MINISTRY OF EDUCATION & TRAINING
**HO CHI MINH CITY UNIVERSITY OF
TECHNOLOGY & EDUCATION**

UNDERGRADUATE PROGRAM

Major of
INFORMATION TECHNOLOGY

Ho Chi Minh City, 08-2024

UNDERGRADUATE PROGRAM

Program's Name: INFORMATION TECHNOLOGY

Level: Undergraduate

Major: **INFORMATION TECHNOLOGY**   **Major's ID: 7480201**

Type of Program: Full Time

Apply for 2024 course onward

1. Duration of study: 4 years

2. Student Enrollment: High-school graduates

3. Grading system, Curriculum and Graduation Requirements

Grading system: 10

Curriculum: Based on regulations issued by decision No. 17/VBHN-BGDĐT

Graduation requirements:

- *General conditions*: Based on regulations issued by decision No. 17/VBHN-BGDĐT
- *Major conditions*: Fulfil the internship.
- *Requirements of High-Quality Training education*: Circular No. *23/2014/TT-BGDĐT dated 18-07-2014.*

4. Program Objectives and Expected Learning Outcomes

Goals

The High-Quality Training program majored in Information Technology is developed based on the IT Training program that has been approved by the President of UTE (2018) in accordance with the requirements from circular no. 23/2014/TT-BGDĐT about high-quality training.

The program aimed at building up learners with strong personal competency, foster soft skills like teamwork, presentation, problem-solving, analysis, substantial foundational understanding of Information Technology and related areas, and ability a adapt him/herself to the continuous changes of the working environment and the ever-growing feature of

Objectives

1. To provide students with fundamental knowledge of social and natural sciences and Information Technology (IT).
2. To develop a student's ability to discover knowledge, to solve problems, to think systematically, personal and professional skills are shaped as well.
3. To develop students' ability to work effectively in teams, especially multidisciplinary teams.
4. To develop student's ability to generate ideas, design, deployment, and operating IT systems along with running IT business in the real world.

Program Outcomes

1. To provide students with fundamental knowledge of social and natural sciences and IT. Students will have:

    1.1. Ability to present principles in social and natural sciences (such as Math, Physics).

    1.2. Ability to apply general principles and core technical basics to the IT field.

    1.3. Ability to demonstrate solid knowledge in application to practice with areas of

concentration: Computer networks (CN), Information systems (IS), Software engineering (SE) and Artificial Intelligence (AI)

2. To develop student's ability in discovering knowledge, solving problems, systematically thinking, as well as forming personal and professional skills. Students will have:

   2.1. Ability to analyze and solve IT problems.

   2.2. Ability to perform surveys and experiments relating to solutions for IT problems.

   2.3. Ability to think systematically about things that are IT-related.

   2.4. personal skills to help improve their work performance: creativity, flexibility, learning skills, time management, etc.

   2.5. professional skills to help improve their work performance: ethics, integrity, career planning.

3. To develop students' ability to work effectively in teams, especially multidisciplinary teams. Students will have:

   3.1. Ability to work effectively in teams and leadership skills.

   3.2. Ability to perform effective communication in text, email, graphics, oral presentation.

   3.3. Ability to communicate in foreign languages.

4. To develop student's ability to generate ideas, design, deployment, and operating IT systems in the real world. Students will have:

   4.1. Awareness of the important role of the social environment to IT systems' operation.

   4.2. Ability to judge correctly the differences in corporate cultures and to work effectively in different cultural environments.

   4.3. Ability to generate ideas, create requirement specification, identify features, and model IT systems.

   4.4. Ability to design IT systems.

   4.5. Ability to deploy hardware and software for IT systems.

   4.6. Ability to operate IT systems.

5. **Studying condition:**

   - Well-equipped classrooms with modern Teaching and Learning facilities to match international standards.
   - The students are given the privilege to use the most modern labs of the University.
   - Class size is small and most suitable for a best teaching/learning environment.
   - The faculty are among the most experienced Professors, Assoc. Professors, Senior lecturers from UTE or the Universities in the region.

   What makes this program differs from the other programs:

   - Honor training programs that are taken from the advanced higher education of G7 countries.
   - More than 75% of faculty are PhDs, Senior lectures who are graduated from spoken English countries.
   - The curriculum is project-based.
   - English competency of graduates is qualified at B2 or EILTS ≥ 5.5 equivalent.
   - Strong soft skills established.
   - Strong ability to research and innovate.

- The Teaching Assistance (TA) policy proves to efficiently support weak students.
- The family-connected policy to inform the academic status of the students proved to foster the students' studying progress.

6. Total program credits: 150 credits (133 Subject-matter + 17 English language)

7. Allocation of credits

Name	Credits		
	Total	Compulsory	Elective
General science (I)	**44**	**40**	**4**
Political theory	11	11	0
Social sciences and humanities	6	2	4
Mathematics & Natural sciences	21	21	0
Introduction to Information Technology	6	6	0
English Language (II)	**17**	**17**	**0**
Academic	17	17	
IT Courses (III)	**76**	**58**	**18**
Core courses	52	40	12
Specialized courses	24	18	6
Practical & Business involvement	**13**	**13**	**0**
Information Technology Enterprise	2	2	0
Internship	4	4	0
Capstone projects	7	7	0
Total (I+II+III+IV)	**150**	**128**	**22**
Physical Education	**3**		
Physical Education 1	1		
Physical Education 2	1		
Physical Education 3	1		
Military Education	**165 Hours**		

7. Content of the program

A. Compulsory courses

A.1. General science courses (40 credits)

No	Course ID	Course name	Credits	Notes
1	LLCT130105E	Philosophy of Marxism and Leninism	3	Political science
2	LLCT120205E	Political Economics of Marxism and Leninism	2	
3	LLCT220514E	History of Vietnamese Communist Party	2	
4	LLCT120314E	Ho Chi Minh's Ideology	2	
5	LLCT120405E	Scientific Socialism	2	
4	GELA220405E	General Law	2	
7	MATH132901E	Mathematical Statistics for Engineers	3	Math & Natural Science
8	MATH132401E	Calculus 1	3	
9	MATH132501E	Calculus 2	3	
10	MATH143001E	Linear Algebra and Algebraic Structure	4	

11	PHYS130502E	Physics 1	3	
12	PHYS111202E	Physics 1 - Laboratory	1	
13	EEEN231780E	Basic Electronics	3	
14	PRBE214262E	Practice Basic Electronics	1	
15	INIT130185E	Introduction to Information Technology	3 (2+1)	Information Technology
16	INPR130285E	Introduction to programming	3 (2+1)	
17	PHED110130	Physical Education 1	0(1)	
18		Physical Education 2	0(1)	
19		Physical Education 3	0(1)	
20		Military Education	0	**165**
		Total	**40**	

Physical Education:

STT	Mã học phần	Tên học phần	Số tín chỉ	Số tiết LT	Số tiết TH	Tổng số tiết	Ghi chú
1	PHED110130	Giáo dục thể chất 1	1	9	21	30	Môn bắt buộc
2	FOOT112330	Bóng đá	1	9	21	30	Hai học phần Giáo dục thể chất 2 và Giáo dục thể chất 3 (Sinh viên chọn học 02 học phần trong 07 học phần lựa chọn theo danh sách)
3	VOLL112330	Bóng chuyền	1	9	21	30	
4	BASK112330	Bóng rổ	1	9	21	30	
5	BADM112330	Cầu lông	1	9	21	30	
6	TENN112330	Quần vợt	1	9	21	30	
7	KARA112330	Không thủ đạo	1	9	21	30	
8	CHES112330	Cờ vua	1	9	21	30	

A.2. Information Technology Courses

A.2.1. IT Core courses (40 credits)

No	Course ID	Course name	Credits
1	PRTE230385E	Programming techniques	3 (2+1)
2	DIGR230485E	Discrete Mathematics and Graph Theory	3(2+1)
3	DASA230179E	Data Structures and Algorithms	3(2+1)
4	OOPR230279E	Object-Oriented Programming	3(2+1)
5	WIPR230579E	Windows Programming	3(2+1)
6	INSE330380E	Information Security	3(2+1)
7	WEPR330479E	Web Programming	3(2+1)
8	CAAL230180E	Computer Architecture and Assembly Language	3(2+1)
9	OPSY330280E	Operating Systems	3(2+1)
10	NEES330380E	Networking Essentials	3(2+1)
11	DBSY230184E	Database Systems	3(2+1)
12	DBMS330284E	Database Management Systems	3(2+1)

13	ARIN330585E	Artificial Intelligence	3(2+1)
14	PROJ215879E	IT Project	1
		Total	**40**

A.2.2. Specialized courses *(Students choose one among the following areas of concentration)*

No	Course ID	Course name	Credits
Software Engineering (SE)			
1	OOSE330679E	Object-Oriented Software Engineering	3(2+1)
2	DEPA330879E	Design Patterns	3(2+1)
3	MOPR331279E	Programming for Mobile Devices	3(2+1)
4	SOTE431079E	Software Testing	3(2+1)
5	MTSE431179E	Modern Technologies on Software Engineering	3(2+1)
6	POSE431479E	Project on Software Engineering	3
Computer network (CN)			
1	NPRO430980E	Network Programming	3(2+1)
2	ADNT330580E	Advanced Networking Technology	3(2+1)
3	ETHA332080E	Ethical Hacking	3(2+1)
4	CNDE430780E	Computer Networks Design	3(2+1)
5	NSEC430880E	Networks Security	3(2+1)
6	POCN431280E	Project on Computer Network & Network Security	3
Information system (IS)			
1	ISAD330384E	Information Systems Analysis and Design	3(2+1)
2	DAMI330484E	Data Mining	3(2+1)
3	SEOC431884E	Search Engine Optimization	3(2+1)
4	BDES333877E	Big Data Essentials	3(2+1)
5	DBSE431284E	Database security	3(2+1)
6	POIS431184E	Project on Information System	3
	Total per each specialization		**18**

A.2.3. Internship & Graduation (13 credits)

No	Course ID	Course name	Credits
1	ITEN420885E	Information Technology Enterprise	2
2	ITIN441085E	Internship	4
3	GRPR471979E	Capstone project	7

B – Elective courses:

General Knowledge Courses (4 credits)

No.	Course ID	Course Title	Credits	Note
1	GEEC220105E	General Economics	2	

No.	Course ID	Course Title	Credits	Note
2	INMA220305E	Introduction to Management	2	Select 2 courses
3	INLO220405E	Introduction to Logics	2	
4	LESK120190E	Learning Skills	2	
5	SYTH220491E	Systematic Thinking	2	
6	PLSK120290E	Planning Skill	2	
7	IVNC320905E	Introduction to the Vietnamese Culture	2	
8	INSO321005E	Introduction to Sociology	2	
9	ENPS220591E	Engineering Psychology	2	
10	WOPS120390E	Workplace Skills	2	
11	REME320690E	Research Methodology	2	

IT Core Elective Courses (12 credits)

No.	Course ID	Course Title	Credits	Note
1	ADPL331379E	Advanced Programming Language	3	Select 4 courses
2	ESYS431080E	Embedded Systems	3	
3	ITPM430884E	Information Technology Project Management	3	
4	ECOM430984E	Electronic Commerce	3	
5	WESE431479E	Web Security	3	
6	CLCO332779E	Cloud Computing	3	
7	INOT431780E	Internet of Things	3	
8	DIPR430685E	Digital Image Processing	3	
9	MALE431085E	Machine Learning	3	

Specialized Courses (6 credits)

No.	Course ID	Course Title	Credits	Note
1	SEEN431579E	Search Engine	3(2+1)	Select 2 courses
2	ADMP431879E	Advanced Mobile Programming	3(2+1)	
3	HCIN431979E	Human-Computer Interaction	3(2+1)	
4	ESDN432079E	Educational Software Design	3(2+1)	
5	BDAN333977E	Big Data Analysis	3(2+1)	
6	DAWH430784E	Data Warehouse	3(2+1)	
7	INRE431084E	Information Research	3(2+1)	
8	DIFO432180E	Digital Forensics	3(2+1)	

No.	Course's ID	Course Name	Credits	Notes
9	NSMS432280E	Network Security Monitoring System	3(2+1)	
10	WISE432380E	Wireless and Mobile Security	3(2+1)	
11	CLAD432480E	Cloud Computing Administration	3(2+1)	
13	MAAN431680E	Malware Analysis	3(2+1)	
14	ADDB331784E	Advanced Database	3(2+1)	
15	ERPC431984E	ERP	3(2+1)	
17	AIOT331185E	Artificial Intelligence for IoT	3(2+1)	
18	NLPR431585E	Natural Language Processing	3(2+1)	
19	RELE431685E	Reinforce Learning	3(2+1)	
20	PCOM331285	Parallel Computing	3(2+1)	

C. Supplementary courses (17 credits)

No.	Course's ID	Course Name	Credits	Notes
1	ACEN340535E	Academic English 1	4	
2	ACEN340635E	Academic English 2	4	
3	ACEN440735E	Academic English 3	4	
4	ACEN440835E	Academic English 4	4	
6	ENTW611038E	English for Thesis Writing	1	

D. Plan

1st Semester

No.	Course ID	Course Title	Credits	Notes
1	LLCT130105E	Philosophy of Marxism-Leninism	3	
2	MATH132401E	Calculus 1	3	
3	ACEN340535E	Academic English 1	4	
4	ACEN340635E	Academic English 2	4	
5	INIT130185E	Introduction to IT	3	
6	INPR130285E	Introduction to Programming	3	
7	PHED110130	Physical Education 1	0(1)	
		Total	**20**	

2nd Semester

No.	Course ID	Course Title	Credits	Notes

No.	Course ID	Course Title	Credits	Notes
1	LLCT120205E	Political Economics of Marxism and Leninism	2	
2	MATH132501E	Calculus 2	3	
3	MATH143001E	Linear Algebra and Algebraic Structure	4	
4	ACEN440735E	Academic English 3	4	
5	ACEN440835E	Academic English 4	4	
6		Social Sciences and Humanities Elective 1	2	
7	PRTE230385E	Programming techniques	3	
8	PHYS130902E	Physics 1	3	
9		Physical Education 2	0(1)	
Total			**25**	

3rd Semester

No.	Course ID	Course Title	Credits	Notes
1	LLCT120405E	Scientific socialism	2	
2	DIGR230485E	Discrete Mathematics & Graphs Theory	3	
3	DASA230179E	Data Structure and Algorithm	3	
4	OOPR230279E	Object-Oriented Programming	3	
5	EEEN231780E	Basic Electronics (IT)	3	
6	DBSY230184E	Database System	3	
7	PHYS111202E	Physics 1 - Laboratory	1	
8		Social Sciences and Humanities Elective 2	2	
9		Physical Education 3	0(3)	
Total			**20**	

4th Semester

No.	Course ID	Course Title	Credits	Notes
1	DBMS330284E	Database Management System	3	
2	WIPR230579E	Windows Programming	3	
3	OPSY330280E	Operating System	3	
4	CAAL230180E	Computer Architecture and Assembly Language	3	
5	NEES330380E	Networking Essentials	3	
6	PRBE214262E	Practice Basic Electronics	1	

7	MATH132901E	Mathematical Statistics for Engineers	3	
8	LLCT120314E	Ho Chi Minh's Ideology	2	
		Total	**21**	

5th Semester

No.	Course ID	Course Title	Credits	Notes
1	GELA220405E	General law	3	
2	WEPR330479E	Web Programming	3	
3	ARIN330585E	Artificial Intelligence	3	
4	INSE330380E	Information Security	3	
5	PROJ215879E	IT Project	1	
6		IT Core elective 1	3	
7		IT Core elective 2	3	
8	LLCT220514E	History of Vietnamese Communist Party	2	
		Total	**20**	

6th Semester

No.	Course ID	Course Title	Credits	Prerequisite
1		IT Core Elective 3	3	
2		IT Core Elective 4	3	
3		IT Specialized Elective 1	3	
4	ENTW611038E	English for Thesis Writing	1	
	Software Engineering Concentration			
5	OOSE330679E	Object-Oriented Software Engineering	3	
6	DEPA330879E	Software Design Patterns	3	
7	MOPR331279E	Mobile Programming	3	DBSY230184E
	Networking and Network Security Concentration			
5	NPRO430980E	Network Programming	3	INSE330380E DASA230179E
6	ADNT330580E	Advanced Networking Technology	3	NEES330380E
7	ETHA332080E	Ethical Hacking	3	NEES330380E, INSE330380E
	Information System Concentration			
5	ISAD330384E	Information System Analysis and Design	3	
6	BDES333877E	Big Data Essentials	3	
7	DAMI330484E	Data Mining	3	

No	Course ID	Course Title	Credits	Prerequisite
		Artificial Intelligence Concentration		
5	MAAI330985E	Mathematics for Artificial Intelligence	3	
6	INDS331085E	Introduction to Data Science	3	
7	MOPR331279E	Mobile Programming	3	
		Total	**19**	

7ᵗʰ Semester

No	Course ID	Course Title	Credits	Prerequisite
1	ITEN420885E	Information Technology Enterprise	2	
2	ITIN441085E	Internship	4	
		Software Engineering Concentration		
3	SOTE431079E	Software Testing	3	
4	MTSE431179E	New Technologies in Software Engineering	3	
5	POSE431479E	Project in Software Engineering	3	
		Networking and Network Security Concentration		
3	CNDE430780E	Computer Network Design	3	
4	NSEC430880E	Network Security	3	
5	POCN431280E	Project on Networking & Network Security	3	
		Information System Concentration		
3	BDAN333977E	Big Data Analysis	3	BDAN333977E
4	DBSE431284E	Database Security	3	DBSE431284E
5	POIS431184E	Project on Information System	3	POIS431184E
		Artificial Intelligence Concentration		
3	BDPR431385E	Big Data Processing	3	
4	DLEA432085E	Deep Learning	3	
5	POAI451485E	Project on Artificial Intelligence	3	
		Total	**15**	

8ᵗʰ Semester

No.	Course ID	Course Title	Credits	Prerequisite
1		IT Specialized Elective 2	3	
2	GRPR471979E	Capstone Project	7	

		Total			10	

E. Massive Open Online Courses

Aimed to leverage the students' competency to quickly adapt themselves to higher education of advanced countries, the following courses may be taken in place of courses.

#	Course ID	Course name	Credits	Equivalent MOOC	Equivalent percentage
1.	DIPR330685	Digital Image Processing	3	Fundamentals of Digital Image and Video Processing https://www.coursera.org/learn/digital	100
2.	MALE431984	Machine Learning	3	https://www.coursera.org/learn/machine-learning	50
3.	BDES233877	Big Data Essentials	3	https://www.coursera.org/learn/big-data-essentials	100

9. Course descriptions and credits
MATHS, PHYSICS AND CHEMISTRY COURSES

1. **Calculus 1**

   Credits: 3 (3/0/6)

   Course description :

This course provides the basic principles of limits, continuity, differential calculus and integral calculus of single variable algebraic and transcendental functions and applications of the derivative, differentials, indefinite integrals, definite integrals.

2. **Calculus 2**

   Credits: 3 (3/0/6)
   Prerequisite courses: Calculus 1
   Course description:

Calculus 2 provides the basic knowledge of the integration of functions of a variable, of infinite series, of power series, and of vectors in the plane and in space.

3. **Calculus 3**

   Credits: 3 (3/0/6)
   Prerequisite courses: Calculus 1, Calculus 2
   Course description:

The course equips students with the basic knowledge about functions of several variables, partial derivatives, double and triple integrals, line and surface integrals, and vector calculus. The students also learn how to apply this knowledge to solve problems in physical science and other life sciences.

4. **Mathematical Economics 1**

   Credits: 3 (3/0/6)

   Course description:

Mathematical Economics 1 course provides the basic knowledge of matrix, determinant, linear

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equation system, vector space $\square^n$, quadratic form, differentiation of functions of one variable and many variables. This course also provides some applications in economics.

5. **Mathematical Economics 2**

Credits: 3 (3/0/6)

Prerequisite courses: Mathematical Economics1

Course description:

The course includes knowledge of Total Differentials, Integration and Random Variables, Linear Difference Equations, Differential Equations and some applications in economics.

6. **Mathematical Statistics for Engineers**

Credits: 3 (3/0/6)
Prerequisite courses: Calculus 2 or Mathematical Economics1
Course description:
This course is designed to cover topics from mathematical statistics that are of interest to students from engineering and/or the sciences. Topics should include descriptive statistics, elementary probability, random variables and distributions, mean variance, parameter estimation, hypothesis testing and time permitting- correlation, regression and analysis of variance.

7. **Linear algebra and Algebraic structures**

Credits: 4 (4/0/8)

Course description:

The purpose of the course is to develop a basic understanding of linear algebra, some basic algebraic structures and their relationship with cryptology. In this course, the students will learn how to work with vector spaces, manipulate matrices, solve systems of linear equations, encode and decode messages. In particular, the students should learn to recognize vector spaces, and compute their bases, express a linear transformation as a matrix, perform basic matrix manipulations, compute the determinant of a matrix, use the Gram-Schmidt process, compute eigenvalues and eigenvectors and diagonalize (orthogonally) a (symmetric) matrix, classify quadratic forms, use some algebraic crypto-systems to encode and decode messages, …

8. **Linear algebra**

Credits: 3 (3/0/6)

Course description:

The purpose of the course is to develop a basic understanding of linear algebra. In this course, the students will learn how to work with vector spaces, manipulate matrices and solve systems of linear equations. In particular, the students should learn to recognize vector spaces, and compute their bases, express a linear transformation as a matrix, perform basic matrix manipulations, compute the determinant of a matrix, use the Gram-Schmidt process, compute eigenvalues and eigenvectors and diagonalize (orthogonally) a (symmetric) matrix, classify quadratic forms, …

9. **Higher mathematics for engineers 1**

Credits: 3 (3/0/6)

Prerequisite courses: Calculus 1, 2, 3
Course description:

This course provides the basic knowledge about first order differential equations; models using first order differential equations; higher order differential equations; models using higher order differential equations; Laplace transformation; Series solutions of linear differential equations.

10. Higher mathematics for engineers 2

Credits: 3 (3/0/6)

Prerequisite courses: Higher mathematics for engineers 1

Course description:

This course provides the basic knowledge about linear algebra; system of differential equations, Fourier series and solutions to boundary-value problems for partial differential equations.

11. Mathematics for engineers

Credits: 3 (3/0/6)

Prerequisite courses: Calculus 1, 2, 3

Course description:

This course provides the basic knowledge about first-order differential equations; models with first-order differential equations; higher-order differential equations; models with higher-order differential equations; the Laplace transform; linear algebra, and Fourier series.

12. Physics 1

Credits: 3(3/0/6)

Prerequisites: *None*

Course Description:

This course provides students with fundamental physics including classical mechanics, fluid mechanics, mechanical oscillations and waves, and thermodynamics. Besides that, the course will also help students to understand how to build mathematical models based on experimental results and know how to analyze, to write, to present as well as to develop a specific model based on the recorded data. The content of the course consists of chapters from 1 to 22 in the book "Physics for Scientists and Engineers with Modern Physics", 9th edition of R.A. Serway and J.W. Jewett.

13. Physics 2

Credits: 3(3/0/6)

Prerequisites: *Physics 1, Physics – Laboratory 1*

Course Description:

This course provides students with the basic knowledge of physics including electricity, magnetism, light and optics, which is compulsory to access specialized courses in science, engineering and technology branches.

The content of the module consists of chapters 23 to 38 of the book "Physics for Scientists and Engineers with Modern Physics", 9th edition of R.A. Serway and J.W. Jewett.

14. Physics 3

Credits: 3(3/0/6)

Prerequisites: *Physics 1, Physics 2, Physics – Laboratory 1, Physics – Laboratory 2*

Course Description:

This module provides students with the basics of modern physics, including relativity, quantum mechanics, atomic physics, molecules and solids, nuclear structure, and particle physics. Physics 3 forms the basis for access to university-level specialized subjects in science, engineering and technology. Students will be equipped with knowledge of phenomena in the natural world and apply that knowledge in scientific research, and technical and technology development.

The content of the module includes chapters 39 to 46 in the book Physics for scientists and engineers with modern physics, the 9th edition of R.A. Serway and J.W. Jewish.

15. Physics - Laboratory 1

Credits: 1(0/1/6)

Prerequisite: *Physics 1*

Course Description:

This course provides students with 9 physical experiments related to kinetics, dynamics, rotational motion and thermodynamics as a basic knowledge for approaching major college subjects of science, engineering and technology. The course helps students verify the laws of physics, gain a deeper understanding of what they learned in Physics 1. The module also trains students skills to observe, conduct experiments, measure, analyze, and process the collected data.

16. Physics - Laboratory 2

Credits: 1(0/1/6)

Prerequisites: *Physics 1, Physics 2, Physics – Laboratory 1*

Course Description:

This course provides students with 9 physical experiments related to electromagnetism and optics as a basic knowledge for approaching major college subjects of science, engineering and technology. The course helps students verify the laws of physics, gain a deeper understanding of what they learned in Physics 2. The module also trains students skills to observe, conduct experiments, measure, analyze, and process the collected data.

17. General Chemistry for Engineers

Credits: 1(0/1/6)

Prerequisites: *High school chemistry*

Course Description:

This course is intended to provide engineering students with a background of important concepts and principles of chemistry, including atomic and molecular structures, states of matter, chemical thermodynamics, kinetics, equilibria, and electrochemistry. Emphasis will be placed on problem solving and engineering applications.

This course will be using an online learning management system (LMS) with all reading materials, HomeWorks.

GENERAL KNOWLEDGE ELECTIVES COURSES

01. Engineering Psychology

Credits: 2(2/0/4)

Prerequisites: None

Course Description:

In order to create the interaction between technology and people, students of technology majors need to understand the basic psychological characteristics of humans. This course will provide students with knowledge of human psychology and the application of this knowledge into the design of engineering systems that are suitable for humans.

Textbook:

02. System Thinking
Credits: 2(2/0/4)

Prerequisites: None

Course Description:

This course provides students with basic knowledge about systems, systematic methodologies, and creative thinking methods while forming in students the ability to reason and solve problems systematically, logically, and creatively.
Textbook:

03. Planning Skills

Credits: 2(2/0/4)

Prerequisites: None

Course Description:

This course provides learners with basic knowledge about planning methods and develops students' thinking skills and the ability to find solutions suitable to conditions and circumstances.

This enables learners to develop their study skills, short-term and long-term personal and professional plans and teaches them how to be effective. In addition, students will learn time management skills and effective work arrangements.
Textbook:

04.　Workplace Skills

Credits: 2(2/0/4)

Prerequisites: None

Course Description:

This course aims to provide students with basic working skills in a technical environment, especially those needed for working in a multicultural, modern environment with rapid technological change.
Textbook:

05.　Research Methods

Credits: 2(2/0/4)

Prerequisites: None

Course Description:

This course covers the content of concepts, processes, and structures regarding research methods. The students will go through the selection of research topics, prepare an outline and apply it, collect and process information while conducting scientific research. By the end of the course, students will be able to sign up for research projects at the university level, as well as to conduct graduate theses or graduation projects scientifically and successfully.

ACADEMIC ENGLISH COURSES

01.　Academic English 1

Prerequisites — Classes or Knowledge required for this Course:

Students' English level must be Low-B2 (CEFR)

Course Description:

This course is designed for full-time students. It is a 45-class contact hour course focusing on Reading and Writing skills which is expected to bring students from Low-B2 to Mid-B2 (CEFR).

It is the first of the four courses of Academic English for the students who are studying academic programs in English medium.

Textbooks:

Brook-hart, G. & Jakeman, V. (2012). *Complete IELTS, bands 4-5. Student's book*. Cambridge University Express.
Carter, S. (2012) **IELTS** *Introduction Study Skills, Macmillan. Macmillan Education.*

02.　Academic English 2

Prerequisites — Classes or Knowledge required for this Course:

Students' English level must be Low-B2 (CEFR)

Course Description:

This course is designed for full-time students. It is a 45-class contact hour course focusing on Listening and Speaking skills which is expected to bring students from Low-B2 to Mid-B2 (CEFR). It is the second of the four courses of Academic English for the students who are studying academic programs in English medium.

Textbooks:

Brook-hart, G. & Jakeman, V. (2012). *Complete IELTS, bands 4-5. Student's book*. Cambridge University Express.
Carter, S. (2012) **IELTS** *Introduction Study Skills, Macmillan. Macmillan Education.*

03. Academic English 3

Prerequisites — Classes or Knowledge required for this Course:

Students' English level must be Mid-B2 (CEFR)

Course Description:

This course is designed for full-time students of the Faculty of High-Quality Training. It is a 45-class contact hour course focusing on four macro skills which is expected to bring students from Mid-B2 to High-B2 (CEFR). It is the third of the four courses of Academic English for the students who are studying academic programs in English medium.

Textbooks:

Brook-hart, G. & Jakeman, V. (2013). *Complete IELTS, bands 5-6.5 (Student's book)*. Cambridge University Express.
Brook-hart, G. & Jakeman, V. (2013). *Complete IELTS, bands 5-6.5 (Workbook)*. Cambridge University Express.

04. Academic English 4

Prerequisites — Classes or Knowledge required for this Course:

Students' English level must be Low-C1 (CEFR)

Course Description:

This course is designed for full-time students. It is a 45-class contact hour course focusing on four macro skills which is expected to bring students from High-B2 to Low-C1 (CEFR). It is the last of the four courses of Academic English for the students who are studying academic programs in English medium. The course lasts 15 weeks.

Textbooks:

Brook-hart, G. & Jakeman, V. (2013). *Complete IELTS, bands 6.5-7 (Student's book)*. Cambridge University Express.

Brook-hart, G. & Jakeman, V. (2013). *Complete IELTS, bands 6.5-7 (Workbook)*. Cambridge University Express.

Introduction to Information Technology   **Credits: 3**

Prerequisites: None
Course Description:
This course provides students with a broad range of introductory IT concepts; General knowledge of contemporary information technology and job skills required to enter the IT market, especially soft skills. An introduction Computational Thinking and AI Python for Beginers are also included.
Textbooks:
This course has no textbook.
References:
1) Dawson, Michael. *Python Programming for the Absolute Beginner*. 3rd ed., Course Technology, 2010.
2) ITL ESL. *Introduction to Information Technology*. Pearson Education India, 2013.
3) http://www.cs4fn.org/computationalthinking/
4) https://deeplearning.ai

INFORMATION TECHNOLOGY COURSES

Introduction to Programming   **Credits: 3**

Prerequisites: None
Course Description:
This course provides students with basic programming concepts using C/C++ programming language, knowledge of data presentation in computing, numeric systems, and methods to solve a programming problem. Moreover, this course presents computational thinking, programming styles, approaches to problem-solving and instructions to create console applications using the standard I/O routines in C/C++ with MS Visual Studio.
Textbooks:
1) Kernighan, Brian W., and Dennis M. Ritchie. *The C Programming Language*. Prentice Hall International Editions, 1997.
2) King, K. N. *C Programming: A Modern Approach*. 2nd ed., W.W. Norton, 2008.
References:
1) Prinz, Peter, and Ulla Kirch-Prinz. *A Complete Guide to Programming in C++*. Jones and Bartlett Publishers, 2002.
2) Raman, Rajar. *Fundamentals of Computers*. Prentice Hall, 2002.
3) Shaw, Zed A. *Learn C The Hard Way*. Addison-Wesley, 2016.

Programming Techniques   **Credits: 3**

Prerequisites: None
Course Description:
This is an intermediate course with an emphasis on specialized knowledge in the design and analysis of efficient algorithms. Students are exposed to various algorithm design paradigms. The module serves two purposes: to improve students' ability to design algorithms in different areas and to prepare students for the study of more advanced algorithms. The module covers lower and upper bounds, recurrences, basic algorithm paradigms such as prune-and-search, dynamic programming, recursion, big-numbers, divide and conquer, greedy algorithms and some selected advanced topics.
Textbooks:
1) Knuth, Donald E. *The Art of Computer Programming – Vol. 2*. 3rd ed., Addison Wesley,

1997.

References:
1) Cormen, Thomas H., et al. *Introduction to Algorithms.* 3rd ed., MIT Press, 2009.
2) Kernighan, Brian W., and Dennis M. Ritchie. *The C Programming Language.* Prentice Hall International Editions, 1997.
3) Lê Minh Hoàng. *Algorithms and Programming.* University of Pedagogy, Hanoi, 2006.
4) Skiena, Steven S., and Miguel A. Revilla. *Programming Challenges.* Springer, 2003.

Discrete Mathematics and Graph Theory   **Credits: 3**

Prerequisites: None
Course Description:
The discrete mathematics part of the course provides students with basic knowledge of sets, propositional logic, predicates and quantifiers, rules of inference, equivalence relations, partial orderings, Boolean functions, representing Boolean functions, logic gates, and minimization of circuits. *The graph theory* part of the course provides students with basic knowledge of graphs and graph models, graph terminologies, representing graphs, graph isomorphism, connectivity, Euler and Hamilton paths, shortest-path problems, introduction to trees, tree traversal, spanning trees and minimum spanning trees.

Textbooks:
1) Rosen, Kenneth H. *Discrete Mathematics and Its Applications.* 7th ed., McGraw-Hill Companies, Inc, 2012.

References:
1) Dang Truong Son, et al. *Discrete Mathematics and Graph Theory.* Vietnam National University, Ho Chi Minh City Publishing Company, 2016.
2) Nguyen Huu Anh. *Discrete Mathematics.* Vietnam National University, Ho Chi Minh City Publishing Company, 2003.
3) Seymour L., and Marc L. *Discrete Mathematics.* McGraw-Hill Companies, Inc, 2007
4) Tran Ngoc Danh. *Advanced Discrete Mathematics.* Vietnam National University, Ho Chi Minh City Publishing Company, 2004.

Artificial Intelligence   **Credits: 3**

Prerequisites: None
Course Description:
This course aims to provide students with knowledge of AI applications; knowledge on search methods for solving problems (blind, experience, optimization, competition); knowledge of representation and argument, semantic network, expert system, machine learning; knowledge and skills relating to developing smart applications.

References:
http://library.thinkquest.org/2705/

Data Structures and Algorithms   **Credits: 3**
Prerequisites: Introduction to programming, Programming Techniques
Course Description:
This course provides students with specialized knowledge in data structures and algorithms used for developing computer programs. Students are able to analyse and describe algorithms using pseudocodes as well as develop the algorithms on a computer using C/C++ programming language. Furthermore, this course also provides students with the ability to apply data structures and algorithms to solve real-world problems. Besides, students can work in groups and develop their presentation skills through seminars.

Textbooks:
1) Kruse, R. L. *Data structures and Program Design in C++*. Prentice-Hall Inc., 1999.

References:
1) Lê Văn Vinh. *Giáo Trình Cấu Trúc Dữ Liệu Và Giải Thuật*. NXB Đại Học Quốc Gia TP. Hồ Chí Minh, 2013.
2) Nguyễn Hồng Chương. *Cấu Trúc Dữ Liệu – Ứng Dụng Và Cài Đặt Bằng C*. NXB TP HCM, 2005.
3) Trần Hạnh Nhi. *Nhập Môn Cấu Trúc Dữ Liệu Và Giải Thuật*. Đại Học Khoa Học Tự Nhiên TP. HCM, 2000.

Object-Oriented Programming   Credits: 3

Prerequisites: Introduction to programming
Course Description:
Object-oriented programming (OOP) is a programming paradigm based on the concept of "objects", which may contain data, in the form of fields, often known as attributes; and code, in the form of procedures, often known as methods. A feature of objects is that an object's procedures can access and often modify the data fields of the object with which they are associated (objects have a notion of "this" or "self"). In OOP, computer programs are designed by making them out of objects that interact with one another.

This course provides students with specialized knowledge in OOP used for developing application programs. Students are able to write and run programs using C++/C#/Java/Python programming language or JavaScript. Furthermore, this course also provides students with the ability to apply OOP to solve real-world problems. Besides, students can develop their teamwork and presentation skills through seminars.

Textbook:
1) Harwani, B. M. *Learning Object-Oriented Programming in C# 5.0*. Cengage Learning PTR, 2015.

References:
1) Chiarelli, Andrea. *Mastering JavaScript Object-Oriented Programming*. 2nd ed., Packt Publishing Limited, 2016.
2) Lafore, Robert. *Object-Oriented Programming in C++*. 4th ed., SAMS Publishing, 2002.
3) Phillips, Dusty. *Python 3 Object-Oriented Programming*. 1st ed., Packt Publishing Limited, 2015.
4) Skrien, Dale. *Object-Oriented Design Using Java*. 1st ed., McGraw-Hill Companies Inc., 2009.

Information Security   Credits: 3

Prerequisites: None

Course Description:

This course provides students with consideration of security problems in computing. Topics include: (1) Foundations: security mindset, essential concepts (Policy, CIA, etc.); (2) Software and OS security: vulnerabilities and protections, malware analysis; (3) Practical cryptography: encryption, authentication, hashing, symmetric and asymmetric crypto; (4) Networks: protocols, attacks and countermeasures.

Main textbook:
1) William Stallings and Lawrie Brown (2014), *Computer Security, Principles and Practice*, Third Edition ISBN-10: 0-133-77392-2

2) Wenliang Du (2017), *Computer security a hands-on approach*, ISBN-10: 154836794X

References:

1) Mark Stamp (2011), *Information Security, Principle and Practices, 2nd Edition*, Wiley Inc. Publication

2) W. Stallings (2011), *Cryptography and Network Security* - Principles and Practices, 5th Edition, Pearson.

3) Matt Bishop (2004), *Introduction to Computer Security*, Prentice Hall, ISBN 0-321247442

Web Programming   Credits: 3

Prerequisites: Introduction to programming
Course Description:
This course provides students with fundamental knowledge used to develop web applications based on Servlet and JSP technology. The main contents include (1) Servlet; (2) JSP and JSTL (JSP Standard Tag Library - a collection of useful JSP tags that encapsulate core functionality common to many JSP applications); (3) JDBC; (4) some front-end technologies such as JavaScript and JQuery.
Textbooks:
1) Hall, Marty, and Larry Brown. *Core Servlets & JSP.* 2nd ed., Prentice Hall, 2003.

References:
1) Basham, Bryan, Kathy Sierra, and Bert Bates. *Headfirst Servlets and JSP.* 2nd ed., O'Reilly Media, 2008.

2) Murach, Joel, and Michael Urban. *Murach's Java Servlets and JSP.* 3rd ed., Murach, 2014.

Windows Programming   Credits: 3

Prerequisites: Introduction to programming, OOP, DBMS
Course Description:
This course provides students with specialized knowledge and methods in programming on Windows systems. Students are also provided with the fundamentals of ADO.NET to work with different database management systems. Furthermore, students are able to develop different applications using .NET technologies, including windows form controls, graphics controls, LINQ to SQL, Entity framework, Microsoft report. This course also provides students with the ability to apply .NET technologies to solve real-world problems. Besides, students can work in groups and develop their presentation skills through seminars.
Textbooks:
1) Brown, Erik. *Windows Form Programming with C Sharp*. Manning, 2002.

2) Sells, Chris. *Windows Form Programming in C Sharp*. Addison-Wesley Professional, 2003.

3) Troelsen, Andrew. *C# 5.0 and the .NET 4.5 Framework*. Apress, 2012.

Software Engineering   Credits: 3

Prerequisites:
Course Description:
This course aims to provide knowledge and skills related to software engineering, such as receiving requests, modelling the requirement, analysing the requirements, designing the requirements, building software and testing software.
Textbooks:
1) Roger S. Pressman. *Software Engineering*. Education Publisher, 2001.

References:

1) Brooks, Frederick P. *The Mythical Man-Month: Essays on Software Engineering.* 20th Anniversary Edition, Addison-Wesley, 1995.
2) Dương Anh Đức. *Object-Oriented Analysis and Design with UML.* Statistical Publisher, 2002.
3) Larman, Craig. *Applying UML and Pattern.* Prentice Hall, 1998.
4) Nguyễn Minh Đạo. Education Publisher. FIT - HCMUTE, 2004.
5) Pressman, Roger S. *Software Engineering: A Practitioner's Approach.* 4th ed., McGraw-Hill, 1997.
6) Sommerville, Ian. *Software Engineering.* 9th ed., Addison-Wesley, 2011.

Object-Oriented Software Design   **Credits: 3**

Prerequisites: OOP
Course Description:
This course provides students with fundamental knowledge about software analysis and design using object-oriented techniques, Unified Modelling Language (UML) and UML tools, as well as design patterns and their applications in software development. By the end of the course, students will be equipped with analysis and design skills, such as the ability to use UML tools to create software design components and the ability to apply appropriate design patterns in various situations to improve software resilience and extensibility. Moreover, soft skills such as teamwork and public presentation are also developed during the course.
Textbooks:
1) Gamma, E., et al. *Design Patterns - Elements of Reusable Object-Oriented Software.* Addison-Wesley, 2005.
2) Hamilton, Kim, and Russell Miles. *Learning UML 2.0.* O'Reilly, 2006.
References:
1) Cooper, James W. *The Design Patterns Java Companion.* Addison-Wesley, 1998.
2) Horstmann, Cay. *Object-Oriented Design & Patterns.* 2nd ed., John Wiley & Sons, 2006.
3) Larman, Craig. *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development.* Pearson, 2008.
4) http://www.omg.org/spec/UML/2.3/

Software Testing   **Credits: 3**

Prerequisites: Software Engineering
Course Description:
This course provides students with specialized knowledge in software development life cycles, software development models, software testing, software testing processes, fundamental designing and implementing testing techniques. After finishing the course, students will be able to understand terms, definitions, and concepts in software testing and they will be able to apply knowledge to design, execute, analyse and evaluate software quality. Besides that, students will have the opportunity to do practical work using bug management tools and automation testing tools.
Textbooks:
1) Ammann, Paul, and Jeff Offutt. *Introduction to Software Testing.* Cambridge University Press, 2008.
References:
1) Dustin, Elfriede. *Effective Software Testing: 50 Specific Ways to Improve Your Testing.*

Wiley Publishing, 2002.

2) Myers, Glenford J. The Art of Software Testing. John Wiley & Sons, 2004.

3) Nguyen, Hung Q. *Testing Application on the Web: Testing Planning for Mobile and Internet-Based System.* Wiley Publishing, 2003.

Modern Technologies on Software Engineering   Credits: 3

Prerequisites: Web programming
Course Description:
This course provides students with the ability to build an application using the MEAN stack by writing as little code as possible and taking a high-level view of the key components along the way. The students will use as many abstractions and templates as possible.
MEAN is an acronym for the four main technologies (1) MongoDB: A non-relational database; (2) ExpressJS: A node framework that has powerful middleware features; (3) AngularJS: A frontend JavaScript library created and maintained by Google that is used to create single-page applications; (4) Node.JS: A server-side JavaScript environment based on V8.
Textbook:
1) Holmes, Simon. *Getting MEAN with Mongo, Express, Angular, and Node*. Manning Publications Co., 2016.

References:
1) Haviv, Amos Q. *MEAN Web Development*. Packt Publishing, 2014.

Programming for Mobile Devices   Credits: 3

Prerequisites: Web programming
Course Description:
This course provides students with fundamentals used to develop Android Applications. The main contents include Java concepts, Android Platform concepts, Android Application Structures, Android Libraries, and Android User Interface Design. After finishing this course, students will be able to analyse, design and choose appropriate libraries for developing full-stack Android Applications.
Textbooks:
1) Darwin, Ian F. *Android Cookbook*. O'Reilly Media, 2012.

2) Lee, Wei-Meng. *Beginning Android Development*. Wrox, 2012.

References:
1) Lee, Wei-Meng. *Beginning Android Development*. Wrox, 2012.

Web Security   Credits: 3

Prerequisites: Information security, Web programming
Course Description:
This course provides students with knowledge about the major risks and basic popular attacking types into Web applications. This course also presents some defending methods against such types of attacks. The course also equips students with the knowledge and the ability to identify threats and use appropriate tools and techniques to build a safe web application and protect it from attacks.
Textbooks:
1) Bryan, S., and Vincent, L. *Web Application Security – A Beginner's Guide.* McGraw Hill, 2012.

2) Ryan, B. *Web Application Defender's Cookbook*. Wiley Publishing, Inc., 2013.

References:
1) Stuttard, Dafydd, and Marcus Pinto. *The Web Application Hacker's Handbook*. Wiley, 2011.
2) OWASP Top 10 - 2013.

Software Project Management   Credits: 3

Prerequisites: none

Course Description:
This course provides students with basic terminology in information technology project management, especially software project management. The course focuses on major knowledge areas involved in the software management process, including project planning, scope management, requirement and change management, time and cost management, risk and human resource management. In this course, students are also equipped with basic skills in project planning and various project management activities.

Textbooks:
1) Project Management Institute. *A Guide to Project Management Body of Knowledge* 5th ed., PMI, 2013.

References:
1) Chemuturi, Murali K., and Thomas M. Cagley Jr. *Software Project Management: Best Practices, Tools, and Techniques*. J. Ross Publishing, 2010.
2) Hughes, Bob, and Mile Cotterell. *Software Project Management.* 5th ed., McGraw-Hill, 2009.
3) Jalote, Pankaj. *Software Project Management in Practice*. Addison-Wesley, 2002.

Advanced Programming for Mobile Devices   Credits: 3

Prerequisites: Mobile programming
Course Description:
Ionic teaches web developers how to build cross-platform mobile apps for phones and tablets on iOS and Android. Students will learn how to extend their web development skills to build applications that are indistinguishable from native iOS or Android projects.

Textbooks:
1) Ravulavaru, Arvind. *Learning Ionic*. Packt Publishing, 2015.

References:
1) Bohner, Michael. *Building Mobile Apps with Ionic Framework*. Michael Bohner, 2015.
2) Wilken, Jeremy. *Ionic in Action*. Manning Publications Co, 2016.

Database Systems   Credits: 3

Prerequisites: Database
Course Description:
This course covers the fundamentals of database architectures and database systems, focusing on basics such as the data model, relational algebra, SQL and query optimization. The course also features database design and relational design principles based on dependencies and normal forms. It is designed for undergraduate students; no prior database experience is assumed.

Textbook:
1) Elmasri, Ramez, and Shamkant Navathe. *Fundamentals of Database System.* 7th ed., Texas, Addison-Wesley, 2015.

References:
1) Garcia-Molina, H., J. D. Ullman, and J. Widom. *Database Systems - The Complete Book.* 2nd ed., New Jersey, Pearson Prentice Hall, 2008.

2) Silberschatz, A., H. Korth, and S. Sudarshan. *Database System Concepts.* 6th ed., New York, McGraw-Hill, 2010.

Database Management Systems   Credits: 3

Prerequisites: Database
Course Description:
This course covers the fundamentals of database management systems, database programming, and principles of database administration. This course emphasizes database concepts, developments, use and management in two main sections: database concepts and practice. The relational database management system is the main focus of the course alongside the practical design of databases and developing database applications.
Textbooks:
1) Ramakrishnan, Raghu, and Johannes Gehrke. *Database Management Systems.* 3rd ed.*,* McGraw Hill, 2003.
2) Tutorials Point, Database Management System, www.tutorialspoint.com, 2015.
3) https://docs.microsoft.com/en-us/sql/t-sql/statements/statements
References:
1) Elmasri, Ramez, and Shamkant Navathe. *Fundamentals of Database System.* 7th ed., Texas, Addison-Wesley, 2015.
2) Garcia-Molina, H., J. D. Ullman, and J. Widom. *Database Systems - The Complete Book.* 2nd ed., New Jersey, Pearson Prentice Hall, 2008.
3) Silberschatz, A., H. Korth, and S. Sudarshan. *Database System Concepts.* 6th ed., New York, McGraw-Hill, 2010.

Data Warehouse   Credits: 3

Prerequisites: Database systems
Course Description:
This course provides students with basic knowledge of the data warehouse. In this course, the learners will learn the basic concepts of data warehouse, data warehouse architecture, and multidimensional models. They will gain hands-on experience in data warehouse design and use open-source products for manipulating pivot tables and creating data integration workflows. Besides, students will also learn how to use analytical elements of SQL supported by relational database management systems for answering business intelligence questions.
Textbooks:
1) Jensen, Christian S., et al. *Multidimensional Databases and Data Warehousing*. Morgan & Claypool, 2010.
2) Lane, Paul, et al. *Oracle Database Data Warehousing Guide.* 12c Release 1 (12.1), Oracle, 2014.
References:
1) Casters, Matt, et al. *Pentaho Kettle Solutions: Building Open Source ETL Solutions with Pentaho Data Integration*. Wiley, 2010.
2) Elmasri, Ramez, and Shamkant Navathe. *Fundamentals of Database Systems.* 6th ed., Addison-Wesley, 2011.
3) Kimball, Ralph, and Margy Ross. *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling*. 3rd ed., Wiley, 2013.
4) Microsoft. *SQL Server 2012 Tutorials: Analysis Services - Multidimensional Modelling*. SQL Server 2012 Books Online, 2012.

Information Retrieval **Credits: 3**

Prerequisites: None
Course Description:
This course provides students with basic knowledge in the field of information retrieval. It aims to help students understand how an information retrieval system (search engine) works and how to build an information retrieval system, especially a text retrieval system. It includes basic techniques used in text retrieval systems: (1) The general architecture of an information retrieval system; (2) Text pre-processing and indexing; (3) Important information retrieval models: vector space models, probabilistic models, language models; (4) Methods to evaluate the accuracy of an information retrieval system; (5) Relevance feedback and query expansion techniques; (6) The mechanism in which a web search engine works and links analysis algorithms.
Textbooks:
1) Manning, Christopher D., et al. *Introduction to Information Retrieval*. Cambridge University Press, 2008.
2) Zhai, ChengXiang, and Sean Massung. *Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining*. ACM Books, 2016.
References:
1) Baeza-Yates, Ricardo A., and Berthier A. Ribeiro-Neto. *Modern Information Retrieval.* 2nd ed., Addison-Wesley, 2010.
2) Büttcher, Stefan, and Charles L. A. Clarke, *Information Retrieval: Implementing and Evaluating Search Engines*. 2010.
3) Croft, Bruce, et al. *Search Engine: Information Retrieval in Practice*. Pearson, 2009.

Data Mining **Credits: 3**

Prerequisites: None
Course Description:
The course will cover various issues such as fundamental data mining concepts, algorithms, and computational paradigms. These algorithms and computational paradigms allow computers to find patterns and regularities in databases and generally improve their performance through interactions with data. Data mining is currently regarded as the key element of a more general process called *knowledge discovery* that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures.
Textbook:
1) Han, Jiawei. *Data Mining: Concepts and Techniques.* 3rd ed., Morgan Kaufmann, 2011.
References:
1) Kantardzic, Mehmed. *Data Mining: Concepts, Models, Methods, and Algorithms*. John Wiley & Sons, 2003.
2) Larose, Daniel T. *Data Mining Methods and Models*. John Wiley & Sons, 2006.
3) Wu, X., et al. "Top 10 Algorithms in Data Mining". *Knowl Inf Syst* **14,** 1–37, 2008.

Information Systems Analysis and Design **Credits: 3**

Prerequisites: None
Course Description:
System analysis and design deals with planning the development of information systems through understanding and specifying in detail what a system should do and how the components of the

system should be implemented and work together. This course provides the concepts, skills, methodologies, techniques, tools, and perspectives essential for systems analysts. It emphasizes the development of information systems based on object-oriented analysis and design methods. Students are required to go through the steps of the systems analysis and design process to solve real-life problems.

Textbook:

1) Solms, Fritz. *Object-Oriented Analysis and Design using UML*. Solms Training, Consulting and Development (STCD), 2012.

References:

1) Bennett, S., S. McRobb, and R. Farmer. *Object-Oriented Systems Analysis and Design Using UML*. 4th ed., McGraw Hill, 2010.

2) Booch, G., I. Jacobson, and J. Rumbaugh. *The Unified Modelling Language for Object-Oriented Development.* Documentation set, version 1.0, Rational Software Corporation, 1997.

3) Dennis, A., B. H. Wixom, and D. Tegarden. *Systems Analysis and Design with UML Version 2.0*. John Wiley & Sons, 2005.

Database Security   Credits: 3

Prerequisites: Database system, Information Security
Course Description:
This course provides fundamental knowledge about data and database security. It also presents models as well as basic approaches and methods to implement database security: data encryption, access control, etc. By the end of this course, students will be able to implement security mechanisms in database management systems. Moreover, the course offers students the opportunity to develop soft skills such as teamwork and public presentation.

Textbooks:

1) Ben-Natan, Ron. *Implementing Database Security, and Auditing*. Elsevier, 2005.

2) Bishop, Matt. *Computer Security: Art and Science*. Addison-Wesley, 2002.

References:

1) Afyouni, Sam. *Database Security and Auditing: Protecting Data Integrity and Accessibility*. Boston, Course Technology Press, 2005.

2) Ben-Natan, Ron. *How To Secure and Audit Oracle 10g & 11g*. CRC Press, 2009.

3) Bertino, Elisa, Gabriel Ghinita, and Ashish Kamra. *Access Control for Databases: Concepts and Systems*. Now Publishers, 2011.

4) Clarke, Justin. *SQL Injection Attacks, and Defense*. Syngress, 2012.

5) Gertz, Michael, and Sushil Jajodia. *Handbook of Database Security: Applications and Trends*. Springer, 2009.

6) Walters, R., and G. Fritchey. *Beginning SQL Server 2012 Administration*. Apress, 2012.

Computer Architecture and Assembly Languages   Credits: 3

Prerequisites: None
Course Description:
This course provides students with basic knowledge in computer architecture and those attributes that have a direct impact on the logical execution of a program, the operational units and their interconnection that realize the architectural specifications. The students also get to know x86 processor organization, instruction set, memory segmentation, addressing modes, how to assemble a program with assembly language and debug low-level language program.

Textbooks:
1) Stallings, William. *Computer Organization and Architecture*. 9th ed., Pearson Education, Prentice-Hall, 2013.

References:
1) Nguyễn Đăng Quang. *Computer Organization and Architecture lecture notes*. 2015.
2) Đinh Công Đoan. *Bài Giảng Cấu Trúc Máy Tính Và Hợp Ngữ*. Khoa CNTT Trường, ĐH. SPKT Tp. HCM, 2008.

Operating Systems   Credits: 3

Prerequisites: Computer Architecture and Assembly language
Course Description:
This course provides students with basic knowledge of the operating system, including the general model, structure, functions, basic components of the operating system, and basic principles for building operating systems. The students also get to know the structure and application of basic principles in specific operating systems, as well as research and simulate OS device drivers through system programming.

Textbook:
1) Silberschatz, Abraham, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts.* 6th ed., Wiley, 2001.

References:
1) Stallings, William. *Operating Systems: Internals and Design Principles.* 8th ed.**,** Pearson, 2014.

Networking Essentials   Credits: 3

Prerequisites: None
Course Description:
 This course provides students with knowledge of basic network fundamentals, network topologies, networking operating systems, and common network protocols. This course also provides knowledge and skills related to network administration for popular network operating systems such as Windows OS and Linux OS.

References:
1) Bresnahan, Christin, and Richard Blum. *LPIC-2 Linux Professional Institute Certification Study Guide.* 2nd ed., Sybex, 2016.
2) Odom, Wendell. *CCENT/CCNA ICND1 – Official Cert Guide.* Cisco Press, 2016.
3) Odom, Wendell. *CCNA Routing and Switching – Official Cert Guide.* Cisco Press, 2016.
4) Smith, Roderick W. *LPIC-1 Linux Professional Institute Certification Study Guide*. 3rd ed., Sybex, 2013.
5) Thomas, Orin. *Training Guide: Administering Windows Server 2012 R2.* Microsoft Press, 2014.
6) Tulloch, Mitch. *Training Guide: Installing and Configuring Windows Server 2012 R2.* Microsoft Press, 2014.

Data Communications   Credits: 3

Prerequisites: Networking Essentials
Course Description:
This course will explore the various types of data communication systems, networks, and applications. Concept and terminologies like computer networks, layer architecture (OSI, TCP/IP), network hardware, network software, standardization, network medium, and IP

addressing will be explored. The practical aspect will deal with building small to medium level networks including Cabling, Configuring TCP/IP, Peer to Peer networking, and sharing resources.

Textbooks:
1) Forouzan, Behrouz A. *Data Communication and Networking.* 5th ed., McGraw Hill International Edition, 2012.

References:
1) Halsall**,** Fred. *Data Communications, Computer Networks and Open Systems.* 4th ed., Addison-Wesley, 1995.
2) Stallings, William. *Data and Computer Communications*. 10th ed., Prentice Hall, 2014.

Advanced Networking Technology   Credits: 3

Prerequisites: Networking Essentials
Course Description:
This course provides students with knowledge in the routing technologies, characteristics of routing protocols, VLANs, VTP, STP, Inter-VLAN routing, ACL, NAT, WAN. Moreover, this course provides students with an understanding of the core issues and awareness of proposed solutions so they can actively follow and participate in the development of network technologies. This course also offers students the opportunity to develop soft skills such as teamwork and public presentation.

References:
1) Odom*,* Wendell. *CCENT/CCNA ICND1 – Official Cert Guide.* Cisco Press, 2016.
2) Odom*,* Wendell. *CCNA Routing and Switching – Official Cert Guide.* Cisco Press, 2016.

Unix Operating System   Credits: 3

Prerequisites: Networking essentials
Course Description:
This course is designed to give experienced Unix/Linux users the skills and knowledge needed to be qualified system administrators. The students are introduced to specialized knowledge of the structure, operations of the Unix/Linux file system, Shell programming skills, Unix/Linux system, and network services administration. The students will deal with and solve real-life problems in setting up, writing scripts and administrating system/ network services on Unix/Linux operation system. The students will discuss the various aspects of the problem, various possible solutions, and try them all.

Textbooks:
1) Nguyen Thi Thanh Van. *Unix Network Operation System*. 2008.

References:
1) Glass, Graham, and King Ables. *Linux for Programmers and Users.* Prentice Hall, 2006.
2) Nemeth, Evi, et al. *UNIX and Linux System Administration Handbook*. 4th ed., Pearson Education Inc., 2010.
3) Smith, Roderick W. *LPIC-1: Linux Professional Institute Certification Study Guide*. 3rd ed., SYBEX Inc., 2013.

Computer Networks Design   Credits: 3

Prerequisites: Networking Essentials, Advanced Networking Technology
Course Description:
This course provides students with knowledge in network design processes and phases; designing networks with 3 class models; designing Local Area Network (LAN), Wireless LAN (WLAN),

Wide Area Network (WAN); designing with High availability and Load balancing.
References:
1) Bruno, Anthony. *CCDA Official Cert Guide.* Cisco Press, 2016.
2) Wilkins, Sean. *Designing for Cisco Internetwork Solutions (DESIGN).* Cisco Press, 2011.

Networks Security   Credits: 3

Prerequisites: Networking Essentials, Information Security
Course Description:
This course provides students with knowledge in network security technologies, network security analysis tools, Firewall, Intrusion Detection System/Intrusion Prevention System (IDS/IPS), Security Information and Event Management (SIEM).
References:
1) Chapman, Chris. *Network Performance and Security*. SynGress, 2016.
2) Gibson, Darryl. *CompTIA Security+: Get Certified Get Ahead*. CompTIA, 2014.
3) Maiwald, Eric. *Fundamentals of Network Security*. McGraw Hill, 2010.
4) McNab, Chris. *Network Security Assessment.* 3rd ed., O'Reilly Media, 2016.
5) Stallings, William. *Network Security Essentials*. 4th ed., Prentice Hall, 2011.

Networks Programming   Credits: 3

Prerequisites: Networking Essentials, Introduction to programming
Course Description:
This course is designed to provide knowledge and skills in the analysis and design of computer networks by focusing on network programming. Through this course, students are equipped with basic knowledge about the Socket API library on Windows, object classes in System.NET or java.net. Students can build data transmission applications at the Network layer with UDP, TCP, ICMP protocols and distributed applications using RMI. They can also apply knowledge of the course to program network management applications.
Textbooks:
1) Blum, Richard. *C# Network Programming*. SYBEX, 2003.
2) Harold, Elliotte Rusty. *Java Network Programming.* 4th ed., O'Reilly Media Inc., 2014.

Embedded Systems   Credits: 3

Prerequisites: Computer Architecture
Course Description:
This course provides students with basic knowledge of embedded systems, including the basic concepts of embedded systems, the properties of embedded applications; basic components of an embedded system; embedded system design process; ARM microcontroller; ARM instruction set; C programming language for embedded systems; and embedded programming for arm microcontroller.
Textbooks:
1) Crowley, Patrick, and Peter Barry. *Modern Embedded Computing – Designing Connected, Pervasive, Media-Rich Systems*. Morgan Kaufmann Publishers, Inc., 2012.
2) Lee, Edward A., and Sanjit A. Seshia. *Introduction to Embedded Systems – A Cyber-Physical Systems Approach.* MIT Press, 2014.
References:
1) Vahid, Frank, and Tony Givargis. *Embedded System Design: A Unified Hardware/Software Approach*. John Wiley & Sons Inc., 2002.
2) Valvano, Jonathan W. *Embedded Systems: Introduction to Arm®. Cortex (TM)-M Micro-*

controllers (Volume 1). 5th ed., CreateSpace Independent Publishing Platform, 2012.

3) Valvano, Jonathan W. *Embedded Systems: Real-Time Interfacing to Arm®. Cortex™-M Microcontroller.* 2nd ed., CreateSpace Independent Publishing Platform, 2012.
4) Yiu, Joseph. *The Definitive Guide to the ARM Cortex-M3*. Elsevier Newnes, 2007.

Network Monitoring Systems   Credits: 3

Prerequisites: Networking Essentials, Advanced Networking
Course Description:
This course provides students with knowledge of the components of a network monitoring system; knowledge of implementing a network monitoring system, network monitoring protocols, network monitoring tools, and alert systems.
References:
1) Bejtlich, Richard. *The Practice of Network Security Monitoring*. No Starch Press, 2013.
2) Kundu, Dinangkur, and S. M. Ibrahim Lavlu. *Cacti 0.8 Network Monitoring*. Packt Publishing, 2009.
3) Olups, Rihards. *Zabbix Network Monitoring*. 2nd ed., Packt Publishing, 2016.
4) Ryder, Tom. *Nagios Core Administration Cookbook.* 2nd ed., Packt Publishing, 2016.

Wireless Networks   Credits: 3

Prerequisites: Networking Essentials
Course Description:
 This course provides students with basic knowledge in wireless and mobile networks, including applications, history of the wireless networks, future wireless network applications, features of wireless environment and signal modulation techniques, multi-access methods, cell phone networks, and wireless LAN.
Textbooks:
1) Schiller, Jochen H. *Mobile Communication.* 3rd ed., Prentice Hall, 2007.
References:
1) Rappaport, Theodore S. *Wireless communications: Principle and practice.* 2nd ed., Prentice Hall.
2) Stallings, William. *Wireless Communications and Networks*. Prentice Hall, 2005.

Speech Processing   Credits: 3

Course Description:

This course provides students with the knowledge and skills to write basic speech processing programs. Based on this foundation, students will be able to solve fundamental problems in speech processing, specifically speech recognition and synthesis with a small vocabulary.

Digital Image Processing   Credits: 3

Course Description:

This course provides students with the knowledge and skills to write basic digital image processing programs. Based on this foundation, students will be able to solve problems such as enhancing image quality, describing characteristic information of objects in images, and recognizing objects in images.

Mathematics for Artificial Intelligence   **Credits: 3**

Course Description:

This course provides students with two parts:

Part 1: Basic mathematical knowledge such as linear algebra, vector calculus, analytical geometry, matrix analysis, probability, distribution, and optimization.

Part 2: Application of the mathematical concepts from Part 1 to solve fundamental problems in artificial intelligence, such as regression, dimensionality reduction, density estimation, and classification. Based on this foundation, students can apply the knowledge from this course to study subsequent subjects in artificial intelligence, such as machine learning and deep learning.

Introduction to Data Science   **Credits: 3**

Course Description:

This course equips learners with fundamental knowledge about the concepts, algorithms, and applications of data science. Learners will also experience libraries and open-source tools to implement and test algorithms for data analysis. The topics covered in this course include: basic concepts and applications of data science, issues related to the data preprocessing process, classification algorithms, regression (linear and logistic regression, k-NN, decision tree, random forest, neural network), clustering algorithms (k-means clustering, mixture models, hierarchical agglomerative clustering AGNES, density-based clustering DBSCAN), dimensionality reduction methods (PCA, LDA, Autoencoder), and metrics and methods for evaluating algorithms.

Artificial Intelligence for IOT   **Credits: 3**

Course Description:

This course provides students with a foundation of knowledge and methods for applying AI in IoT. Students will gain the ability to build IoT applications and make them more intelligent by incorporating knowledge of artificial intelligence, machine learning, and deep learning. Students will also learn how to use tools like TensorFlow and Keras.

Parallel Computing   **Credits: 3**

Course Description:

This course provides fundamental knowledge about parallel application design and development techniques. In addition, students will be equipped with skills in building applications using MPI (Message Passing Interface), OpenMP, and parallel programming on GPUs (Graphics Processing Units) using the CUDA library

Big Data Processing   **Credits: 3**

Course Description:

This course equips learners with fundamental knowledge about concepts and techniques for processing big data. The topics covered in the course include basic concepts, issues related to processing, storage, querying, and analysis of big data. Learners can experience libraries and open-source tools such as Hadoop, Hive, Pig, and Spark.

Deep Learning   **Credits: 3**

Course Description:
This course provides foundational knowledge and helps build skills in using deep learning techniques to solve machine learning problems. The main topics include basics of neural networks, implementing ANNs using TensorFlow APIs, data preprocessing, training deep ANNs, convolutional neural networks (CNNs), and recurrent neural networks (RNNs).

Natural Language Processing   Credits: 3

Course Description:
This course equips learners with fundamental knowledge about the concepts and techniques of natural language processing (NLP). Students can experience libraries and open-source tools for natural language processing. The topics covered in this course include applications and challenges of natural language processing, problems and models in NLP such as sentiment classification, text retrieval, text representation, machine translation, and other related topics.

Reinforce Learning   Credits: 3

Course Description:
This course provides foundational knowledge and helps build skills in using reinforcement learning techniques to solve artificial intelligence problems. The main topics include basics of reinforcement learning, OpenAI Gym and Pytorch libraries, Cross-Entropy methods, Deep Q-learning, Policy gradients, REINFORCE, and Actor-Critic.

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