent heterogeneous distributed software applications as collection of services or software agents which can communicate freely with each other. The course aims to provides the knowledge, including theory and practice, in order to design, develop, architect and consume software applications or components. The main contents of course are the principle technologies like Web Services, Service-oriented architecture, core Web Services standards (SOAP, WSDL, and UDDI), Software as a Service.

This course seeks to discuss the key concepts for service-oriented computing. Its intent is to formulate the foundational concepts of services, to evaluate existing approaches, and to present existing techniques from other areas that can be adopted for services, and lastly to introduce emerging techniques for addressing challenges that are unique to services.

4. Nội dung chi tiết học phần (Outlines)**Chapter 1 Web services basics**

- 1.1. Introduction
- 1.2. SOA architecture principles
- 1.3. Types of web services

Chapter 2 XML basics

- 2.1. XML documents
- 2.2. Document type definition's (DTD's)
- 2.3. Xml schema definition (XSD)

Chapter 2 SOAP Web service

- 2.2. SOAP - service invocation
- 2.3. Service description (WSDL)
- 2.4. Service publication and discovery (UDDI)
- 2.5. Service composition (BPEL)
- 2.6. SOA platforms
- 2.7. Case Study: Building service-based web/application with JAX-WS

Chapter 3 REST service with JSON

- 3.1. Introduction to REST and JSON
- 3.2. Designing a REST service
- 3.3. Microservices
- 3.4. Case Study: Building service-based web/application with JAX-RS

Chapter 4 Service design pattern

- 4.1. Web service API styles
- 4.2. Client-service interaction styles

- 4.3. Request and response management
- 4.4. Web service implementation styles
- 4.5. Web service infrastructures
- 4.6. Case Study: Building service-based web/application with a specific platform

Chapter 5 As a service paradigm

- 5.1. Cloud computing
- 5.2. Software as a service (SaaS)
- 5.3. Infrastructure as a service (IaaS)
- 5.4. Platform as a service (PaaS)
- 5.5. Everything as a service (XaaS)

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

1. M. Papazoglou. Web Services and SOA: Principles and Technology, 2nd Edition. 2012

5.2. Học liệu tham khảo (Optional Textbooks)

2. Robert Daigneau. Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTful Web Services. Addison-Wesley Signature. 2011

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Nguyễn Trọng Khánh

DISTRIBUTED SYSTEMS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Distributed systems

Mã học phần (Course code): INT1405

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- | | |
|--------------------------------|-----|
| - Lý thuyết (Lectures): | 36h |
| - Bài tập (Exercises): | 0h |
| - Bài tập lớn (Projects): | 9h |
| - Thực hành (Lab): | 0h |
| - Tự học (Individual reading): | 0h |

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aims of this course are to provide learners with fundamental knowledge about distributed systems, including:

- Basic concepts and fundamentals in distributed systems
- Architectures and designs of a distributed system.

Kỹ năng (Skills):

The aims of this course are to equip learners with skills in:

- Distributed system design and coding.
- Fluency in web services, RMI, COBRA.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects

3. Tóm tắt nội dung học phần (Description)

This course provides learners with backgrounds on distributed systems, including basic concepts and fundamental issues of distributed systems such as processes, communications,

synchronization, consistency, fault toleration and security. In addition, applications of distributed systems and distributed system design techniques and methods are introduced to learners.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction

- 1.1. Definition of a distributed system
- 1.2. Types of distributed systems
 - 1.2.1. Distributed computing systems
 - 1.2.2. Distributed information systems
 - 1.2.3. Distributed pervasive systems
- 1.3. Characteristics and design goals of distributed systems
- 1.4. Architectures of distributed systems
 - 1.4.1. Architectural styles
 - 1.4.2. System architectures
 - 1.4.3. Architecture versus middleware
- 1.5. Distributed system models
 - 1.5.1. Physical models
 - 1.5.2. Architectural models
 - 1.5.3. Fundamental models

Chapter 2: Fundamental issues in distributed systems

- 2.1. Processes
 - 2.1.1. Threads
 - 2.1.2. Virtualization
 - 2.1.3. Clients and Servers
- 2.2. Communication
 - 2.2.1. Fundamentals
 - 2.2.2. Remote procedure call
 - 2.2.3. Message-oriented communication
 - 2.2.4. Stream-oriented communication
 - 2.2.5. Multicast communication
- 2.3. Naming
 - 2.3.1. Names, Identifiers, Addresses
 - 2.3.2. Flat naming
 - 2.3.3. Structured naming
 - 2.3.4. Attribute-based naming
- 2.4. Synchronization
 - 2.4.1. Clock synchronization
 - 2.4.2. Logical clocks
 - 2.4.3. Mutual exclusion
 - 2.4.4. Global positioning of nodes
 - 2.4.5. Election algorithms
- 2.5. Consistency and replication
 - 2.5.1. Data-centric consistency models
 - 2.5.2. Client-centric consistency models
 - 2.5.3. Replica management
 - 2.5.4. Consistency protocols
- 2.6. Fault tolerance
 - 2.6.1. Process resilience
 - 2.6.2. Reliable client-server communication
 - 2.6.3. Reliable group communication
 - 2.6.4. Distributed commit
 - 2.6.5. Recovery

- 2.7. Security
 - 2.7.1. Secure channels
 - 2.7.2. Access control
 - 2.7.3. Security management

Chapter 3: Distributed systems in practice

- 3.1. Distributed object-based systems
 - 3.1.1. Architecture
 - 3.1.2. Processes
 - 3.1.3. Communication
 - 3.1.4. Naming
 - 3.1.5. Synchronization
 - 3.1.6. Consistency and replication
 - 3.1.7. Fault tolerance
 - 3.1.8. Security
- 3.2. Distributed file systems
 - 3.2.1. Architecture
 - 3.2.2. Processes
 - 3.2.3. Communication
 - 3.2.4. Naming
 - 3.2.5. Synchronization
 - 3.2.6. Consistency and replication
 - 3.2.7. Fault tolerance
 - 3.2.8. Security
- 3.3. Distributed Web-based systems
 - 3.3.1. Architecture
 - 3.3.2. Processes
 - 3.3.3. Communication
 - 3.3.4. Naming
 - 3.3.5. Synchronization
 - 3.3.6. Consistency and replication
 - 3.3.7. Fault tolerance
 - 3.3.8. Security
- 3.4. Distributed coordination-based systems
 - 3.4.1. Architecture
 - 3.4.2. Processes
 - 3.4.3. Communication
 - 3.4.4. Naming
 - 3.4.5. Synchronization
 - 3.4.6. Consistency and replication
 - 3.4.7. Fault tolerance
 - 3.4.8. Security

Chapter 4: Technologies and approaches for distributed systems

- 4.1. COBRA
- 4.2. RMI
- 4.3. Web services
- 4.4. Service-oriented architecture

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. A. S. Tanenbaum, M. V. Steen. *Distributed Systems: Principles and Paradigms*. Prentice Hall, 2nd edition, 2007.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. G. Coulouris, J. Dollimore, T. Kinberg, G. Blair. *Distributed systems: Concept and Design*. Addison-Wesley, 5th Edition, 2012.
- [3]. N.M. Josuttis. *SOA in Practice – The Art of Distributed System Design*. O'Reilly, 2007.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Phạm Văn Cường

Nguyễn Đình Hoá

HUMAN COMPUTER INTERACTION

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Human Computer Interaction

Mã học phần (Course code): INT1460

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 36h
- Bài tập (Exercises): 4h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The course provides an introduction to human computer interaction (HCI), which focusses on the understanding of HCI concepts, design, and frameworks. In addition, the course also provides an understanding of new developments and trends of HCI such as the interactions based on Voice-guided, virtual reality, and wearables. The students will:

- Gain a historical perspective of HCI and its objectives.
- Become familiar with fundamental backgrounds of HCI toward the development of interactive systems.

Kỹ năng (Skills):

Upon successful completion of this source, the students will be able to:

- Understand the HCI scope, goals, and design process
- Can use tools for designing a simple HCI system.
- Can apply the knowledge of HCI to design and implement simple interactive systems.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course starts with the introduction to the basic HCI knowledge: concepts, scope, goals; Next, the course will provide the background of HCI design, including HCI principles, human factors and design, to students. In addition, common HCI frameworks are introduced to students for understanding the underlying of HCI systems such as human gestures, language and vision understanding, and multimodality. Finally, students will also explore some recent trends of HCI.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction to Human Computer Interaction

1.1. Basic concepts

- 1.1.1. What is Human Computer Interaction (HCI)

- 1.1.2. User interface

- 1.1.3. HCI benefits

1.2. HCI scope

- 1.2.1. Use & context

- 1.2.2. Human factors

- 1.2.3. Computers

- 1.2.4. Interaction

- 1.2.5. Development Process

1.3. HCI goals

- 1.3.1. Safety

- 1.3.2. Utility

- 1.3.3. Effectiveness

- 1.3.4. Usability

- 1.3.5. Appeal

Chapter 2: Human Factors and HCI Design

2.1. Principles of HCI

- 2.1.1. Know the user

- 2.1.2. Understand the task

- 2.1.3. Reduce memory load

- 2.1.4. Strive for consistency

- 2.1.5. Remind user and refresh their memory

- 2.1.6. Prevent error and reverse actions

- 2.1.7. Naturalness

2.2. Human factors

- 2.2.1. Task modeling and human problem-solving model

- 2.2.2. Human reaction and prediction of cognitive performance

- 2.2.3. Visual

- 2.2.4. Aural

- 2.2.5. Tactile and haptic

- 2.2.6. Single and multimodal interaction

2.3. HCI Design

- 2.3.1. Design process

- 2.3.2. Requirement analysis

- 2.3.3. User analysis

- 2.3.4. Scenario and task modeling

- 2.3.5. Interface design

- 2.3.5. Input and Output at low-level

- 2.3.5. Input and output processing

2.4. A project example

Chapter 3: Interactive Frameworks

- 3.1. Gestures
 - 3.1.1. Wearable based gesture recognition
 - 3.1.2. Sensor-free gesture recognition
- 3.2. Language understanding
 - 3.3.1. Text vs. voice commands
 - 3.3.2. Audio speech recognition
 - 3.3.3. Naïve vs. stochastic semantics
- 3.4. Image recognition and understanding
 - 3.4.1. Face and facial expression detection
 - 3.4.2. User attention recognition
 - 3.4.3. People and object detection and tracking
 - 3.4.4. Human action and context recognition
- 3.5. Multimodal interaction
 - 3.5.1. Multimodal input
 - 3.5.2. Multimodal Output
 - 3.5.3. Vision, audio and tactician
 - 3.5.4. Multimodal fusion
- 3.6. A project assignment

Chapter 4: Advanced Topics on HCI

- 4.1. Voice guided interface
 - 4.1.1. Voice triggers
 - 4.1.2. Dependencies and devices
 - 4.1.3. Exercise
- 4.2. Virtual/Augmented Reality
 - 4.2.1. Head-worn and mounted display
 - 4.2.2. Hand-held display
 - 4.2.3. Project display
 - 4.2.4. Spatial augmented reality
 - 4.2.5. Input devices
 - 4.2.6. Exercise
- 4.3. Wearables
 - 4.3.1. Visible wearable technology
 - 4.3.2. Non-obtrusive wearable technology
 - 4.3.3. The Internet-of-Things (IoT) based wearables
 - 4.3.4. Exercise

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Gerard Jounghyun Kim. *Human Computer Interaction: fundamentals and practice*. CRC Press, 2014.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Jeff Johnson. *Designing with the Mind in Mind: simple guide to understanding user interface design rules*. MK press. 2010.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual

- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Phạm Văn Cường

EMBEDDED SYSTEM DEVELOPMENT

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Embedded System Development

Mã học phần (Course code): INT1461

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker, black board or white board.

- Phòng thực hành (Laboratory): Computers

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h

- Bài tập (Exercises): 8h

- Bài tập lớn (Projects): 0h

- Thực hành (Labs): 4h

- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with the fundamentals of embedded systems, including:

- basic concepts and fundamental tasks in embedded system development
- embedded system development models
- various kinds of embedded systems

Kỹ năng (Skills):

Learners will learn skills to develop various kinds of embedded systems using Arduino platform. These skills consist of:

- analyzing the requirement of an embedded system.
- designing hardware and software architecture of the system.
- evaluating the system.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes, do exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course is focused on giving the learners practical embedded system development process and hands-on projects with Andruino platform. The learner will learn how to implement software configuration management and develop embedded software applications. Course assignments include creating various kinds of applications using C++ language on Arduino-based processors. On completion of this course, the learners will be able to understand the fundamentals of embedded systems as well as to develop a working embedded system.

4. Nội dung chi tiết học phần (Outlines)**Chapter 1: Introduction to Embedded Systems****1.1. Basic concepts**

- 1.1.1. Embedded systems
- 1.1.2. Processor
- 1.1.3. Embedded hardware
- 1.1.3. Embedded software

1.2. Embedded system design

- 1.2.1. Examples of embedded systems
- 1.2.2. Embedded system-on-chip and Use of VLSI circuit design technology
- 1.2.3. Complex system design and processor
- 1.2.4. Design process in embedded system
- 1.2.5. Formalization of system design
- 1.2.6. Design process and design examples
- 1.2.7. Classification of embedded systems
- 1.2.8. Skill required for an embedded system designer

Chapter 2: Introduction to Arduino Platform**2.1. Getting started with Arduino**

- 2.1.1. Introduction
- 2.1.2. Arduino Variants
- 2.1.3. Install the drivers
- 2.1.4. Arduino IDE

2.2. Basic functions

- 2.2.1. Overview
- 2.2.2. Structure
- 2.2.3. Digital I/O functions
- 2.2.4. Analog I/O functions
- 2.2.5. Advanced I/O functions
- 2.2.6. Timer functions
- 2.2.7. Communication functions
- 2.2.8. Interrupt functions
- 2.2.9. Math functions
- 2.2.10. Programming language reference

Chapter 3: Using Sensor with Arduino**3.1. Introduction****3.2. Analog sensors**

- 3.2.1. Light sensitive sensors
- 3.2.2. Temperature sensors
- 3.2.3. Gas sensor
- 3.2.4. Analog sound sensor
- 3.2.5. Triple axis acceleration sensor

- 3.2.6. Joystick module
- 3.3. Digital sensor
 - 3.3.1. Digital Tilt sensor
 - 3.3.2. Digital temperature sensor
 - 3.3.3. Digital Infrared motion sensor
 - 3.3.4. Digital ultrasonic
 - 3.3.5. Digital vibration sensor
- 3.4 Case study: student projects on sensor reading

Chapter 4: Electromechanical Control using the Arduino

- 4.1. DC motor
 - 4.1.1. Overview
 - 4.1.2. Driven circuit design
- 4.2. Stepper motor
 - 4.2.1. Overview
 - 4.2.2. Working principle of stepper motor
 - 4.2.3. Driven circuit design
 - 4.2.4. Demonstration
- 4.3. Servo setting
 - 4.3.1. Overview
 - 4.3.2. Driven circuit design
- 4.4 Case study: student projects on motor controlling

Chapter 5: Wireless Control using the Arduino

- 5.1. Infrared Transmitter and Receiver module
 - 5.1.1. Introduction
 - 5.1.2. IR transmitter/receiver module
 - 5.1.3. IR Kit
- 5.2. 2.4G Wireless radio frequency module
 - 5.2.1. Introduction
 - 5.2.2. 2.4G Wireless RF transmitter module
 - 5.2.3. Demonstration
- 5.3. Bluetooth module
 - 5.3.1. Introduction
 - 5.3.2. HC-05 module
 - 5.3.3. Modify HC-05 module default using a command
- 5.4. GSM/GPRS module
 - 5.4.1. Introduction
 - 5.4.2. A6 GSM/GPRS module
 - 5.4.3. Demonstration
- 5.5. Wifi module
 - 5.5.1. Introduction
 - 5.5.2. Wi-fi module
 - 5.5.3. Demonstration
- 5.6. Case study: Student project on wireless communication

Chapter 6: Embedded System Applications

- 6.1. PM2.5/Air Quality Monitor using Arduino
 - 6.1.1. Introduction
 - 6.1.2. System design
 - 6.1.3. Production demonstration
- 6.2. Intelligent Lock System using Arduino
 - 6.2.1. Introduction
 - 6.2.2. System design

6.2.3. Production demonstration

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Embedded systems – Raj Kamal, Tata McGraw-Hill Education, 2011, ISBN: 0070667640.

[2] Designing Embedded Systems with Arduino – Tianhong Pan and Yi Zhu, Springer Singapore, 2018, ISBN: 978-981-13-5131-0.

5.2. Học liệu tham khảo (Reference Textbooks)

[3] Making Embedded Systems: Design Patterns for Great Software - Elecia White, O'Reilly Media, Inc, 2011, ISBN: 1449302149.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Vũ Hoài Nam

SECURE SOFTWARE DEVELOPMENT

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Secure Software Development

Mã học phần (Course code): INT1463

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Tự chọn (Elective)

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker
- Laboratory: LAN computers with Virtual machine running Linux

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 34h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 6h
- Thực hành (Labs): 5h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with basic knowledge about analyzing software security requirements as well as designing and implementing software securely; methods for security software testing and secure software development integration.

Kỹ năng (Skills):

After completing the course, students master the knowledge about developing secure software; students are capable of analyzing and verifying security requirements and incorporating them into the process of developing and implementing software projects that ensure the security requirements.

Thái độ, Chuyên cần (Attitude):

Students are required to attend at least 80% of lectures during the course and actively participated in discussions on given topics. Also, students must fulfill lab exercises and project by the end of the course.

3. Tóm tắt nội dung học phần (Abstract) (5- 6 dòng)

The course provides basic knowledge of how to collect and analyze security requirements in software development. In addition, the course introduces security design and implementation as well as assessing the security response level of software. Finally, the course presents methods and tools to facilitate the integration between the security software development process (SSD) and the common software development process (SDLC).

4. Nội dung chi tiết học phần (Outlines)

Chapter 5. Overview of secure software development (SSD)

- 5.1. Software security requirements and challenges
- 5.2. Current and future risks of insecurity
- 5.3. Effect of network environment
- 5.4. Security issues of the programming language

Chapter 6. Analyzing software security requirements

- 6.1. Collect requirements
- 6.2. Functional and non-functional security requirements
- 6.3. Mapping vulnerable components
- 6.4. Evaluation of requirements

Chapter 7. Design and implementation

- 7.1. Design
- 7.2. Implementation
- 7.3. Class level security issues
- 7.4. Procedure level security
- 7.5. Evaluation of design and implementation

Chapter 8. Software security testing

- 8.1. Static analysis
- 8.2. Dynamic analysis
- 8.3. Testing security requirements
- 8.4. Evaluation of test results

Chapter 9. Combining SSD and SDLC

- 9.1. Develop plan responding to security incidents
- 9.2. Final evaluation of security
- 9.3. Building culture in software development
- 9.4. Tools to support SSD and SDLC combination

Project and assignment. Students are assigned a small project and work with a group of 4 persons

- 4. Project requirements and guidelines is presented at the beginning of the course
- 5. Project outcomes are revised in the middle of the course
- 6. Project results are presented and graded at the end of the course

Lab exercise.

Students are required to complete Lab exercises under the provision and guidance of the lecturer

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Theodor Richardson, Charles N. Thies, *Secure Software Design*, Jones & Bartlett Learning, 2013.

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Mark Dowd; John McDonald; Justin Schuh, *The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities*, Addison-Wesley Professional, 2006.

[3] Michael Howard, Steve Lipner, *The Security Development Lifecycle: SDL: A Process for Developing Demonstrably More Secure Software*, Microsoft Press, 2006.

[4] Mano Paul, *The 7 Qualities of Highly Secure Software*, CRC Press, 2012.

[5] Asoke K. Talukder, Manish Chaitanya, *Architecting Secure Software Systems*, Auerbach, 2009.

[6] Ian Sommerville, *Software Engineering (9th Edition)*, Addison-Wesley, 2010.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects and Assignment	20%	Group or Individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Hoàng Xuân Dậu

Phạm Hoàng Duy

SOFTWARE ENGINEERING GRADUATION MODULE 1

1. Thông tin về học phần (General Information)

Tên học phần (Course name): SOFTWARE ENGINEERING GRADUATION MODULE 1

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Data structure and algorithm (INT13064)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory: Computer with C/C++ or Java IDE, internet/intranet connection to submit

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lectures (lí thuyết): 20h
- Exercises (bài tập): 0h
- Projects (bài tập lớn): 30h
- Lab (thực hành): 10h
- Individual reading (tự đọc): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to summarize the foundational knowledge of information technology subjects through programming, including:

- summary of algorithm knowledge through programming.
- summary of knowledge about data structures through programming.
- summary of knowledge about programming techniques through programming.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the foundational knowledge in solving specific problems of computer science.
- applying all the foundational programming techniques to solve specific problems of computer science.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course summarizes the entire knowledge of foundations of information technology through programming. Learners must have a solid knowledge of discrete mathematics, data structures, algorithms to solve problems. In addition, learners are also required to have good programming skills on different programming languages such as C, C ++, Java or Python to solve practical problems in computer sciences.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Generation algorithm model

- 1.1. Introduction
- 1.2. Basic problems
- 1.3. Intermediate problems
- 1.4. Hard problems
- 1.5. Summarization

Chapter 2. Recursion algorithm model

- 2.1. Introduction
- 2.2. Basic problems
- 2.3. Intermediate problems
- 2.4. Hard problems
- 2.5. Summarization

Chapter 3. Backtracking algorithm model

- 3.1. Introduction
- 3.2. Basic problems
- 3.3. Intermediate problems
- 3.4. Hard problems
- 3.5. Summarization

Chapter 4. Greedy algorithm model

- 4.1. Introduction
- 4.2. Basic problems
- 4.3. Intermediate problems
- 4.4. Hard problems
- 4.5. Summarization

Chapter 5. Divide and conquer algorithm model

- 5.1. Introduction
- 5.2. Basic problems
- 5.3. Intermediate problems
- 5.4. Hard problems
- 5.5. Summarization

Chapter 6. Dynamic programming model

- 6.1. Introduction
- 6.2. Basic problems
- 6.3. Intermediate problems
- 6.4. Hard problems
- 6.5. Summarization

Chapter 7. Stack based programming

- 7.1. Introduction
- 7.2. Basic problems
- 7.3. Intermediate problems
- 7.4. Hard problems

7.5. Summarization

Chapter 8. Queue based programming

8.1. Introduction

8.2. Basic problems

8.3. Intermediate problems

8.4. Hard problems

8.5. Summarization

Chapter 9. Tree based programming

9.1. Introduction

9.2. Basic problems

9.3. Intermediate problems

9.4. Hard problems

9.5. Summarization

Chapter 10. Graph based programming

10.1. Introduction

10.2. Basic problems

10.3. Intermediate problems

10.4. Hard problems

10.5. Summarization

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. M. Main, W. Savitch, Data Structures and Other Objects Using C++ (4th Edition) 4th Edition, 2010.

[2]. Donald E. Knuth, “The Art of Programming”, Addison-Wesley Publishing Company, 2005.

5.2. Học liệu tham khảo (Optional Textbooks)

[3]. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 3rd Edition, the MIT Press, 2009.

[4]. Bradley N. Miller, “Problem Solving with Algorithms and Data Structures Using Python, 2nd Edition, 2011

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

Nguyễn Duy Phương

SOFTWARE ENGINEERING GRADUATION MODULE 2

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Software Engineering graduation module 2

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Information System analysis and Design (INT1342)
- Software quality assurance (INT1416)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- | | |
|--------------------------------|-----|
| - Lectures (lí thuyết): | 20h |
| - Exercises (bài tập): | 0h |
| - Projects (bài tập lớn): | 40h |
| - Lab (thực hành): | 0h |
| - Individual reading (tự đọc): | 0h |

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with knowledge and skills for object oriented software analysis, design and software quality assurance. They include classes and relationships, software models with UML, requirement determination, analysis and design in object oriented approach. Learners will apply these skills and knowledge and make use of tools for developing software projects. They also understand the standards of software quality assurance, the techniques of testing, reviewing for each phase of software development process.

Kỹ năng (Skills):

On successful completion of this course, a learner will be able to:

- use UML diagrams for modeling software systems
- make use of tools such as VP in representing UML diagrams
- apply knowledge and skills of analysis, design and implementation for developing of software projects technique into the development of a software.

- Apply the learned knowledge to execute reviewing, testing during software development

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

On completion of this course, learners are able to understand and apply knowledge and skills of object-oriented paradigm to developing large scale software systems and software quality assurance, applying reviewing and testing techniques during software development process are compulsory for current software engineers.

Learners are also able to take part in software projects as well as in develop software phases from requirement determination, analysis, design, implementation as well as following software quality assurance activities for the software development process, from review requirement to review analysis, review design, review source code, and testing.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Software development process

- 1.1. Scope of software engineering
 - 1.1.1. Software
 - 1.1.2. Software development
- 1.2. Software development life-cycle
 - 1.2.1. Object-oriented software development process
 - 1.2.2. Software life-cycle models
 - 1.2.3. Tools for software development

Chapter 2 Software quality assurance process

- 2.1. Software quality assurance
 - 2.1.1. The aspects in SQA
 - 2.1.2. Standards in SQA
- 2.2. SQA during software development process
 - 2.2.1. Quality assurance in requirement phase
 - 2.2.2. Quality assurance in analysis phase
 - 2.2.3. Quality assurance in design phase
 - 2.2.4. Quality assurance in implementation phase

Chapter 3 Requirement and analysis

- 3.1. Requirement
 - 3.1.1. Concept exploration
 - 3.1.2. Business perspective
 - 3.1.3. Developer perspective
- 3.2. Requirement analysis
 - 3.2.1. Static analysis
 - 3.2.2. Dynamic analysis
- 3.3. Case study: student project in requirement and analysis phase

Chapter 4 Design

- 4.1. Database design
- 4.2. Architecture design
 - 4.2.1. MVC design
 - 4.2.2. Using CRC card
 - 4.2.3. Class candidate
- 4.3. Detail design
 - 4.3.1. Attribute and method design
 - 4.3.2. Algorithm design (SFM)
- 4.4. Case study: student project in design phase

Chapter 5 Testing

- 5.1. Testing processes
 - 5.1.1. Unit test
 - 5.1.2. Integrated test
 - 5.1.3. System test
 - 5.1.5. Acceptance test
- 5.2. Generation of testcase
 - 5.2.1. Blackbox testing
 - 5.2.3. Whitebox testing
- 5.3. Testing life-cycle
 - 5.3.1. Basic testing life-cycle
 - 5.3.2. Error report writing
 - 5.3.3. Result analysis
 - 5.3.4. Tools for testing
- 5.4. Case study: student project in testing

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Mike O'Docherty, Object-Oriented Analysis and Design: Understanding System Development with UML 2.0, Publisher John Wiley & Sons, 2005
- [2]. Murali Chemuturi. *Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers*. J. Ross Publication Inc., 2011.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. A. Dennis, B. Wixom and D. Tegarden, System Analysis Design UML 2.0: an object-oriented approach, Publisher John Wiley & Sons, Fourth Edition, 2012
- [4]. Paul Ammann and Jeff Offutt. Introduction to Software Testing. Cambridge University Press, 2016.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	20%	Individual
- Mid-term projects/exams	20%	Group
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Nguyễn Mạnh Hùng

Giảng viên biên soạn
(Lecturer)

Nguyễn Mạnh Hùng

PYTHON PROGRAMMING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Python Programming

Mã học phần (Course code): INT_E14119

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board
- Laboratory: Computers

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to teach learners fundamental skills in the python programming language, including:

- Data types
- Control flows
- Functions and classes
- Practical projects

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- developing better programming skills.
- designing a python program to solve a problem in computer science.
- thinking and building applications that work in python.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

Python is a very powerful programming language used for many different applications.

This course provides students with a fundamental understanding of programming in python by creating a variety of applications for the Web and for system development. In particular, we will cover topics that include data types, control flow, object-oriented programming, as well as graphical user interface-driven applications. Students will have a chance to apply these basic concepts into several practical projects, i.e. games, data visualization, and web applications.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction

- 1.1. Python history
- 1.2. Getting started
 - 1.2.1. Installing python
 - 1.2.2. Installing text editor
- 1.3. ‘Helloworld.py’ program

Chapter 2: Variable and simple data types

- 2.1. Variables
- 2.2. Strings
- 2.3. Numbers
- 2.4. Comments

Chapter 3: Lists

- 3.1. Definition
- 3.2. Changing, adding, and removing elements
- 3.3. Organizing a list
- 3.4. Avoiding index error
- 3.5. Looping through an entire list
- 3.6. Making numerical lists
- 3.7. Working with part of a list
- 3.8. Tuples

Chapter 4: If Statement

- 4.1. A simple example
- 4.2. Conditional tests
- 4.3. If statement
- 4.4. If statement with lists

Chapter 5: Dictionaries

- 5.1. A simple dictionary
- 5.2. Working with dictionaries
- 5.3. Looping through a dictionary
- 5.4. Nesting

Chapter 6: User input and while loop

- 6.1. How the input() function work
- 6.2. Introducing while loop
- 6.3. Using a while loop with lists and dictionaries

Chapter 7: Functions

- 7.1. Defining a function
- 7.2. Passing arguments
- 7.3. Return values
- 7.4. Passing a list

- 7.5. Passing an arbitrary number of arguments
- 7.6. Storing your function in a module

Chapter 8: Classes

- 8.1. Creating and using a class
- 8.2. Working with classes and instances
- 8.3. Inheritance
- 8.4. Importing classes
- 8.5. The python standard library

Chapter 9: File and exceptions

- 9.1. Reading from a file
- 9.2. Writing to a file
- 9.3. Exceptions
- 9.4. Storing data

Chapter 10: Projects

- 10.1. Alien invasion
 - 10.1.1. A ship that fires bullets
 - 10.1.2. Aliens
 - 10.1.3. Scoring
- 10.2. Data visualization
 - 10.2.1. Generating data
 - 10.2.3. Downloading data
 - 10.2.3. Working with APIs
- 10.3. Web applications
 - 10.3.1. Getting started with Django
 - 10.3.2. User accounts
 - 10.3.3. Styling and deploying an app

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Eric Matthes. *Python crash course: a hands-on, project-based introduction to programming*, No Starch Press, 2016.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, O'Reilly, 2015
- [3]. Zed A. Shaw, *Learn Python 3 the Hard Way*, Addison-Wesley, 2016

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

Ngô Xuân Bách

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Văn Thủy

INTRODUCTION TO DATA SCIENCE

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Introduction to Data Science

Mã học phần (Course code): INT_E14120

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with basic knowledge about data science and methods for data processing and analytics, including:

- data processing (data gathering, data cleaning, data scaling and normalization, data reduction and transformation, SQL)
- data visualization
- methods for data analytics (prediction/classification/clustering/recommendation)

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to process and analyze some types of data
- evaluation of data analytic models.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to basic knowledge about data science (data, data types, hypothesis, and statistical hypothesis testing) and methods for data processing and analytics, including data preparation (data gathering, data cleaning, data scaling and normalization, data reduction and transformation), data visualization, and data prediction/classification/clustering/recommendation models. The course also teaches students how to evaluate data analytic models.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Preliminaries

- 1.1. Introduction
- 1.2. Linear algebra review
 - 1.2.1. Vectors
 - 1.2.2. Matrices
- 1.3. Probability review
 - 1.3.1. Dependence and independence
 - 1.3.2. Conditional probability and Bayes' theorem
 - 1.3.3. Random variables
 - 1.3.4. Continuous distributions
 - 1.3.5. The Normal distribution
- 1.4. Hypothesis
 - 1.4.1. Statistical hypothesis Testing
 - 1.4.2. Confidence intervals
 - 1.4.3. Examples

Chapter 2: Data Preparation

- 2.1. Getting data
- 2.2. Data type portability
- 2.3. Data cleaning
 - 2.3.1. Handling missing entries
 - 2.3.2. Handling incorrect and inconsistent entries
- 2.4. Scaling and normalization
- 2.5. Data reduction and transformation
 - 2.5.1. Sampling
 - 2.5.2. Feature subset selection
 - 2.5.3. Dimensionality reduction
- 2.5. Projects

Chapter 3: Data Visualization

- 3.1. Simple line plots
- 3.2. Simple scatter plots
- 3.3. Visualizing errors
- 3.4. Density and contour plots
- 3.5. Histograms, bins, and density
- 3.6. Multiple subplots
- 3.7. Text and annotation
- 3.8. Three-dimensional plotting
- 3.9. Geographic data

Chapter 4: Machine Learning

- 4.1. Basic concepts
 - 4.1.1. Learning and inference
 - 4.1.2. Model evaluation
 - 4.1.3. Overfitting and underfitting

- 4.1.4. Bias and variance
- 4.2. Feature engineering
 - 4.2.1. Categorical features
 - 4.2.2. Text features
 - 4.2.3. Image features
 - 4.2.4. Derived features
- 4.3. Supervised learning
- 4.4. Unsupervised learning
- 4.5. Semi-supervised learning
- 4.6. Ensemble learning
- 4.7. Projects

Chapter 5: Databases and SQL

- 5.1. Basics
 - 5.1.1. CREATE TABLE and INSERT
 - 5.1.2. UPDATE
 - 5.1.3. DELETE
 - 5.1.4. SELECT
 - 5.1.5. GROUP BY
 - 5.1.6. ORDER BY
 - 5.1.7. JOIN
- 5.2. Beyond basics
 - 5.2.1. Subqueries
 - 5.2.2. Query Optimization
 - 5.2.3. NoSQL

Chapter 6: Recommender Systems

- 6.1. Introduction to recommender systems
- 6.2. Content-based filtering
- 6.3. Collaborative filtering
 - 6.3.1. User-based collaborative filtering
 - 6.3.2. Item-based collaborative filtering
 - 6.3.3. Matrix factorization
- 6.4. Hybrid recommender systems
- 6.5. Context-aware recommender systems
- 6.6. Session-based recommendation

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Joel Grus. *Data Science from Scratch: First Principles with Python*. O'Reilly Media, 2nd edition, 2019.
- [2]. Jake VanderPlas. *Python Data Science Handbook: Essential Tools for Working with Data*. O'Reilly Media, 2017.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. Charu C. Aggarwal. *Data Mining: The Textbook*. Springer International Publishing Switzerland, 2015.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual

- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Ngô Xuân Bách

MACHINE LEARNING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Machine Learning

Mã học phần (Course code): INT_E14121

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Algebra (BAS1201)
- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to provide an introduction to machine learning algorithms and applications. The students will:

- Become familiar with fundamental concepts of machine learning and current achievements in this area.
- Gain knowledge of important machine learning algorithms including supervised learning (generative/discriminative learning, parametric/non-parametric learning, support vector machines); unsupervised learning (clustering, dimensionality reduction); and learning theory (bias/variance tradeoffs).
- Gain an application perspective of machine learning.

Kỹ năng (Skills):

Upon successful completion of this source, the students will be able to:

- Demonstrate the understanding of machine learning fundamental concepts, including potential applications.
- Understand and implement representative algorithms for supervised and unsupervised learning.
- Implement solutions for some real world applications using machine learning software or library.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

Machine learning explores the study and construction of algorithms that learn from data in order to make inferences about future outcomes. This course provides a broad introduction to algorithms and applications of machine learning. Topics include supervised learning (generative/discriminative learning, parametric/non-parametric learning, support vector machines); unsupervised learning (clustering, dimensionality reduction); and learning theory (bias/variance tradeoffs). The course will also discuss applications of machine learning, such as data mining, pattern recognition, and text and web data processing.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction

- 1.1. Machine learning definition and concepts
- 1.2. Types of learning
 - 1.2.1. Supervised learning
 - 1.2.2. Unsupervised learning
 - 1.2.3. Reinforcement learning
- 1.3. Components of a machine learning system
 - 1.3.1. Learning phase
 - 1.3.2. Prediction phase

Chapter 2. Linear regression

- 2.1. Simple linear regression
- 2.2. Multiple linear regression
- 2.3. Other considerations in the regression model
- 2.4. Project and Lab

Chapter 3. Logistic regression

- 3.1. An overview of classification
- 3.2. The logistic model
- 3.3. Estimating the regression coefficients
- 3.4. Making predictions
- 3.5. Multiple logistic regression
- 3.6. Logistic regression for multiple response classes
- 3.7. Project and lab

Chapter 4. Resampling Methods

- 4.1. Cross-validation
 - 4.1.1. The validation set approach
 - 4.1.2. Leave-One-Out Cross-validation
 - 4.1.3. k-Fold Cross-validation
 - 4.1.4. Bias-Variance Trade-off for k-Fold Cross-validation

- 4.1.5. Cross-Validation on classification problems
- 4.2. The bootstrap

Chapter 5. Tree-based methods

- 5.1. The basics of decision trees
 - 5.1.1. Regression and classification trees
 - 5.1.2. Tree versus linear models
 - 5.1.3. Advantages and disadvantages of tree models
- 5.2. Bagging, random forests, boosting
 - 5.2.1. Bagging
 - 5.2.2. Random forests
 - 5.2.3. Boosting
- 5.3. Project and Lab

Chapter 6. Support vector machines

- 6.1. Max-margin classifiers
- 6.2. Support vector classifiers
- 6.3. Support vector machines
- 6.4. SVMs with multiple classes
- 6.5. Project and Lab

Chapter 7. Principal component analysis

- 7.1. What are principal components
- 7.2. Interpretation of principal components
- 7.3. More on PCA
- 7.4. Other uses for principal components

Chapter 8. Clustering

- 8.1. K-Means clustering
- 8.2. Hierarchical clustering
- 8.3. Practical issues
- 8.4. Project and Lab

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2014. *An Introduction to Statistical Learning: With Applications in R*. Springer Publishing Company, Incorporated.
- [2]. Shai Shalev-Shwartz and Shai Ben-David. 2014. *Understanding Machine Learning: From Theory to Algorithms*. Cambridge University Press, New York, NY, USA.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. Hal Daumé III. A Course in Machine Learning. <http://ciml.info/>.
- [4]. A. Ng. *Lecture notes for Machine learning*. <http://cs229.stanford.edu/materials.html>

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	10%	Group or individual

- Final examination	70%	Individual
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**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Ngô Xuân Bách

Từ Minh Phương

INTRODUCTION TO DEEP LEARNING

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Introduction to Deep Learning

Mã học phần (Course code): INT_E14122

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

- Algebra (BAS1201)
- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker.
- Phòng thực hành (Laboratory): Computers (can do python programming), microphone, speaker.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 4h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 4h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course provides learners with the fundamentals of deep learning components. The learners are required to understand:

- basic concepts of deep learning.
- various kinds of problems in which deep learning-based methods outperform traditional methods.
- various kinds of successful deep learning-based applications.

Kỹ năng (Skills):

Learners will learn the skills to develop various kinds of deep learning-based applications, including:

- applying deep learning frameworks to solve the problems.
- modifying parameters to achieve expected performance.
- evaluation of deep learning-based applications.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes and do exercises , assignments.

3. Tóm tắt nội dung học phần (Description)

This course will cover the basic knowledge of applied deep learning in research and practice. Learners will go from basic knowledge of deep learning building blocks to advanced deep learning architectures. Some real-world applications of deep learning are also introduced. On completion of this course, the learners will be able to understand the fundamentals of deep learning as well as how to apply deep learning models to solve practical problems.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: What is deep learning ?

- 1.1. Basic concepts
 - 1.1.1. Artificial intelligence
 - 1.1.2. Machine learning
 - 1.1.3. Deep learning
- 1.2. Why deep learning? Why now?
 - 1.3.1. What makes deep learning different
 - 1.3.2. The modern machine-learning landscape
 - 1.3.3. Available resources
 - 1.3.4. Community interests

Chapter 2: Mathematical building blocks of neural networks

- 2.1. Data representation of neural networks
 - 2.1.1. Overview of neural networks
 - 2.1.2. Tensor
 - 2.1.3. Tensor manipulation with Numpy
 - 2.1.4. Real-world examples of data tensors
- 2.2. Tensor operations
 - 2.2.1. Basic operations
 - 2.2.2. Geometric interpolation of tensor operations
 - 2.2.3. A geometric interpolation of deep learning
- 2.3. Gradient-based optimization
 - 2.3.1. What is derivative?
 - 2.3.2. Stochastic gradient descent
 - 2.3.3. Back-propagation algorithm

Chapter 3: Neural networks

- 3.1. Anatomy of neural networks
 - 3.1.1. The building blocks of deep learning
 - 3.1.2. Network of layers
 - 3.1.3. Loss functions and optimizers
- 3.2. Introduction to Keras
 - 3.2.1. Keras, Tensorflow, Theano, CNTK
 - 3.2.2. Quick overview of Keras
- 3.3. Keras in practice
 - 3.3.1. Keras, Tensorflow, Theano, CNTK
 - 3.3.2. Quick overview of Keras
 - 3.3.2. Keras environment setting

- 3.3.2. Keras examples 1: Classifying movie reviews
- 3.3.2. Keras examples 2: Classifying newswires
- 3.3.2. Keras examples 3: Predicting house prices

Chapter 4: Deep learning in practice

- 4.1. Convolutional networks
 - 4.1.1. The convolution operation
 - 4.1.2. The pooling operation
 - 4.1.3. The fully connected operation
 - 4.1.3. Regularization, dropout operation
- 4.2. Recurrent neural networks
 - 4.2.1. Support for sequences in neural networks
 - 4.2.2. Architecture of RNN
- 4.3. Commonly used deep learning architectures
 - 4.3.1. Resnet for image classification
 - 4.3.2. Facenet for face recognition
 - 4.3.3. RCNN for object detection
 - 4.3.4. Long Short-Term Memory for text classification
 - 4.3.4. Generative adversarial networks
- 4.4. How to build working deep learning model from scratch
- 4.5. Project and lab

Chapter 5: Conclusions

- 5.1. Benefits of Deep learning
- 5.2. Deep learning applications
 - 5.2.1. Deep learning for Optical Character Recognition (OCR).
 - 5.2.1. Deep learning for Video surveillance.
 - 5.2.3. Deep learning for Document summarization.

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Deep learning with python - Francois Chollet, Manning Publications Company, 2017, ISBN 1617294438, 9781617294433

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Deep learning for computer vision with python, Adrian Rosebrock, PyImageSearch, ebook, 2017.

[3] Deep learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, The MIT Press, 2016, ISBN: 0262035618

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Vũ Hoài Nam

IMAGE PROCESSING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Image Processing

Mã học phần (Course code): INT_E14123

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, Chalkboard or Whiteboard.
- Laboratory: Computer with Internet connection, Projector, microphone and speaker, Chalkboard or Whiteboard.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 4h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The main aim of this course is to provide learners with an introduction to basic concepts, methodologies applicable to digital image processing, and a foundation that can be used as the basis for further study and research in this field. Students will gain understanding of:

- Components of an image processing system and its applications, image fundamentals;
- Methods of image filtering and enhancement;
- Color image processing;
- Morphological operators;
- Algorithms of image segmentation;
- Feature extraction and image pattern classification.

Kỹ năng (Skills):

This course aims to equip learners with skills in:

- Discussions in the working group using concepts and methodologies applicable to digital image processing;

- Using a popular library for image processing/computer vision and using a popular machine learning framework;
- Designing, implementing, and evaluating solutions for digital image processing problems.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

In this course, mainstream areas of image processing are covered, including image fundamentals, image filtering and enhancement (intensity transformations and spatial filtering), color image processing, morphology (operations that process images based on shapes such as erosion, dilation, opening, closing), segmentation, image feature extraction, and image pattern classification. Also, computer laboratory exercises are designed to introduce methods of real-world image data manipulation.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction

- 1.1. Digital image processing
- 1.2. The origins of digital image processing
- 1.3. Examples of fields that use digital image processing
- 1.4. Fundamental steps in digital image processing
- 1.5. Components of an image processing system
- 1.6. Digital image fundamentals

Chapter 2. Intensity transformations and spatial filtering

- 2.1. Background
- 2.2. Some basic intensity transformation functions
 - 2.2.1. Image negatives
 - 2.2.2. Log transformations
 - 2.2.3. Power-Law (Gamma) transformations
 - 2.2.4. Histogram processing
- 2.3. Fundamentals of spatial filtering
- 2.4. Smoothing (Lowpass) spatial filters
 - 2.4.1. Box filter kernels
 - 2.4.2. Lowpass Gaussian filter kernels
 - 2.4.3. Order-statistic (nonlinear) filters
- 2.5. Sharpening (highpass) spatial filters
 - 2.5.1. Foundation
 - 2.5.2. Using the second derivative for image sharpening - the Laplacian
 - 2.5.3. Unsharp masking and highboost filtering
 - 2.5.4. Using first-order derivatives for image sharpening - the gradient
- 2.6. Combining spatial enhancement methods

Chapter 3. Color image processing

- 3.1. Color fundamentals
- 3.2. Color models
 - 3.2.1. The RGB color model
 - 3.2.2. The CMY and CMYK color models
 - 3.2.3. The HSI color model
 - 3.2.4. A device independent color model
- 3.3. Pseudocolor image processing
- 3.4. Basics of full-color image processing

- 3.5. Color transformations
 - 3.5.1. Formulation
 - 3.5.2. Color complements
 - 3.5.3. Color slicing
 - 3.5.4. Tone and color corrections
 - 3.5.5. Histogram processing of color images
- 3.6. Color image smoothing and sharpening
 - 3.6.1. Color image smoothing
 - 3.6.2. Color image sharpening
- 3.7. Using color in image segmentation
 - 3.7.1. Segmentation in HSI color space
 - 3.7.2. Segmentation in RGB space
 - 3.7.3. Color edge detection
- 3.8. Noise in color images
- 3.9. Color image compression

Chapter 4. Morphological image processing

- 4.1. Preliminaries
- 4.2. Erosion and dilation
- 4.3. Opening and closing
- 4.4. The hit-or-miss transform
- 4.5. Some basic morphological algorithms
 - 4.5.1. Boundary extraction
 - 4.5.2. Hole filling
 - 4.5.3. Extraction of connected components
 - 4.5.4. Convex hull
 - 4.5.5. Thinning
 - 4.5.6. Thickening
 - 4.5.7. Skeletons
 - 4.5.8. Pruning

Chapter 5. Image Segmentation

- 5.1. Fundamentals
- 5.2. Point, line, and edge detection
 - 5.2.1. Background
 - 5.2.2. Detection of isolated points
 - 5.2.3. Line detection
 - 5.2.4. Edge models
 - 5.2.5. Basic edge detection
 - 5.2.6. More advanced techniques for edge detection
 - 5.2.7. Linking edge points
- 5.3. Thresholding
 - 5.3.1. Foundation
 - 5.3.2. Basic global thresholding
 - 5.3.3. Optimum global thresholding using Otsu's method
 - 5.3.4. Using image smoothing to improve global thresholding
 - 5.3.5. Using edges to improve global thresholding
 - 5.3.6. Multiple thresholds
 - 5.3.7. Variable thresholding
- 5.4. Segmentation by region growing and by region splitting and merging
 - 5.4.1. Region growing
 - 5.4.2. Region splitting and merging
 - 5.5. Region segmentation using clustering and superpixels
 - 5.5.1. Region segmentation using K-Means clustering

- 5.5.2. Region segmentation using superpixels
- 5.6. Region segmentation using graph cuts
- 5.7. Segmentation using morphological watersheds
- 5.8. The use of motion in segmentation

Chapter 6. Feature extraction

- 6.1. Background
- 6.2. Boundary preprocessing
 - 6.2.1. Boundary following (tracing)
 - 6.2.2. Chain codes
 - 6.2.3. Boundary approximations using minimum-perimeter polygons
- 6.3. Boundary feature descriptors
- 6.4. Region feature descriptors
- 6.5. Principal components as feature descriptors
- 6.6. Histogram of oriented gradients (HOG)
- 6.7. Local binary patterns (LBP)
- 6.8. Scale-invariant feature transform (SIFT)
- 6.9. Haar-like feature
- 6.10. Kernel descriptor

Chapter 7. Image pattern classification

- 7.1. Background
- 7.2. Patterns and pattern classes
 - 7.2.1. Pattern vectors
 - 7.2.2. Structural patterns
- 7.3. Pattern classification by prototype matching
- 7.4. Support-vector machine (SVM)
- 7.5. AdaBoost
- 7.6. Optimum (Bayes) statistical classifiers
- 7.7. Neural networks and deep learning
- 7.8. Deep convolutional neural networks

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Gonzalez, R. C. and Woods, R. E. Digital Image Processing, 4th ed., Pearson/Prentice Hall, NY, 2018.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Richard Szeliski. Computer Vision: Algorithms and Applications (Texts in Computer Science), Springer, 2011.
- [3]. Goodfellow, I., Bengio, Y. and Courville, A. Deep learning. MIT press, 2016.
- [4]. Jan Solem. Programming Computer Vision with Python, O'Reilly Media, 2012.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	30%	Group or individual
- Final examination	50%	Individual

**Trưởng Bộ môn
(Head of
Department)**

Ngô Xuân Bách

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Văn Tới

NATURAL LANGUAGE PROCESSING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Natural Language Processing

Mã học phần (Course code): INT_E14124

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about natural language processing (NLP), including:

- basic concepts and fundamental tasks in NLP
- applications in NLP
- methods to solve NLP tasks and build NLP applications

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to solve some NLP tasks
- evaluation of natural language processing models.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to basic knowledge about natural language processing, including basic concepts and fundamental tasks (part-of-speech tagging, language modeling, syntactic parsing, lexical semantics), applications (sentiment classification, information extraction, question answering), techniques and methods to solve natural language processing tasks such as rule-based, dictionary-based, supervised learning, and semi-supervised learning methods.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction

- 1.1. NLP and its applications
 - 1.1.1. Languages
 - 1.1.2. Natural language processing (NLP)
 - 1.1.3. NLP applications
- 1.2. NLP pipeline
- 1.3. Ambiguity
- 1.4. Some brief history

Chapter 2: Part-of-Speech Tagging

- 2.1. Words and word classes
 - 2.1.1. Words
 - 2.1.2. Word classes
- 2.2. The Penn Treebank part-of-speech tagset
- 2.3. Part-of-speech tagging
- 2.4. HMM part-of-speech tagging
 - 2.4.1. Markov chains
 - 2.4.2. The Hidden Markov Model (HMM)
 - 2.4.3. The components of an HMM tagger
 - 2.4.4. HMM tagging as decoding
 - 2.4.5. The Viterbi algorithm
 - 2.4.6. Beam search

Chapter 3: Statistical Language Models

- 3.1. N-gram language models
 - 3.1.1. Language models
 - 3.1.2. N-gram language models
- 3.2. Evaluating language models
 - 3.2.1. Extrinsic and intrinsic evaluation
 - 3.2.2. Perplexity
- 3.3. Generalization
- 3.4. Smoothing
 - 3.4.1. Laplace smoothing
 - 3.4.2. Add-k smoothing
 - 3.4.3. Backoff and interpolation

Chapter 4: Sentiment Classification

- 4.1. Classification
 - 4.1.1. Supervised machine learning
 - 4.1.2. Classification
- 4.2. Naïve Bayes classifiers
 - 4.2.1. The method
 - 4.2.2. Training
 - 4.2.3. Worked example
- 4.3. Sentiment classification with Naïve Bayes
- 4.4. Evaluation
 - 4.4.1. Precision, Recall, F-measure

- 4.4.2. Test sets and Cross-validation
- 4.5. Projects

Chapter 5: Syntactic Parsing

- 5.1. Parsing problem
- 5.2. Context-free grammars
 - 5.2.1. Formal grammars
 - 5.2.2. Context-free grammars
 - 5.2.3. Chomsky normal form
- 5.3. Some grammar rules for English
 - 5.3.1. Sentence-Level Constructions
 - 5.3.2. Clauses and Sentences
 - 5.3.3. The Noun Phrase
 - 5.3.4. The Verb Phrase
 - 5.3.5. Coordination
- 5.4. Treebanks
 - 5.4.1. The Penn Treebank Project
 - 5.4.2. Treebanks as Grammars
- 5.5. CKY parsing
 - 5.5.1. Conversion to Chomsky normal form
 - 5.5.2. CKY recognition
 - 5.5.3. CKY parsing

Chapter 6: Lexical Semantics

- 6.1. Word senses
- 6.2. Relations between senses
 - 6.2.1. Synonymy and antonymy
 - 6.2.2. Hyponymy
 - 6.2.3. WordNet
- 6.3. Word sense disambiguation (WSD)
- 6.4. Methods for WSD
 - 6.4.1. Supervised WSD
 - 6.4.2. Dictionary-based methods
 - 6.4.3. Bootstrapping

Chapter 7: Information Extraction

- 7.1. Introduction to information extraction
- 7.2. Named entity recognition (NER)
 - 7.2.1. NER task
 - 7.2.2. NER as sequence labeling
 - 7.2.3. Features for NER
 - 7.2.4. Evaluation of NER
- 7.3. Relation extraction
 - 7.3.1. Relation extraction task
 - 7.3.2. Using patterns to extract relations
 - 7.3.3. Relation extraction via supervised learning
 - 7.3.4. Semi-supervised relation extraction via bootstrapping
 - 7.3.5. Evaluation of relation extraction
- 7.4. Other types of extraction
 - 7.4.1. Time extraction
 - 7.4.2. Event extraction
- 7.5. Projects

Chapter 8: Question Answering

- 8.1. Introduction to question answering
- 8.2. IR-based factoid question answering
 - 8.2.1. Question processing

- 8.2.2. Query formulation
- 8.2.3. Answer types
- 8.2.4. Document and passage retrieval
- 8.2.5. Answer extraction
- 8.3. Knowledge-based question answering
 - 8.3.1. Rule-based methods
 - 8.3.2. Supervised methods
 - 8.3.3. Semi-supervised methods
- 8.4. Evaluation of factoid answers

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Dan Jurafsky and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*. Prentice Hall, 2nd edition, 2009.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Christopher D. Manning and Hinrich Schütze. *Foundations of Statistical Natural Language Processing*. The MIT Press, 1999.
- [3]. Yoav Goldberg. *Neural Network Methods in Natural Language Processing - Synthesis Lectures on Human Language Technologies*. Morgan & Claypool Publishers, 2017.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Ngô Xuân Bách

INFORMATION RETRIEVAL

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Information Retrieval

Mã học phần (Course code): INT_E14125

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board, microphone and speaker
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 34h
- Bài tập (Exercises): 6h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to provide learners with the fundamental concepts and methods of information retrieval, including:

- basic concepts and fundamental tasks in information retrieval
- applications in information retrieval
- methods for capturing, representing, storing, organizing, and retrieving unstructured or loosely structured information.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to solve some information retrieval tasks
- determining the effectiveness of an information retrieval system using a known document corpus.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

Information retrieval systems are systems that provide the ability to search for specific data or information within a collection. This course will emphasize technologies and fundamental concepts that underlie all information retrieval systems. The course consists of five chapters as follows. Chapter 1 presents the overview of information retrieval. Chapter 2 introduces concepts of text processing. Chapter 3 presents ranking with indexes with inverted index, index construction and compression, and query processing. Chapter 4 presents all about queries and interfaces. Chapter 5 describes different models using in information retrieval. And chapter 6 introduces evaluation methods which help to determine the effectiveness of an information retrieval system.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Overview of Information Retrieval

- 1.1. What is information retrieval?
- 1.2. Examples of information retrieval problems
- 1.3. Approaches to information retrieval
- 1.4. Architecture of a search engine
- 1.5. Performance of an information retrieval system

Chapter 2. Processing Text

- 2.1. Text statistics
 - 2.1.1. Vocabulary growth
 - 2.1.2. Estimating collection and result set sizes
- 2.2. Document Parsing
 - 2.2.1. Tokenizing
 - 2.2.2. Stopping
 - 2.2.3. Stemming
 - 2.2.4. Phrases and N-grams
 - 2.2.5. Document structure and markup
- 2.3. Link Analysis
 - 2.3.1. Anchor text
 - 2.3.2. PageRank
 - 2.3.3. Link quality
- 2.4. Information extraction

Chapter 3. Ranking with Indexes

- 3.1. Abstract model of ranking
- 3.2. Inverted indexes
 - 3.2.1. Documents
 - 3.2.2. Counts
 - 3.2.3. Positions
 - 3.2.4. Fields and extents
 - 3.2.5. Scores
 - 3.2.6. Ordering
- 3.3. Index construction
 - 3.3.1. Blocked sort-based indexing
 - 3.3.2. Single-pass in-memory indexing

- 3.3.3. Distributed indexing
 - 3.3.4. Dynamic indexing
 - 3.3.5. Other types of indexes
- 3.4. Index compression
 - 3.4.1. Statistical properties of terms
 - 3.4.2. Dictionary compression
 - 3.4.3. Postings file compression
- 3.5. Query processing
 - 3.5.1. Document-at-a-time evaluation
 - 3.5.2. Term-at-a-time evaluation
 - 3.5.3. Optimization techniques
 - 3.5.4. Structured queries
 - 3.5.5. Distributed evaluation
 - 3.5.6. Caching

Chapter 4. Queries and Interfaces

- 4.1. Information needs and queries
- 4.2. Query transformation and refinement
 - 4.2.1. Stopping and stemming revisited
 - 4.2.2. Spell checking and suggestions
 - 4.2.3. Query expansion
 - 4.2.4. Relevance feedback and pseudo relevance feedback
 - 4.2.5. Global methods for query reformulation
 - 4.2.6. Context and personalization
- 4.3. Showing the results
 - 4.3.1. Result pages and snippets
 - 4.3.2. Advertising and search
 - 4.3.3. Clustering the results
 - 4.3.4. Translation

Chapter 5. Retrieval Models

- 5.1. The vector space model
 - 5.1.1. Dot products
 - 5.1.2. Queries as vectors
 - 5.1.3. Computing vector scores
- 5.2. Probabilistic information retrieval
 - 5.2.1. The probability ranking principle
 - 5.2.2. The binary independence model
- 5.3. Language models for information retrieval
 - 5.3.1. Language models
 - 5.3.2. The query likelihood model
 - 5.3.3. Language modeling versus other approaches
 - 5.3.4. Extended language modeling approaches

Chapter 6. Evaluation

- 6.1. Information retrieval system evaluation

- 6.2. Standard test collections
- 6.3. Evaluation of unranked retrieval sets
- 6.4. Evaluation of ranked retrieval sets
- 6.5. Assessing relevance
- 6.6. System quality and user utility

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Manning, Christopher, Prabhakar Raghavan, and Hinrich Schütze, *Introduction to Information Retrieval*, Cambridge University Press, 2009.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Stefan Büttcher, Charles Clarke, and Gordon Cormack, *Information retrieval: Implementing and evaluating search engines*. Mit Press, 2016.
- [3]. Bruce Croft, Donald Metzler, and Trevor Strohman, *Search Engines: Information Retrieval in Practice*, Addison-Wesley, 2009.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Nguyễn Ngọc Điệp

MINING MASSIVE DATA SETS

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Mining Massive Data Sets

Mã học phần (Course code): INT_E14126

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker, black board or white board.

- Phòng thực hành (Laboratory): Computers, microphone, speaker.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h

- Bài tập (Exercises): 4h

- Bài tập lớn (Projects): 4h

- Thực hành (Labs): 4h

- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with the fundamental concepts of mining techniques and big data. The learners are required to understand:

- basic concepts and fundamental tasks in data mining.
- application of data mining and big data.
- various kind of data mining system.

Kỹ năng (Skills):

Learners will learn a set of skills to develop various kinds of data mining system. These skills consist of :

- analyzing a data mining problem.
- designing a simple data mining system.
- Evaluating the data mining system.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes, do exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

Understanding the components of data mining system and big data tool is the basic knowledge and skill set for every data scientist. On completion of this course, learners will be able to understand the fundamentals of data mining technique as well as to apply these techniques to solve the problem. The data mining system development consists of analyzing the problem, designing the system architecture, implementing the system, and evaluating the system.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction to Data mining

- 1.1. Introduction to data mining
 - 1.1.1. Statistical modeling
 - 1.1.2. Machine learning
 - 1.1.3. Computational approaches to modeling
 - 1.1.4. Summarization
 - 1.1.5. Feature extraction
- 1.2. Statistical limits on data mining
 - 1.2.1. Total information awareness
 - 1.2.2. Bonferroni's principle
 - 1.2.3. Example of Bonferroni's principle
- 1.3. Feature of data mining
 - 1.3.1. Importance of word in documents
 - 1.3.2. Hash functions
 - 1.3.3. Indexes
 - 1.3.4. Second storage
 - 1.3.5. The base of natural logarithms
 - 1.3.6. Power Laws

Chapter 2: Large-Scale file systems and Map-reduce

- 2.1. Distributed file systems
 - 2.1.1. Physical organization of compute nodes
 - 2.1.2. Large-scale file system organization
- 2.2. Map-Reduce
 - 2.2.1. The map tasks
 - 2.2.2. Grouping and Aggregation
 - 2.2.3. The reduce tasks
 - 2.2.4. Combiners
 - 2.2.5. Details of Map-reduce execution
 - 2.2.6. Coping with node failures
- 2.3. Algorithms using Map-reduce
 - 2.3.1. Matrix-Vector multiplication by Map-reduce
 - 2.3.2. If the vector v cannot fit in main memory
 - 2.3.3. Relational-algebra operations
 - 2.3.4. Computing Selections by Map-Reduce
 - 2.3.5. Computing Projections by Map-Reduce
 - 2.3.6. Union, Intersection, and Difference by Map-Reduce ^[1]_{SEP}
 - 2.3.7. Computing Natural Join by Map-Reduce ^[1]_{SEP}
 - 2.3.8. Generalizing the Join Algorithm ^[1]_{SEP}
 - 2.3.9. Grouping and Aggregation by Map-Reduce ^[1]_{SEP}
 - 2.3.10. Matrix Multiplication ^[1]_{SEP}
 - 2.3.11. Matrix Multiplication with One Map-Reduce Step ^[1]_{SEP}
- 2.4. Algorithms using Map-reduce
 - 2.4.1. Workflow systems
 - 2.4.2. Recursive extension to map-reduce

- 2.4.3. Pregel
- 2.5. Efficiency of cluster-computing algorithms
 - 2.5.1. The communication-cost model for cluster computing
 - 2.5.2. Elapsed communication cost
 - 2.5.3. Multiway joins

Chapter 3: Finding similar items

- 3.1. Applications of Near-neighbor search
 - 3.1.1. Jaccard similarity of sets
 - 3.1.2. Similarity of documents
 - 3.1.3. Collaborative filtering as a similar-set problem
- 3.2. Shingling of documents
 - 3.2.1. K-Shingles
 - 3.2.2. Choosing the shingle size
 - 3.2.3. Hashing shingles
 - 3.2.4. Shingles built from words
- 3.3. Similarity-Preserving summaries of sets
 - 3.3.1. Matrix representation of sets
 - 3.3.2. MinHash
 - 3.3.3. MinHash and Jaccard similarity
 - 3.3.4. MinHash signatures
 - 3.3.5. Computing MinHash signatures
- 3.4. Locality-sensitive hashing for documents
 - 3.4.1. LSH for MinHash signatures
 - 3.4.2. Analysis of banding technique
 - 3.4.3. Combining the techniques
- 3.5. Distance measures
 - 3.5.1. Definition of a distance measure
 - 3.5.2. Euclidean distance
 - 3.5.3. Jaccard distance
 - 3.5.4. Cosine distance
 - 3.5.5. Edit distance
 - 3.5.6. Hamming distance
- 3.6. The theory of locality-sensitive function
 - 3.6.1. Locality-sensitive functions
 - 3.6.2. Locality-sensitive Families for Jaccard distance
 - 3.6.3. Amplifying a locality-sensitive family

Chapter 4: Mining data streams

- 4.1. The stream data model
 - 4.1.1. A data stream management system
 - 4.1.2. Examples of stream source
 - 4.1.3. Stream queries
 - 4.1.4. Issues in stream processing
- 4.2. Sampling data in a stream
 - 4.2.1. A motivating example
 - 4.2.2. Obtaining a representative sample
 - 4.2.3. The general sampling problem
 - 4.2.4. Varying the sample size
- 4.3. Filtering streams
 - 4.3.1. A motivating example
 - 4.3.2. The bloom filter
 - 4.3.3. Analysis of bloom filtering
- 4.4. Counting distinct elements in a stream

- 4.4.1. The count-distinct problem
- 4.4.2. The Flajolet-martin algorithm
- 4.4.2. Combining estimates
- 4.4.4. Space requirements
- 4.5. Estimating moments
 - 4.5.1. Defining of moments
 - 4.5.2. The Alon-matias-szegedy algorithm for second moments
 - 4.5.3. Why the Alon-matias-szegedy algorithm works?
 - 4.5.4. Higher-order moments
 - 4.5.5. Dealing with infinite streams
- 4.6. Counting ones in a window
 - 4.6.1. Cost of exact counts
 - 4.6.2. The datar-gionis-indyk-motwani algorithm
 - 4.6.3. Storage requirements for the DGIM algorithm
 - 4.6.4. Query answering in the DGIM algorithm
 - 4.6.5. Maintaining the DGIM conditions
 - 4.6.6. Reducing the error
 - 4.6.7. Extensions to the counting of ones

Chapter 5: Link analysis

- 5.1. PageRank
 - 5.1.1. Early search engines and term spam
 - 5.1.2. Definition of PageRank
 - 5.1.3. Structure of the web
 - 5.1.4. Avoiding dead ends
 - 5.1.5. Spider traps and taxation
 - 5.1.6. Using PageRank in search engine
- 5.2. Efficient computation of PageRank
 - 5.2.1. Representing transition matrices
 - 5.2.2. PageRank iteration using map-reduce
 - 5.2.3. Use of combiners to consolidate the results vector
 - 5.2.4. Representing blocks of transition matrix
 - 5.2.5. Other efficient approaches to PageRank iteration
- 5.3. Topic-sensitive PageRank
 - 5.3.1. Motivation for topic-sensitive Page Rank
 - 5.3.2. Biased random walks
 - 5.3.3. Using topic-sensitive PageRank
 - 5.3.4. Inferring topics from Words
- 5.4. Link Spam
 - 5.4.1. Architecture of a spam farm
 - 5.4.2. Analysis of a spam farm
 - 5.4.3. Combating link spam
 - 5.4.4. TrustRank
 - 5.4.5. Spam mass
- 5.5. Hubs and Authorities
 - 5.5.1. The intuition behind HITS
 - 5.5.2. Formalizing hubbiness and authority

Chapter 6: Frequent itemsets

- 6.1. The market-basket model
 - 6.1.1. Definition of frequent itemsets
 - 6.1.2. Applications of frequent itemsets
 - 6.1.3. Association rules
 - 6.1.4. Finding association rules with high confidence

- 6.2. Market baskets and the A-priori algorithm
 - 6.2.1 Representation of market-basket data
 - 6.2.2. Use of main memory for itemset counting
 - 6.2.3. Monotonicity of itemsets
 - 6.2.4. Tyranny of counting pairs
 - 6.2.5. The A-priori algorithm
 - 6.2.6. A-priori for all frequent itemsets
- 6.3. Handling larger datasets in main memory
 - 6.3.1. The algorithm of Park, Chen, and Yu
 - 6.3.2. The multistage algorithm
 - 6.3.3. The multihash algorithm
- 6.4. Limited-pass algorithm
 - 6.4.1. The simple, randomized algorithm
 - 6.4.2. Avoiding errors in sampling algorithm
 - 6.4.3. The algorithm of Savasere, Omiecinski and Navathe
 - 6.4.4. The SON algorithm and Map-reduce

Chapter 7: Clustering

- 7.1. Introduction to Clustering Techniques
- 7.2. Hierarchical clustering
 - 7.2.1. Hierarchical clustering in a Euclidean space
 - 7.2.2. Efficiency of Hierarchical clustering
 - 7.2.3. Alternative rules for controlling hierarchical clustering
 - 7.2.4. Hierarchical clustering in non-euclidean spaces
- 7.3. K-means algorithms
 - 7.3.1. K-means basics
 - 7.3.2. Initializing clusters for K-means
 - 7.3.3. Picking the right value of K
 - 7.3.4. The algorithm of Bradley, Fayyad, and Reina
 - 7.3.5. Processing data in the BFR algorithm
- 7.4. The CURE algorithm
 - 7.4.1. Initialization of CURE
 - 7.4.2. Completion of the CURE algorithm
- 7.5. Clustering in Non-Euclidean spaces
 - 7.5.1. Representing clusters in the GRGPF algorithm
 - 7.5.2. Initializing the cluster tree
 - 7.5.3. Adding points in the GRGPF algorithm
 - 7.5.4. Splitting and merging clusters
- 7.6. Clustering for streams and parallelism
 - 7.6.1. The stream-computing model
 - 7.6.2. A stream-clustering algorithm
 - 7.6.3. Initializing buckets
 - 7.6.4. Merging buckets
 - 7.6.5. Answering queries
 - 7.6.6. Clustering in a parallel environment

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Mining massive datasets – Anand Rajaraman and Jeffrey U. Ullman, Cambridge University Press, ISBN: 1107015359, 2011.

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Analytics in a Big Data World: The Essential Guide to Data Science and its Applications - Bart Baesens, Wiley, ISBN: 978-1-118-89270-1, 2014.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Ngô Xuân Bách

Vũ Hoài Nam

TEXT MINING AND ANALYTICS

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Text Mining and Analytics

Mã học phần (Course code): INT_E14127

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 4h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about natural language text and methods for mining and analyzing text data, including:

- natural language basics (languages, words and word classes, syntactics, semantics, corpora)
- text mining problems (text processing, text classification, text summarization, text clustering, semantic analysis)
- methods for mining and analyzing text data (Naïve Bayes, SVM, LSI, LSA, LDA, matrix factorization, k-means, TextRank, and so on)

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to mine and analyze natural language text
- evaluation of text mining models.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to basic knowledge about natural language text (language, words and word classes, syntactics, semantics, corpora), text mining problems (text processing, text classification, text summarization, text clustering, semantic analysis), and methods for mining and analyzing text data (Naïve Bayes, SVM, LSI, LSA, LDA, matrix factorization, k-means, TextRank, and so on). The course also teaches students how to evaluate text mining models.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Natural Language Basics

- 1.1. Natural language
- 1.2. Language syntax and structure
 - 1.2.1. Words
 - 1.2.2. Phrases
 - 1.2.3. Clauses
 - 1.2.4. Grammars
- 1.3. Language semantics
 - 1.3.1. Lexical semantic relations
 - 1.3.2. Representation of semantics
- 1.4. Text corpora
 - 1.4.1. Corpora annotation and utilities
 - 1.4.2. Popular corpora
 - 1.4.3. Accessing text corpora
- 1.5. Natural language processing
 - 1.5.1. Fundamental tasks
 - 1.5.2. Applications

Chapter 2: Processing and Understanding Text

- 2.1. Text tokenization
 - 2.1.1. Sentence tokenization
 - 2.1.2. Word tokenization
- 2.2. Text normalization
 - 2.2.1. Cleaning text
 - 2.2.2. Tokenizing text
 - 2.2.3. Removing special characters and stopwords
 - 2.2.4. Correcting words
 - 2.2.5. Stemming
- 2.3. Understanding text syntax and structure
 - 2.3.1. Parts-of-speech tagging
 - 2.3.2. Shallow parsing
 - 2.3.3. Dependency parsing
 - 2.3.4. Constituency parsing

Chapter 3: Text Classification

- 3.1. Introduction to text classification
- 3.2. Feature extraction
 - 3.2.1. Bag of words
 - 3.2.2. TF-IDF
 - 3.2.3. Word vectors
- 3.3. Classification algorithms
 - 3.3.1. Naïve Bayes

3.3.2. Support vector machines

3.4. Evaluating classification models

3.5. Projects

Chapter 4: Text Summarization

4.1. Introduction to text summarization

4.2. Keyphrase extraction

4.2.1. Collocations

4.2.2. Weighted tag-based phrase extraction

4.3. Topic modeling

4.3.1. Latent semantic indexing

4.3.2. Latent Dirichlet allocation

4.3.3. Non-negative matrix factorization

4.3.4. Extracting topics from product reviews

4.4. Automated document summarization

4.4.1. Latent semantic analysis

4.4.2. TextRank

4.4.3. Multi document summarization

Chapter 5: Text Similarity and Clustering

5.1. Introduction

5.2. Analyzing term similarity

5.2.1. Hamming distance

5.2.2. Manhattan distance

5.2.3. Euclidean distance

5.2.4. Levenshtein edit distance

5.2.5. Cosine distance and similarity

5.3. Analyzing document similarity

5.3.1. Cosine similarity

5.3.2. Hellinger-Bhattacharya distance

5.3.3. Okapi BM25 Ranking

5.4. Document clustering

5.4.1. K-means clustering

5.4.2. Affinity propagation

5.4.3. Hierarchical clustering

Chapter 6: Semantic and Sentiment Analysis

6.1. Exploring WordNet

6.1.1. Understanding synsets

6.1.2. Analyzing lexical semantic relations

6.1.3. Word sense disambiguation

6.1.4. Named entity recognition

6.2. Analyzing semantic representations

6.3. Sentiment analysis

6.3.1. Preparing datasets

6.3.2. Feature extraction

6.3.3. Supervised machine learning techniques

6.3.4. Unsupervised lexicon-based techniques

6.3.5. Model evaluation

6.4. Projects

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. Dipanjan Sarkar. *Text Analytics with Python: A Practical Real-World Approach to*

Gaining Actionable Insights from your Data. Apress, 2016.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Dan Jurafsky and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*. Prentice Hall, 2nd edition, 2009.
- [3]. Yoav Goldberg. *Neural Network Methods in Natural Language Processing - Synthesis Lectures on Human Language Technologies*. Morgan & Claypool Publishers, 2017.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Ngô Xuân Bách

ARTIFICIAL INTELLIGENCE GRADUATION MODULE 1

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Artificial Intelligence Graduation Module 1

Mã học phần (Course code): ???

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Statistics and Probability (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, black board or white board.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 34h
- Bài tập (Exercises): 16h
- Bài tập lớn (Projects): 10h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 – Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number : (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with important knowledge about machine learning, the core part of modern artificial intelligence, including:

- definitions and basic concepts
- machine learning types and machine learning problems
- machine learning algorithms for regression, classification, and clustering
- methods to build machine learning systems

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to solve machine learning problems
- building machine learning systems using Python
- evaluation of machine learning models.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course revises and extends the important knowledge about machine learning that students have studied in the previous semesters, including definitions and basic concepts, machine learning types (supervised learning, unsupervised learning, and semi-supervised learning), machine learning problems (regression, classification, and clustering), machine learning algorithms for regression (linear and non-linear), classification (logistic regression, Naïve Bayes, KNN, decision trees, random forests, SVMs), and clustering (flat and hierarchical), and other topics in machine learning (online learning, ensemble learning). The course also teaches students how to build machine learning systems using Python and how to evaluate them.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Machine Learning Basics

- 1.1. Basic concepts
- 1.2. Types of learning
 - 1.2.1. Supervised learning
 - 1.2.2. Unsupervised learning
 - 1.2.3. Semi-supervised learning
 - 1.2.4. Reinforcement learning
- 1.3. Components of a machine learning system
 - 1.3.1. Learning phase
 - 1.3.2. Prediction phase
- 1.4. Evaluation of machine learning systems

Chapter 2: Python Programming Review

- 2.1. Introduction
- 2.2. Variables, Syntax, and Simple data types
 - 2.2.1. Variables
 - 2.2.2. Syntax
 - 2.2.3. Simple data types
- 2.3. Lists and Dictionaries
 - 2.3.1. Lists
 - 2.3.2. Dictionaries
- 2.4. Functions and Classes
 - 2.4.1. Functions
 - 2.4.2. Classes
- 2.5. Files and Exceptions
 - 2.5.1. Files
 - 2.5.2. Exceptions
- 2.6. Python libraries for machine learning
 - 2.6.1. Numpy
 - 2.6.2. Scipy
 - 2.6.3. Scikit-learn

Chapter 3: Regression

- 3.1. Introduction
- 3.2. Linear regression
 - 3.2.1. Simple linear regression
 - 3.2.2. Multiple linear regression

- 3.3. Non-linear regression
- 3.4. Evaluation of regression models

Chapter 4: Classification

- 4.1. Introduction
- 4.2. Logistic regression
 - 4.2.1. The logistic model
 - 4.2.2. Estimating the regression coefficients
 - 4.2.3. Making predictions
 - 4.2.4. Multiple logistic regression
- 4.3. Naïve Bayes classification
 - 4.3.1. Bayes' theorem
 - 4.3.2. Parameter estimation
 - 4.3.3. Making predictions
 - 4.3.4. Smoothing
- 4.4. K-nearest neighbor
 - 4.4.1. Lazy learning
 - 4.4.2. Sample similarity
 - 4.4.3. The KNN algorithm
- 4.5. Tree-based classification
 - 4.5.1. Decision trees
 - 4.5.2. Random forests
- 4.6. Support vector machines
 - 4.6.1. Max-margin classification
 - 4.6.2. SVMs for binary classification
 - 4.6.3. SVMs for multiple classes
- 4.7. Evaluation of classification models
- 4.8. Projects

Chapter 5: Clustering

- 5.1. Introduction
- 5.2. Similarities and distances
 - 5.2.1. Quantitative data
 - 5.2.2. Categorical data
 - 5.2.3. Textual data
- 5.3. Flat clustering
 - 5.3.1. K-means clustering
 - 5.3.2. K-medians clustering
- 5.4. Hierarchical clustering
 - 5.4.1. Bottom-up methods
 - 5.4.2. Top-down methods
- 5.5. Evaluation of clustering models
- 5.6. Projects

Chapter 6: Other Topics

- 6.1. Online learning
 - 6.1.1. Offline vs. Online learning
 - 6.1.2. The online perceptron algorithm
- 6.2. Semi-supervised learning
 - 6.2.1. Self training
 - 6.2.2. Co-training
 - 6.2.3. Graph-based semi-supervised learning
- 6.3. Ensemble learning

- 6.3.1. Boosting
- 6.3.2. Bagging
- 6.3.3. Bucket of models
- 6.3.4. Stacking
- 6.4. Practical issues

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. *An Introduction to Statistical Learning: With Applications in R*. Springer Publishing Company, Incorporated, 2014.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. Stuart Russell and Peter Norvig. *Artificial Intelligence: A Modern Approach (3rd edition)*. Prentice Hall Press, Upper Saddle River, NJ, USA, 2009.
- [3] Shai Shalev-Shwartz and Shai Ben-David. *Understanding Machine Learning: From Theory to Algorithms*. Cambridge University Press, New York, NY, USA, 2014.
- [4] Sebastian Raschka, Vahid Mirjalili. *Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2 (3rd edition)*. Packt Publishing, 2019.
- [5] Eric Matthes. *Python crash course: a hands-on, project-based introduction to programming*, No Starch Press, 2016.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Ngô Xuân Bách

Ngô Xuân Bách

ARTIFICIAL INTELLIGENCE GRADUATION MODULE 2

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Artificial Intelligence Graduation Module 2

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Algebra (BAS1201)
- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker, black board or white board.

- Phòng thực hành (Laboratory): Computers (can do python programming)

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 40h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 4h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội

Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course provides learners with advanced concepts of deep learning. The learners are required to understand:

- advanced concepts of deep learning and their applications.
- new topics in deep learning research

Kỹ năng (Skills):

Learners will learn the skill set to develop various kinds of deep learning-based systems. These skills consist of:

- using python and deep learning frameworks.
- modifying deep learning architecture to adapt to the problem.
- evaluating various deep learning models.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes, do exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course will cover the advanced knowledge of applied deep learning in research and practice. Learners will learn how advanced deep learning architectures work. Some real-world problems that have been solved by advanced deep learning architectures are also introduced. On completion of this course, the learners will be able to know how to apply and when to apply these architectures to real-world problems. Furthermore, the learners will be able to analyze when the accuracy of the applied architecture is not as high as expected.

4. Nội dung chi tiết học phần (Outlines)**Chapter 1: Deep learning basic**

- 1.1. Deep learning concepts
 - 1.1.1. Deep learning components
 - 1.1.2. Deep learning operations
- 1.2. Deep learning frameworks in python

Chapter 2: Deep learning models for image classification

- 2.1. Introduction to convolutional neural network (CNN)
- 2.2. Residual network learning
 - 2.2.1. Overview of Resnet
 - 2.2.2. ResNet architecture and evaluation
 - 2.2.3. Application of ResNet
- 2.3. 3DCNN for video processing
 - 2.3.1. Overview of 3DCNN
 - 2.3.2. 3DCNN architecture and evaluation
 - 2.3.3. Application of 3DCNN
- 2.4. CapsNet
 - 2.4.1. Overview of CapsNet
 - 2.4.2. CapsNet architecture and evaluation
 - 2.4.3. Application of CapsNet

Chapter 3: Deep learning models for object detection

- 3.1. Faster RCNN
 - 3.1.1. Overview of faster RCNN
 - 3.1.2. Faster RCNN architecture and evaluation
 - 3.1.3. Application of Faster RCNN
- 3.2. YOLO object detection
 - 3.2.1. Overview of YOLO
 - 3.2.2. YOLO architecture and evaluation
 - 3.2.3. Application of YOLO

Chapter 4: Deep learning models for Natural language processing

- 4.1. Introduction to recurrent neural network (RNN)
- 4.2. Word embedding
 - 4.2.1. One-hot encoding
 - 4.2.2. Word2Vec
 - 4.2.3. Global vectors for word representation (GloVe)
- 4.3. Long-short term memory (LSTM)
 - 4.3.1. Overview of LSTM

- 4.3.2. LSTM architecture and evaluation
- 4.3.3. Bi-LSTM architecture and evaluation
- 4.3.3. Application of LSTM and Bi-LSTM
- 4.4. Gated recurrent unit (GRU)
 - 4.4.1. Overview of GRU
 - 4.4.2. GRU architecture and evaluation
 - 4.4.3. Application of GRU

Chapter 5: Advanced Topics in Deep Learning

- 5.1. Introduction
- 5.2. Attention Mechanisms
 - 5.2.1. Recurrent models of visual attention
 - 5.2.2. Attention mechanisms for machine translation
- 5.3. Neural network with external memory
 - 5.3.1. A Fantasy game: sorting by example
 - 5.3.2. Implementing swaps with memory operations
 - 5.3.3. Neural turing machines
 - 5.3.4. Differentiable neural computer: A brief overview
- 5.4. Generative Adversarial Networks (GANs)
 - 5.4.1. Training a Generative Adversarial Networks
 - 5.4.2. Comparison with Variational Autoencoder
 - 5.4.3. Using GANs for Generating Image Data
 - 5.4.4. Conditional Generative Adversarial Networks
- 5.5. Limitations of Neural networks
 - 5.5.1. An aspirational goal: One-shot learning
 - 5.5.2. An aspirational goal: Energy-efficient learning

Chapter 6: Deep learning in practical applications

- 6.1. Implement of video classification.
 - 6.1.1. The datasets and algorithms of video classification
 - 6.1.2. Training model for visual features on an individual frame
 - 6.1.3. Implement 3D convolution in video
 - 6.1.4. Implement I3D framework.
- 6.2. Implement of object segmentation.
 - 6.2.1. The datasets and algorithms of object segmentation
 - 6.2.2. Implement salient object detection
 - 6.2.3. Implement Region-based segmentation
 - 6.2.4. Implement Mask R CNN
- 6.3. Implement of machine translation
 - 6.3.1. The datasets and algorithms of machine translation
 - 6.3.2. Implement Bi-LSTM based method for machine translation
 - 6.3.3. Implement Encoder Decoder structure with attention
- 6.4. Implement of document classification
 - 6.4.1. The datasets and algorithms of document classification
 - 6.4.2. Implement Bi-LSTM based method for document classification
 - 6.4.3. Implement Random multimodel deep learning for document classification

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook, Springer, 2018.

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Adrian Rosebrock. Deep learning for computer vision with Python, ebook, 2017.

[3] Ian Goodfellow, Yoshua Bengio, and Aaron Courville . Deep learning, The MIT Press, 2016, ISBN: 0262035618

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Ngô Xuân Bách

Vũ Hoài Nam

INTRODUCTION TO CRYPTOGRAPHY

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Introduction to Cryptography

Mã học phần (Course code): INT1344

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory: Projector, microphone and speaker, programming support tools.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with background information and knowledge of cryptography, including:

- mathematical concepts in cryptography;
- commonly-used encryption algorithms;
- hash functions
- key management and distribution issues;
- applications of cryptography in practice.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- analyzing and selecting appropriate cryptographic algorithms for real problems;
- applying suitable cryptographic techniques for information security problems in practice.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

This course provides students with basic knowledge of cryptography, including: the roles and the importance of cryptography, basics of applied mathematics in cryptography, common symmetric and asymmetric encryption algorithms, hash functions, issues on management, agreements and distribution of the keys in cryptography, and some practical applications of encryption algorithms.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Introduction of cryptography

- 1.1. Basic terminology and concepts
- 1.2. History of cryptography
- 1.3. Classification of cryptography
- 1.4. The role of cryptography

Chapter 2 Symmetric – key encryption

- 2.1. Introduction
- 2.2. Mathematical aspects of symmetric – key encryption
- 2.3. Classical symmetric – encryption techniques
- 2.4. Modern symmetric – encryption techniques
 - 2.4.1. Data Encryption Standard (DES)
 - 2.4.2. Advanced encryption standard (AES)
 - 2.4.3. Stream ciphers
- 2.5. Evaluation of symmetric – encryption algorithms
- 2.6. Some applications of symmetric key encryption

Chapter 3 Asymmetric – key encryption

- 3.1. Introduction
- 3.2. Mathematical aspects of asymmetric – key encryption
- 3.3. Some asymmetric – key encryption algorithms
- 3.4. Evaluation of asymmetric – encryption algorithms
- 3.5. Some applications of asymmetric – key encryption

Chapter 4 Hash Functions

- 4.1. Introduction
- 4.2. Unkeyed hash functions (MDCs)
- 4.3. Keyed hash functions (MACs)
- 4.4. Some common hash functions
 - 4.4.1. MD5
 - 4.4.2. SHA1
- 4.5. Hash Function Applications

Chapter 5 Key Management and Distribution

- 5.1. Introduction
- 5.2. Background and basic concepts
- 5.3. Techniques for distributing confidential keys
- 5.4. Techniques for distributing public keys
- 5.5. Key agreement
 - 5.5.1. Key agreement based on symmetric techniques
 - 5.5.2. Key agreement based on asymmetric techniques
- 5.6. Real applications of key management and distribution.

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] William Stallings. Cryptography and Network Security. Prentice Hall. 6th Edition. 2013.

5.2. Học liệu tham khảo (Optional Textbooks)

[2] Đỗ Xuân Chợt. Bài giảng Mật mã học cơ sở, Học viện Công nghệ Bưu chính viễn thông. 2016.

[3] Bruce Schneier. Applied Cryptography: Protocols, Algorithms, and Source Code in C. Wiley. 1996.

[4] Behrouz A. Forouzan. Introduction to cryptography and network security. McGraw-Hill Higher Education. 2008.

[5] Jonathan Katz, Yehuda Lindell. Introduction to Modern Cryptography. Chapman & Hall/CRC. 2007.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Đỗ Xuân Chợt

NETWORK SECURITY

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Network Security

Mã học phần (Course code): INT1482

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Computer Networks (INT1336), Fundamentals of Information Security (INT1472)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board, microphone and speaker
- Laboratory: Computers with internet access

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to provide learners with important knowledge about network security, including:

- basic concepts of network security
- threats and vulnerabilities in network security
- network attacks and defense techniques

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to recognize network security threats and vulnerabilities;
- determining and analyzing the type of network attacks and countermeasure;
- simulating network attacks and countermeasures in network security lab.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

The course introduces learners to knowledge about network security, including basic concepts of attacks and defenses, threats and vulnerabilities in network security, different types of attack techniques and countermeasures, prevention and response to network attacks.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction to network security

1.1. Network security requirements and methodology

1.1.1. Network security requirements

1.1.2. Security methodology

1.2. Risk analysis and defense models

1.2.1. Threat assessment

1.2.2. Risk analysis

1.2.3. Defense models

1.3. Security organization

1.3.1. Roles and responsibilities

1.3.2. Security operations management

1.3.3. Security awareness training

Chapter 2. Threat and vulnerability in network security

2.1. Threat and vulnerability in network protocols

2.1.1. Basic application layer protocols

2.1.2. DNS

2.1.3. TCP/UDP

2.1.4. Routing protocols

2.1.5. Others

2.2. Design and analysis of security protocols

2.3. Threat and vulnerability in network devices

2.3.1. Switches

2.3.2. Routers

2.3.3. Others

Chapter 3. Network attack techniques

3.1. Reconnaissance

3.1.1. Introduction

3.1.2. DNS reconnaissance

3.1.3. Collect and check domain name and IP address information

3.1.4. Reconnaissance using search engines

3.2. Scanning

3.2.1. Introduction

3.2.2. Determine active hosts

3.2.3. Determine active ports and services

3.2.4. Determine operating systems

3.2.5. Scan vulnerabilities

3.3. Intrusion techniques

- 3.3.1. Client intrusion
- 3.3.2. Firewall bypassing techniques
- 3.4. Denial of services attacks
 - 3.4.1. Link layer denial of service attacks
 - 3.4.2. Transport layer denial of service attacks
 - 3.4.3. Application layer denial of service attacks

Chapter 4. Attack prevention and response

- 4.1. Attack prevention methods
 - 4.1.1. Secure the physical environment
 - 4.1.2. Keep patches updated
 - 4.1.3. Secure user account
 - 4.1.4. Secure the file system
 - 4.1.5. Create a security defense plan
- 4.2. Incident response
 - 4.2.1. Incident response plan
 - 4.2.2. Forensics
 - 4.2.3. Legal issues
- 4.3. Disaster recovery and business continuity
 - 4.3.1. Disaster recovery plan
 - 4.3.2. Business continuity plan

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg, *Network Security: The Complete Reference*, McGraw-Hill Osborne Media, 2013.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2]. John Chirillo, *Hack attacks revealed: A complete reference with custom security hacking toolkit*, John Wiley & Sons, 2001.
- [3]. Jie Wang, *Computer Network Security: Theory and Practice*, Springer, 2009.
- [4]. Michael T. Simpson, Kent Backman, *Hands-On Ethical Hacking and Network Defense*, Delmar Cengage Learning, 2010.
- [5]. Stuart McClure, Joel Scambray and George Kurtz, *Hacking Exposed 7: Network Security Secrets & Solutions*, McGraw-Hill Osborne Media, 2012.
- [6]. William Stallings, *Cryptography and Network Security: Principles and Practice*, Prentice Hall, 2016.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	30%	Group or individual
- Final examination	50%	Individual

**Trưởng Bộ môn
(Head of Department)**

Hoàng Xuân Dậu

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Ngọc Điệp

WEB APPLICATION AND DATABASE SECURITY

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Web Application and Database Security

Mã học phần (Course code): INT14105

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Fundamentals of Information Security (INT1472)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory: LAN computers with internet connection.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the fundamental and in-depth knowledge about web application security and database security, including:

- web application security: security risks, weaknesses, vulnerabilities and attacks in web applications; measures to secure web servers, applications and browsers;
- database security: risks and attacks to databases; measures to secure databases; database backup and restoration; auditing and monitoring of database activities.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- managing web and database servers;
- analyzing and applying security measures to ensure the security for web servers, web applications, database servers and databases.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

This course provides learners with fundamental and in-depth knowledge about web application security and database security, including security requirements for web applications; security risks, weaknesses and vulnerabilities in web applications; approaches for securing web applications; common attacks to websites and web applications; measures to secure web servers, applications and browsers; security issues in the development and deployment of web applications; security requirements for databases, the general model to secure databases and common attacks to databases; measures to secure databases; and backup and restoration of databases, and auditing and monitoring of database activities.

4. Nội dung chi tiết học phần (Outlines)

Part I- Web Application Security

Chapter 1 Introduction to web application security

- 1.1. Overview of web services and web application architectures
 - 1.1.1. HTTP protocol
 - 1.1.2. Components of web applications
 - 1.1.3. Web application architectures
- 1.2. Principles of web application security
 - 1.2.1. General principles
 - 1.2.2. Layers of web application security
- 1.3. Security risks and vulnerabilities in web applications
 - 1.3.1. Overview
 - 1.3.2. OWASP top 10 vulnerabilities
- 1.4. Approaches for securing web applications
 - 1.4.1. Checking of input data
 - 1.4.2. Minimizing of possible attack surfaces
 - 1.4.3. Defense in depth

Chapter 2 Common attacks to web applications

- 2.1. HTML injections and Cross-Site Scripting (XSS)
- 2.2. Cross-Site Request Forgery (CSRF)
- 2.3. SQL injection
- 2.4. Attacks to authentication mechanisms
- 2.5. Attacks to design defects
- 2.6. Attacks to web browsers and user privacy
- 2.7. Case-studies in web vulnerabilities and attacks

Chapter 3 Security for web servers, applications and browsers

- 3.1. Security for web servers
 - 3.1.1. Vulnerabilities in web server configurations
 - 3.1.2. Security measures based on web server configurations
 - 3.1.3. Vulnerabilities in web server software
 - 3.1.4. Web server software security
- 3.2. Security for web applications
 - 3.2.1. Security measures based on authentication and authorization
 - 3.2.2. Web session security
 - 3.2.3. Web database security
 - 3.2.4. File system security
- 3.3. Security for web browsers

- 3.3.1. Web browser security issues
- 3.3.2. Security measures for web browsers

Chapter 4 Security in the development and deployment of web applications

- 4.1. Approaches in the development and deployment of secure web applications
 - 4.1.1. Overview
 - 4.1.2. The comprehensive approach in application security
- 4.2. Models and methods for the development of secure software
 - 4.2.1. Microsoft SDL
 - 4.2.2. OWASP CLASP
 - 4.2.3. SAMM

Part II- Database Security

Chapter 5 Introduction to database security

- 5.1. Overview
- 5.2. Security requirements for databases
- 5.3. General security model and layers for databases
- 5.4. Common attacks to databases
- 5.5. Top 10 security vulnerabilities in practice

Chapter 6 Security measures for databases

- 6.1. Database authentication and authorization
- 6.2. Securing objects in databases
- 6.3. Using encryption in databases
- 6.4. Other security measures for databases
- 6.5. Security models in common database management systems
 - 6.5.1. Microsoft SQL Server
 - 6.5.2. MySQL
 - 6.5.3. Oracle
- 6.6. Security check and evaluation of database systems

Chapter 7 Database backup, restoration, auditing and monitoring

- 7.1. Database backup & restoration
 - 7.1.1. Overview
 - 7.1.2. Database backup
 - 7.1.3. Backup data security
 - 7.1.4. Database restoration
- 7.2. Database auditing
 - 7.2.1. Introduction to security auditing
 - 7.3.2. Types of database auditing
- 7.3. Database monitoring

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Bryan Sullivan, Vincent Liu, Web Application Security, A Beginner's Guide, McGraw-Hill, 2012.
- [2] Alfred Basta, Melissa Zgola, Database Security, Cengage Learning, 2012.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3] Hoàng Xuân Dậu, Bài giảng An toàn ứng dụng web và cơ sở dữ liệu, Học viện Công nghệ Bưu chính viễn thông, 2017.

- [4] Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, John Wiley & Sons, 2011.
- [5] Mike Shema, Hacking Web Apps: Detecting and Preventing Web Application Security Problems, Elsevier Inc., 2012.
- [6] Denny Cherry, Securing SQL Server: Protecting Your Database from Attackers, Syngress, 2012.
- [7] Mark L. Gillenson, Fundamentals of Database Management Systems, 2nd edition, Wiley, 2011.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Hoàng Xuân Dậu

WINDOWS AND LINUX/UNIX ADMINISTRATION

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Windows and Linux/Unix Administration

Mã học phần (Course code): INT1487

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Computer Networks (INT1336)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, ...
- Phòng thực hành (Laboratory): LAN computers with Windows Server, Linux Server

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the fundamental knowledge on Microsoft Windows / Linux / Unix server operating systems, including:

- Microsoft Windows server operating system and its critical components and services; methods to secure/harden Windows server systems;
- Linux/Unix server operating system and its critical components and services; methods to secure/harden Linux/Unix server systems.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- installing, configuring and managing Windows server and its services;
- installing, configuring and managing Linux/Unix server and its services.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and

self-studying hours.

3. Tóm tắt nội dung học phần (Abstract) (5- 6 dòng)

This course aims to equip students with fundamental knowledge on Microsoft Windows / Linux / Unix server operating systems and network services, including email service, file sharing service, web service, DNS service, user management... Besides, this course gives an overview of techniques and methods to detect and prevent cyber-attacks, and the system backup and recovery in the abnormal situations.

5. Nội dung chi tiết học phần (Outlines)

Chapter 1: Windows server system administration

- 1.1 History and core services of Windows server
 - 1.1.1 History of Windows server
 - 1.1.2 User account management
 - 1.1.3 Active directory (AD)
 - 1.1.4 Domain name system (DNS)
 - 1.1.5 Dynamic host configuration protocol (DHCP)
- 1.2 Web and networking with Windows server
 - 1.2.1 IIS web server
 - 1.2.2 Server core
 - 1.2.3 Certificates in Windows server
 - 1.2.4 IPv6
 - 1.2.5 Networking toolbox
 - 1.2.6 Software defined networking
- 1.3 Hardening and Security
 - 1.3.1 Windows defender advanced threat protection
 - 1.3.2 Windows defender firewall
 - 1.3.3 Encryption technologies
 - 1.3.4 Advanced threat analytics
 - 1.3.5 General security best practices

Chapter 2: Unix and Linux system administration

- 2.1 History and core services of Unix and Linux operating system
 - 2.1.1 History of Unix and Linux operating system
 - 2.1.2 Storage
 - 2.1.3 Access control and root privileges
 - 2.1.4 Process control
 - 2.1.5 The file system
 - 2.1.6 User account management
 - 2.1.7 Drivers and the Kernel
- 2.2 Web and networking with Unix/Linux operating system
 - 2.2.1 TCP/IP Networking
 - 2.2.2 Software defined networking
 - 2.2.3 IP Routing
 - 2.2.4 Domain name system
 - 2.2.5 Single sign on
 - 2.2.6 Web hosting

- 2.2.7 Samba server
- 2.2.8 Virtualization
- 2.3 Hardening and Security
 - 2.3.1 Basic security measures
 - 2.3.2 Linux firewall
 - 2.3.3 Encryption technologies
 - 2.3.4 Performance analysis
 - 2.3.5 Methodology and security policy

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Jordan Krause, *Mastering Windows Server 2019*, Packt Publishing, Second edition, 2019.
- [2] Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, *Unix and Linux system administration handbook*, Addison-Wesley Professional, Fifth edition, 2018.

5.2. Học liệu tham khảo (Reference Textbooks)

- [3] Tom Carpenter, *Microsoft Windows Server Operating System Essentials*, Sybex, 2011.
- [4] Wale Soyinka, *Linux Administration A Beginners Guide*, McGraw-Hill Osborne Media, 2012.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	20%	Individual
- Projects	20%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Ngô Quốc Dũng

PENETRATION TESTING

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Penetration testing

Mã học phần (Course code): INT14107

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Fundamentals of Information Security (INT1472)

Học phần song hành (Parallel courses): Network Security (INT1482)

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, black board, microphone and speaker
- Laboratory: Computers with internet access

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to provide learners with fundamental knowledge about penetration testing, including:

- basic concepts of penetration testing
- penetration testing techniques for information systems
- knowledge of techniques for exploiting using shellcode
- knowledge of vulnerability analysis.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- applying the learned knowledge to perform penetration testing
- analyzing and exploiting some vulnerabilities.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

This course introduces learners to basic knowledge of penetration testing, including types of penetration testing techniques; the detailed steps of penetration testing with planning, implementation and completion; techniques of penetration testing for information systems and supporting tools; and in-depth knowledge of techniques for exploiting and analyzing vulnerabilities.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Introduction

- 1.1. Introduction to penetration testing
- 1.2. Roles of penetration testing
- 1.3. Ethics of penetration testing
- 1.4. Penetration testing stages
- 1.5. Supporting tools

Chapter 2. Essential techniques for penetration testing

- 2.1. Social engineering
 - 2.1.1. Introduction
 - 2.1.2. Common attack techniques
 - 2.1.3. Social engineering prevention
- 2.2. Physical penetration testing
 - 2.2.1. Introduction
 - 2.2.2. Common attack techniques
 - 2.2.3. Prevention
- 2.3. Insider attack penetration testing
 - 2.3.1. Introduction
 - 2.3.2. Conduct an insider attack
 - 2.3.3. Insider attack prevention
- 2.4. Network penetration testing
 - 2.4.1. Network penetration testing techniques
 - 2.4.2. Prevention

Chapter 3. Vulnerability exploit using shellcode

- 3.1. Buffer overflow vulnerability exploit
 - 3.1.1. Introduction to buffer overflow
 - 3.1.2. Exploiting buffer overflow
 - 3.1.3. Memory protection methods
- 3.2. Shellcode and its application in exploiting vulnerabilities
- 3.3. Types of shellcode
 - 3.3.1. Shellcode in user space
 - 3.3.2. Shellcode in kernel space

- 3.4. Create a shellcode
 - 3.4.1. Create a simple shellcode
 - 3.4.2. Create a shell bind shellcode
 - 3.4.3. Create a reverse shell shellcode
 - 3.4.4. Encrypt a shellcode
 - 3.4.5. Shellcode generator

Chapter 4. Vulnerability analysis

- 4.1. Source code analysis
 - 4.1.1. Manual source code analysis
 - 4.1.2. Automated source code analysis
- 4.2. Binary code analysis
 - 4.2.1. Manual auditing of binary code
 - 4.2.2. Automated binary analysis
- 4.3. Fuzzing technique
 - 4.3.1. Fuzzing with known protocols
 - 4.3.2. Fuzzing with unknown protocols
- 4.4. Client-side vulnerability
 - 4.4.1. Impacts of client-side vulnerability
 - 4.4.2. Detecting client-side vulnerability
 - 4.4.3. Prevention
- 4.5. Vulnerability exploitation
 - 4.5.1. Exploitability
 - 4.5.2. Payload construction
- 4.6. Exploit mitigation
 - 4.6.1. Some common methods
 - 4.6.2. Patching

Chapter 5: Post exploitation

- 5.1. Rules of engagement
- 5.2. Data gathering, network analysis
- 5.3. Pillaging
- 5.4. Pivoting
- 5.5. Clean-up

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1]. Lee Allen, *Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide*, Packt Publishing, 2012.
- [2]. Harper, Allen, et al, *Gray Hat Hacking: The Ethical Hackers Handbook*, McGraw-Hill

Osborne Media, 2011.

5.2. Học liệu tham khảo (Optional Textbooks)

- [3]. Stuart McClure, Joel Scambray, George Kurtz, *Hacking Exposed 7: Network Security Secrets and Solutions*, McGraw Hill, 2012.
- [4]. Sean-Philip Oriyano, Michael Gregg, *Hacker Techniques, Tools, and Incident Handling*, Jones & Bartlett Learning, 2010.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	30%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Nguyễn Ngọc Diệp

MANAGEMENT OF INFORMATION SECURITY

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Management of information security

Mã học phần (Course code): INT14106

Loại học phần (Course type): Tự chọn (Elective)

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector

- Laboratory: LAN computers with Virtual machine running Linux/Windows Server

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h

- Bài tập (Exercises): 0h

- Bài tập lớn (Projects): 8h

- Thực hành (Labs): 5h

- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with basic knowledge of information security management, including basic principles for building and managing information security solutions; common security standards as well as Vietnamese and international information security laws and policies; common methods for identifying, assessing and minimizing safety risks; methods to perform security operations and handle security incidents.

Kỹ năng (Skills):

After completing the course, students master the comprehensive knowledge of information security management. Students are capable of planning and developing information security programs for specific systems. Also, the students can identify and assess risks and apply risk control strategies; are able to develop procedures to operate and maintain systems securely and to respond appropriately to security incidents.

Thái độ, Chuyên cần (Attitude):

Students are required to attend at least 80% of lectures during the course and actively participated in discussions on given topics. Also, students must fulfill lab exercises and project at the end of the course.

3. Tóm tắt nội dung học phần (Abstract) (5- 6 dòng)

The course of information security management provides basic knowledge and presents practical issues in developing and managing information security solutions to meet security requirements of given organizations. In particular, the course presents common security standards including domestic and international information security legislation under which security measures should be followed or adapted. In addition, the course also introduces methods to identify and assess risks to minimize the impact of information security gaps. Finally, the course outlines the principles and measures that make it possible to operate the system securely, as well as to maintain continuous operation and how to respond to security incidents.

4. Nội dung chi tiết học phần (Outlines)

Chapter 10. Overview of information security management

- 10.1. Introduction
- 10.2. Security policies and laws
- 10.3. Principles of information security management
- 10.4. Organizations of information security management

Chapter 11. Legal system of information security in Vietnam and other countries

- 11.1. Legal and policy requirements
- 11.2. Vietnamese laws on security of information
- 11.3. Legal information security systems of other countries
 - 11.3.1. US Laws
 - 11.3.2. European Laws
 - 11.3.3. Laws in the region

Chapter 12. Information security standards

- 12.1. International standards on information security
 - 12.1.1. ISO / IEC
 - 12.1.2. NIST
- 12.2. Vietnamese information security standards

Chapter 13. Information security management system

- 13.1. Security framework
- 13.2. Risk management
- 13.3. Risk identification, analysis and assessment
- 13.4. Strategies for risk control
- 13.5. Risk control practices

Chapter 14. Management of security operation

- 14.1. Principles of security operation
- 14.2. Configuration management
- 14.3. Control of equipment and data
- 14.4. Management responsibilities

Chapter 15. Business continuity and incident response

- 15.1. Principle of business continuity and incident response
- 15.2. Develop business continuity plans

15.3. Incident recovery strategy

15.4. Test and update the plan

Project and assignment. Students are assigned a small project and work with a group of 4 persons

- Project requirements and guidelines is presented at the beginning of the course
- Project outcomes are revised in the middle of the course
- Project results are presented and graded at the end of the course

Lab exercise.

Students are required to complete Lab exercises under the provision and guidance of the lecturer

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Michael E. Whitman, Herbert J. Mattord, *Roadmap to Information Security: For IT and Infosec Managers*, Delmar Publishers Inc., 2011.

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Quốc hội Việt Nam, Luật Công nghệ thông tin (67/2006/QH11), 12/07/2006.

[3] Quốc hội Việt Nam, Luật An toàn thông tin mạng (86/2015/QH13), 19/11/2015

[4] Quốc hội Việt Nam, Luật An ninh mạng (24/2018/QH14), 12/6/2018

[5] Michael E. Whitman and Herbert J. Mattord, *Management of Information Security*, Course Technology, Cengage Learning, 2010.

[6] Michael E. Whitman, Herbert J. Mattord, *Principles of information security*, 4th edition, Course Technology, Cengage Learning, 2012.

[7] Sari Greene, *Security Policies and Procedures Principles and Practices*, Prentice Hall, 2005.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Hình thức kiểm tra (Grading method)	Tỷ lệ đánh giá (Percentage)	Đặc điểm đánh giá (Group/Individual)
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Project and Assignment	20%	Group or Individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Hoàng Xuân Dậu

Phạm Hoàng Duy

ADVANCED NETWORK SECURITY

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Advanced Network Security

Mã học phần (Course code): INT1483

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Network Security (INT1482)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory: LAN computers with internet connection.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 30h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 7h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the in-depth knowledge network security, including:

- techniques and technologies to ensure security of network systems;
- secure communication protocols and techniques;
- cloud computing, its security issues and measures.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- advanced analyzing security risks and threats to the network systems;
- identifying network attack types and deploying appropriate solutions with advanced techniques.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects & labs and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

The course provides in-depth knowledge about the advanced techniques to ensure network security, including advanced security techniques for network infrastructure; information security techniques and protocols; security solutions for local area networks, wireless computer networks, Intranet network, and mobile networks; security issues, security architecture and measures to ensure data security in cloud computing.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Techniques and technologies to ensure network security

- 1.1. Access control
 - 1.1.1. Physical security control
 - 1.1.2. Authentication method
 - 1.1.3. Access control method
- 1.2. Firewall
 - 1.2.1. Concept of firewalls
 - 1.2.2. Some kind of firewall
 - 1.2.3. Some auxiliary functions
 - 1.2.4. Deploy firewall
- 1.3. Virtual private network technology
 - 1.3.1. Mechanism of action
 - 1.3.2. Virtual private network protocols
 - 1.3.3. Deploy virtual private network
- 1.4. Honeypot system
 - 1.4.1. Concept of honeypot system
 - 1.4.2. Types of honeypot
 - 1.4.3. Deploying honeypot system
 - 1.4.4. Exercise on configuring and deploying honeypot
- 1.5. DDoS protection
 - 1.5.1. Analysis of DDoS attacks in the Internet
 - 1.5.2. DDoS prevention method
 - 1.5.3. The network architecture supports IP search

Chapter 2: Information security techniques on networks

- 2.1. Security requirements on the network
 - 2.1.1. Security of networks and network services
 - 2.1.2. Security in information exchange
 - 2.1.3. Security for e-commerce services
 - 2.1.4. Network security monitoring
- 2.2. Network security solutions based on encryption
 - 2.2.1. PKI public key infrastructure
 - 2.2.2. Digital signatures
 - 2.2.3. Digital certificate
 - 2.2.4. Hybrid cryptographic systems
- 2.3. Information security protocols
 - 2.3.1. IPSec
 - 2.3.2. SSL / TLS, SSH
 - 2.3.3. PGP and S-MIME
 - 2.3.4. Anonymous protocols

Chapter 3: Security for network systems

- 3.1. Security for local area network
 - 3.1.1. Risks and vulnerabilities
 - 3.1.2. Analyze and risks assessment
 - 3.1.3. Security Policy

- 3.1.4. Secure network design with access control, firewalls and IDS
- 3.2. Security for wireless local area network
 - 3.2.1. Wireless local area network
 - 3.2.2. Security protocols
- 3.3. Security for Intranet network
 - 3.3.1. Risks and vulnerabilities
 - 3.3.2. Analyze and risks assessment
 - 3.3.3. Authentication and encryption
 - 3.3.4. User training
- 3.4. Security for mobile networks
 - 3.4.1. Mobile network
 - 3.4.2. Secure routing
 - 3.4.3. Keys management

Chapter 4: Security for cloud computing

- 4.1. Overview of cloud computing
 - 4.1.1 Architecture of cloud computing
 - 4.1.2 Security for cloud computing
- 4.2. Security issues for cloud computing
 - 4.2.1. Virtualization
 - 4.2.2. Preventive
 - 4.2.3. Storage
 - 4.2.4. Activities and networks
- 4.3. Security architecture in cloud computing
 - 4.3.1. The requirements
 - 4.3.2. Security models
 - 4.3.3. Security architecture for cloud computing
 - 4.3.4. Planning of operational security strategies
- 4.4. Data security for cloud computing
 - 4.4.1. Data security for cloud computing
 - 4.4.2. Data encryption
 - 4.4.3. Data classification and security strategies

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg, Network Security: The Complete Reference, McGraw-Hill Osborne Media, 2013.

5.2. Học liệu tham khảo (Optional Textbooks)

- [2] Vic J.R. Winkler, Securing the Cloud: Cloud Computer Security Techniques and Tactics, Syngress, 2011.
- [3] John Chirillo, Hack attacks revealed: A complete reference with custom security hacking toolkit, John Wiley & Sons, 2001.
- [4] Jie Wang, Computer Network Security: Theory and Practice, Springer, 2009.
- [5] Michael T. Simpson, Kent Backman, Hands-On Ethical Hacking and Network Defense, Delmar Cengage Learning, 2010.
- [6] Stuart McClure, Joel Scambray and George Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, McGraw-Hill Osborne Media, 2012.
- [7] William Stallings, Cryptography and Network Security, Prentice Hall, 2010.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams	10%	Individual
- Projects	30%	Group or individual
- Final examination	50%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Hoàng Xuân Dậu

Đặng Minh Tuấn

INFORMATION SECURITY GRADUATION MODULE 1

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Information Security graduation module 1

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Fundamentals of Information Security (INT1472), Introduction to Cryptography (INT1344), Windows and Linux/Unix Administration (INT1487)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 20h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 40h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the in-depth knowledge about the security for operating systems, databases, web applications and some network services, including email, DNS and DHCP services.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- Analyzing security risks and threats to the information systems;
- Selecting and applying security measures to ensure the security for operating systems, web applications, databases and email, DNS and DHCP services.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects and self-studying

hours.

3. Tóm tắt nội dung học phần (Description)

This course provides students with in-depth knowledge and skills in software security, including the general security model and detailed security measures for software systems. Specific topics of the course consist of security issues and security measures for operating systems, databases, web applications and some network services, including email, DNS and DHCP services.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Operating system security

- 1.1. Security issues in operating systems
- 1.2. Security measures for operating systems
- 1.3. Project: Research the architecture, installation and administration of server operating systems (Windows server, Linux server)

Chapter 2 Database security

- 2.1. Security issues in databases
- 2.2. Security measures for databases
- 2.3. Project: Research the architecture, installation and administration of common database management systems (Microsoft SQL Servers, MySQL, Oracle DBMS)

Chapter 3 Web application security

- 3.1. Security issues in web applications
- 3.2. Security measures for web applications
- 3.3. Project: Research the architecture, installation and administration of common web servers (Apache web servers, Microsoft IIS, Nginx, Tomcat/Java applications,...)

Chapter 4 Other network services security

- 4.1. Emails and email service security
- 4.2. DNS security
- 4.3. DHCP security
- 4.4. Projects:
 - 4.4.1. Research the architecture, installation and administration of common email servers
 - 4.4.2. Research the architecture, installation and administration of DNS, DHCP servers

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

- [1] Trent Jaeger, Operating System Security, Morgan & Claypool Publishers, 2008.
- [2] Alfred Basta, Melissa Zgola, Database Security, Cengage Learning, 2012.
- [3] Bryan Sullivan, Vincent Liu, Web Application Security, A Beginner's Guide, McGraw-Hill, 2012.

5.2. Học liệu tham khảo (Optional Textbooks)

- [4] Michael E. Whitman, Herbert J. Mattord, Principles of information security, 4th edition, Course Technology, Cengage Learning, 2012.

- [5] Mike Shema, Hacking Web Apps: Detecting and Preventing Web Application Security Problems, Elsevier Inc., 2012.
- [6] Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, John Wiley & Sons, 2011.
- [7] Darril Gibson, Microsoft Windows Security Essentials, Wiley Publishing, 2011.
- [8] Mehedi Al Mamun, Operating Systems Security: Linux, LAP Lambert Acad. Publishing, 2011.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams		
- Projects	40%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Đỗ Xuân Chợt

INFORMATION SECURITY GRADUATION MODULE 2

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Information security graduation module 2

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Elective

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses): Fundamentals of Information Security (INT1472), Introduction to Cryptography (INT1344), Network Security (INT1482)

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker.
- Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 20h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 40h
- Thực hành (Labs): 0h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide students with the knowledge about cyber-attack and prevention, malware and prevention, techniques to ensure information security, cryptographic systems and cryptographic applications in network security.

Kỹ năng (Skills):

The aim of this course is to equip students with skills in:

- analyzing and identifying security risks and threats to the network systems;
- selecting and applying suitable security measures to protect information, systems, networks in practice.

Thái độ, Chuyên cần (Attitude):

Students must ensure the required class attendance, assigned projects and self-studying hours.

3. Tóm tắt nội dung học phần (Description)

The course provides students with knowledge and skills for network security, including network security issues as well as methods of ensuring network security. Specific topics include network attacks and prevention measures, malware and prevention solutions, network information security techniques and technologies, cryptography and cryptographic applications in network security.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1. Network attacks and prevention solutions

1.1. Typical types of network attacks

1.2. Prevention solutions

1.3. Exercise / Discussion: Understanding some typical types of network attacks (Spoofing, Sniffing, DOS, Phishing) and deploying prevention solutions

Chapter 2. Malware and prevention solutions

2.1. Malware classification

2.2. Solutions to detect and prevent malware

2.3. Exercise / Discussion: Understanding some malware and installing anti-malware scanning and removal tools

Chapter 3. Techniques and technologies to ensure information security

3.1. Access control

3.2. Firewall

3.3. IDS / IPS

3.4. IPSec, VPN

3.5. Exercise / Discussion: installing, configuring some information security systems

Chapter 4. Cryptography and cryptographic applications in network security

4.1. Symmetric key encryption

4.2. Asymmetric key encryption

4.3. Hash functions

4.4. Digital signature, digital certificate and PKI

4.5. Exercise / Discussion:

4.5.1. Understanding the algorithms and installing some encryption algorithms (AES, RSA, SHA1, Understanding how to create and verify digital signatures)

4.5.2. Understanding security protocols based on encryption (SSL / TLS, PGP, Kerberos)

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Roberta Bragg, Mark Rhodes-Ousley and Keith Strassberg, Network Security: The Complete Reference, McGraw-Hill Osborne Media, 2013.

[2] William Stallings, Cryptography and Network Security : Principles and Practice (6th Edition), Pearson, 2013.

5.2. Học liệu tham khảo (Optional Textbooks)

[3] Michael E. Whitman, Herbert J. Mattord, Principles of information security, 4th edition, Course Technology, Cengage Learning, 2012.

- [4] John Chirillo, Hack attacks revealed: A complete reference with custom security hacking toolkit, John Wiley & Sons, 2001.
- [5] Jie Wang, Computer Network Security: Theory and Practice, Springer, 2009.
- [6] Michael T. Simpson, Kent Backman, Hands-On Ethical Hacking and Network Defense, Delmar Cengage Learning, 2010.
- [7] Stuart McClure, Joel Scambray and George Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, McGraw-Hill Osborne Media, 2012.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Mid-term exams		
- Projects	40%	Group or individual
- Final examination	50%	Individual

Trưởng Bộ môn
(Head of Department)

Giảng viên biên soạn
(Lecturer)

Hoàng Xuân Dậu

Đặng Minh Tuấn