

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



**UNDERGRADUATE PROGRAM
MAJOR OF
INFORMATION TECHNOLOGY
(FOR ENROLMENT YEAR OF 2015)**

Program's Name: INFORMATION TECHNOLOGY
Major: INFORMATION TECHNOLOGY
Program's Vietnamese name: **Công Nghệ Thông Tin**
Level: Undergraduate
Major's ID: 52480201
Type of program: FULL TIME

MAY 2017

TRAINING PROGRAM

Program's Name: INFORMATION TECHNOLOGY

Level: UNDERGRADUATE

Major: INFORMATION TECHNOLOGY

Major's ID: 52480201

Type of Program: FULL TIME

(Issued by decision No.dated....of Rector of.....)

1. Duration of study: 4 years

2. Student Enrollment: High school graduates

3. Grading system, Training procedure, Graduation conditions

Grading system: 10

Training procedure: According to regulations issued by decision No. 43/2008/BGDĐT

Graduation conditions:

General conditions: According to regulations issued by decision No. 43/2008/BGDĐT

Major conditions: N/A

4. Program Objectives and Program Outcomes

4.1 Goals

With objectives of all-sided developments in knowledge, skills, attitudes, practical competence and having consciousness of responsibility for society, students specializing in Information Technology (IT) are trained for needs of recruitment, wholly developments of “hard skills” and “soft skills” to be able to rapidly adapt to continuous changes in working environment.

4.2 Objectives

After completing the program, students will be able to:

PLO	Objectives
1	Apply general knowledge in social sciences, natural sciences and Information Technology (IT)
2	Develop knowledge discovery, problem-solving, system-thinking skills and professional skills in the field of IT
3	Demonstrate effective teamwork and communication skills

4	Conceive, design, implement and operate IT systems, together with leadership and engineering entrepreneurship knowledge
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PLO = Program learning outcomes

4.3 Program outcomes

Code	Program Outcomes
1	General knowledge in social sciences, natural sciences and Information Technology (IT)
1.1	Apply general knowledge in social and natural sciences into the field of IT
1.2	Apply fundamental knowledge into the field of IT
1.3	Apply specialized knowledge into the field of IT, especially networking and network security, information systems, and software engineering
2	Personal and professional skills
2.1	Identify, analyze and solve problems in the IT field
2.2	Deconstruct and perform experiments on IT problems
2.3	Analyze IT problems using system thinking skill
2.4	Demonstrate personal attitudes and skills, such as self-confidence, enthusiasm, creative thinking, critical thinking, lifelong learning and time management
2.5	Demonstrate professional attitudes and skills, such as ethics, professional behavior and proactive vision
3	Teamwork and communication skills
3.1	Work effectively in a group
3.2	Communicate effectively in various forms, such as writing, graphics and presentation
3.3	Demonstrate the ability to use technical English in the field of IT
4	CDIO skills and attitudes (conceive, design, implement, operate) and knowledge about leadership and entrepreneurship
4.1	Recognize the roles and responsibility of IT engineers in societal context
4.2	Conform to different enterprise cultures
4.3	Conceive ideas for computer networks, software and information systems
4.4	Design computer networks, software and information systems
4.5	Implement hardware and/or software for IT systems
4.6	Operate and maintain IT systems

5. Total program credits: 152

6. Allocation of credits

Nanme	Credits		
	Total	Required	Elective
Foundation science courses	57	51	6
Political theory	10	10	0
Social sciences and humanities	8	2	6
English	9	9	0
Mathematics & Natural sciences	27	27	0
Introduction to Information Technology	3	3	0
IT-specialized Courses	95	70	25
Fundamental courses	52	52	0
Specialized courses	33	18	15
Capstone projects	10	0	10
Physical Education	5		
Physical Education 1	1		
Physical Education 2	1		
<i>Physical Education 3</i>	3		
Military Education	165 credits		

7. Content of program

A – Required courses

7.1. Foundation science courses

No	Course code	Course name	Credits	Notes
1.	LLCT150105	Principles of Marxism-Leninism	5	
2.	LLCT120314	Ho Chi Minh's Ideology	2	
3.	LLCT230214	Vietnamese Communist Party Policy of Revolution	3	
4.	GELA220405	General law	2	
5.	MATH141401	Algebra	4	
6.	MATH130601	Mathematical analysis 1	3	
7.	MATH130701	Mathematical analysis 2	3	
8.	PHYS130102	Principles of Physics A1	3	
9.	PHYS120202	Principles of Physics A2	2	
10.	PHYS110302	Basic Physical Laboratory	1	
11.	MATH130401	Probability and Statistic	3	
12.	EEEN234162	Basic Electronics	3	
13.	PRBE214262	<i>Basic Electronics Practice</i>	<i>1</i>	
14.	INIT130185	Introduction to Information Technology	3(2+1)	
15.	INPR140285	Introduction to Programming	4(3+1)	

16.	ENGL130137	English 1	3	
17.	ENGL230237	English 2	3	
18.	ENGL330337	English 3	3	

7.2. IT Courses

7.2.1. Fundamental IT courses

No	Course code	Course name	Credits	Notes
1.	DIGR240485	Discrete Mathematics and Graph Theory	4(3+1)	
2.	PRTE240385	Programming Techniques	4(3+1)	
3.	DASA240179	Data Structures and Algorithms	4(3+1)	
4.	OOPR240279	Object-Oriented Programming	4(3+1)	
5.	WIPR240579	Windows Programming	4(3+1)	
6.	INSE340379	Information Security	4(3+1)	
7.	WEPR340479	Web Programming	4(3+1)	
8.	SOEN340679	Software Engineering	4(3+1)	
9.	CAAL240180	Computer Architecture and Assembly Languages	4(3+1)	
10.	OPSY340280	Operating Systems	4(3+1)	
11.	NEES340380	Networking Essentials	4(3+1)	
12.	DBSY240184	Database Systems	4(3+1)	
13.	DBMS340284	Database Management Systems	4(3+1)	

7.2.2.a Specialized courses (*Students selects one of following specializations*)

No	Course code	Course name	Credits	Notes
SPECIALIZATION OF SOFTWARE ENGINEERING (SE)				
1.	WESE431479	Web Security	3(2+1)	
2.	OOSD330879	Object-Oriented Software Design	3(2+1)	
3.	MOPR331279	Programming for Mobile Devices	3(2+1)	
4.	SOTE431079	Software Testing	3(2+1)	
5.	MTSE431179	Modern Technologies on Software Engineering	3	
6.	POSE431479	Project on Software Engineering	3	
SPECIALIZATION OF COMPUTER NETWORK (CN)				
1.	DCTE330480	Data Communications	3	
2.	ADNT330580	Advanced Networking Technology	3(2+1)	
3.	UNOS330680	Unix Operating System	3(2+1)	
4.	CNDE430780	Computer Networks Design	3(2+1)	
5.	NSEC430880	Networks Security	3(2+1)	
6.	POCN431280	Project on Computer Networks	3	
SPECIALIZATION OF INFORMATION SYSTEM (IS)				
1.	ISAD330384	Information Systems Analysis and Design	3(2+1)	
2.	DAMI330484	Data Mining	3(2+1)	

3.	DIDB330584	Distributed Databases	3(2+1)	
4.	MISY430684	Management information systems	3	
5.	DBSE431284	Database Security	3(2+1)	
6.	POIS431184	Project on Information Systems	3	

7.2.3. Graduation *(Students select one of following options)*

No	Course code	Course name	Credits	Notes
7.	GRPR401979	Capstone project	10	
8.		Special subjects	12	
9.	SPSU432579	Special subject 1	3(2+1)	C++
10.	SPSU432679	Special subject 2	3(2+1)	Lập trình iOS
11.	SPSU431584	Special subject 3	3(2+1)	Kỹ năng LV
12.	SPSU431680	Special subject 4	3(2+1)	Mạng wireless

B – Elective courses:

Foundation science courses *(Students select 3 of following courses)*

No	Course code	Course name	Credits	Notes
1.	GEEC220105	Introduction to Economics	2	
2.	IQMA220205	Introduction to Quality Assurance	2	
3.	INMA220305	Introduction to Quản trị học	2	
4.	INLO220405	Introduction to Logics	2	
5.	PPST000226	Creativity methodology	2	
6.	SYTH220505	Thinking in Systems	2	
7.	PLSK320605	Planning skill	2	
8.	PRSK320705	Presentation skill	2	
9.	TDTS320805	Presentation of documents	2	
10.	CSVH230338	Vietnamese culture	2	
11.	INSO321005	Introduction to sociology	2	

IT courses *(Students select 3 of following courses)*

No	Course code	Course name	Credits	Notes
1.	ARIN330585	Artificial Intelligence	3	
2.	DIPR430685	DIGITAL IMAGE PROCESSING	3	
3.	MOPL331379	Advanced Programming Language	3(2+1)	
4.	ESYS431080	Embedded Systems	3(2+1)	*
5.	FOIT331380	Fundamental of Information Theory	3(2+1)	
6.	ITPM430884	Information Technology Project Management	3(2+1)	
7.	ECOM430984	Electronic Commerce	3	*
8.	CLCO432779	Cloud computing	3(2+1)	*

Specialized courses *(Students select 2 courses according to their specializations)*

No	Course code	Course name	Credits	Notes
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9.	TOEN430979	Software Development Environments and Tools	3(2+1)	
10.	SEEN431579	Search Engine	3(2+1)	
11.	SOPM431679	Software project management	3	*
12.	WEAP431779	Web Services and Applications	3	
13.	ADMP431879	Advanced Programming for Mobile Devices	3(2+1)	
14.	NPRO430980	Networks Programming	3(2+1)	
15.	NMSY331180	Network Monitoring Systems	3(2+1)	
16.	WINE331480	Wireless Networks	3	
17.	DAWH430784	Data Warehouse	3(2+1)	*
18.	INRE431084	Information Retrieval	3(2+1)	*
19.	ISAC431384	Information systems audit and control	3	
20.	SOIS431484	Special topics in IS	3	
21.	HCIN431979	Human computer interaction	3	
22.	ESDN432079	Design of educational software	3(2+1)	*

8. Plan

Semester 1:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	LLCT150105	Principles of Marxism-Leninism	5	
2.	MATH141401	Algebra	4	
3.	MATH130601	Mathematical analysis 1	3	
4.	ENGL130137	English 1	3	
5.	INIT130185	Introduction to Information Technology	3	
6.	INPR140285	Introduction to Programming	4	
	Total		22	

Semester 2:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	LLCT120314	Ho Chi Minh's Ideology	2	
2.	GELA220405	General law	2	
3.	MATH130701	Mathematical analysis 2	3	
4.	PHYS130102	Principles of Physics A1	3	
5.	MATH130401	Probability and Statistic	3	
6.	ENGL230237	English 2	3	
7.	PRTE240385	Programming Techniques	4	
8.	PHED110513	<i>Physical education 1</i>	<i>1</i>	

	Total		20	
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Semester 3:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	PHYS120202	Principles of Physics A2	2	
2.	PHYS110302	Basic Physical Laboratory	1	
3.	EEEN234162	Basic Electronics	3	
4.	ENGL330337	English 3	3	
5.	DIGR240485	Discrete Mathematics and Graph Theory	4	
6.	DASA240179	Data Structures and Algorithms	4	
7.	OOPR240279	Object-Oriented Programming	4	INPR140285
8.	PHED110613	<i>Physical education 2</i>	1	
	Total		21	

Semester 4:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	PRBE214262	<i>Basic electronics practice</i>	1	
2.	WIPR240579	Windows Programming	4	
3.	CAAL240180	Computer Architecture and Assembly Languages	4	
4.	DBSY240184	Database Systems	4	
5.	PHED110715	<i>Physical education 3 (SV tự chọn)</i>	1	
6.		<i>Elective foundation science course 1</i>	2	
7.		<i>Elective foundation science course 2</i>	2	
8.		<i>Elective foundation science course 3</i>	2	
Students select 3 of 11 following courses:				
	GEEC220105	Introduction to economics	2	
	IQMA220205	Introduction to Quality assurance	2	
	INMA220305	Introduction to business administration	2	
	INLO220405	Introduction to Logics	2	
	PPST000226	Creativity methodology	2	
	SYTH220505	Thinking in Systems	2	
	PLSK320605	Planing skill	2	
	PRSK320705	Presentation skill	2	
	TDTS320805	Presentation of documents	2	
	CSVH230338	Vietnamese culture	2	
	INSO321005	Introduction to sociology	2	
	Total		19	

Semester 5:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	WEPR340479	Web Programming	4	
2.	SOEN340679	Software Engineering	4	DBSY240184, DASA240179, WIPR240579
3.	OPSY340280	Operating Systems	4	
4.	NEES340380	Networking Essentials	4	
5.	DBMS340284	Database Management Systems	4	
	Total		20	

Semester 6: (Begin to study specialized courses)

TT	Course code	Course name	Credits	Code of prerequisite course
1.	INSE340379	Information Security	4	
2.		<i>Elective IT course 1 – Choose following course</i>	3	
3.	CLCO432779	<i>Cloud computing</i>		Elective IT course 1
4.		<i>Elective IT course 2 – Choose following course</i>	3	
5.	ECOM430984	<i>Electronic Commerce</i>		<i>Elective IT course 2</i>
Chuyên ngành Software Engineering				
4.	WESE431479	Web Security	3	
5.	OOSD330879	Object-Oriented Software Design	3	
6.	MOPR331279	Programming for Mobile Devices	3	
SPECIALIZATION OF COMPUTER NETWORKS				
4.	DCTE330480	Data Communications	3	
5.	ADNT330580	Advanced Networking Technology	3	
6.	UNOS330680	Unix Operating System	3	
SPECIALIZATION OF INFORMATION SYSTEMS				
6.	ISAD330384	Information Systems Analysis and Design	3	
7.	DAMI330484	Data Mining	3	PRTE240385, DASA240179, MATH130401
8.	DIDB330584	Distributed Databases	3	INPR140285, DBSY240184
	Total		19	

Semester 7:

TT	Course code	Course name	Credits	Code of prerequisite course
1.	LLCT230214	Vietnamese Communist Party Policy of Revolution	3	
2.		<i>Elective IT course 3 – Choose following course</i>	3	
3.	ESYS431080	<i>Embedded Systems</i>		<i>Elective IT course3</i>
4.		<i>Môn CN tự chọn 1</i>	3	
Students choose 1 of 3 courses according to their specializations				
5.	SOPM431679	<i>Software project management</i>		<i>Elective specialized course 1 – SE</i>
6.	NPRO430980	<i>Networks Programming</i>		<i>Elective specialized course 1 – CN</i>
7.	DAWH430784	<i>Data Warehouse</i>		<i>Elective specialized course 1 – IS</i>
Chuyên ngành Software Engineering				
4.	SOTE431079	Software Testing	3	
5.	MTSE431179	Modern Technologies on Software Engineering	3	WEPR340479
6.	POSE431479	Project on Software Engineering	3	
SPECIALIZATION OF COMPUTER NETWORKS				
4.	CNDE430780	Computer Networks Design	3	
5.	NSEC430880	Networks Security	3	
6.	POCN431280	Project on Computer Networks	3	
SPECIALIZATION OF INFORMATION SYSTEMS				
4.	MISY430684	Management information systems	3	DBSY240184, NEES340380, PRTE240385
5.	DBSE431284	Database Security	3	
6.	POIS431184	Project on Information Systems	3	
	Total		18	

Semester 8:

TT	Course code	Course name	Credits	Code of prerequisite course
1.		<i>Elective specialized courses</i>	3	
Students select 1 of 3 courses according to their specializations				
2.	ESDN432079	<i>Educational software design</i>		Elective

				specialized course 2 – SE
3.	NMSY331180	<i>Network Monitoring Systems</i>		Elective specialized course 2 – CN
4.	INRE431084	<i>Information Retrieval</i>		Elective specialized course 2 – IS
5.	GRPR401979	<i>Capstone project (Or special subjects)</i>	10	
6.	SPSU432579	Special subject 1	3(2+1)	C++
7.	SPSU432679	Special subject 2	3(2+1)	IOS Programming
8.	SPSU431584	Special subject 3	3(2+1)	Working skills
9.	SPSU431680	Special subject 4	3(2+1)	Wireless network
	Total		13	

9. Course descriptions and their credits

A. Department of informatics foundation

1 Course name: Introduction to Information Technology

Credits: 3

Course description:

This course provides students with following areas of knowledge and skills:

- The general knowledge of contemporary Information Technology areas and job skills required to enter the IT market, especially soft skills;
- Introduction to the university's organization as well as skills and strategies for effective learning at university;
- A broad range of introductory Information Technology concepts, especially computational thinking. To help students gradually form the computational thinking skill, this course provides them with basic knowledge of the Python programming language and then guides them to use this language to implement solutions for several given problems.

Main textbooks:

This course has no textbook.

References:

[1] ITL ESL, *Introduction to Information Technology*, Pearson Education India, 2013.

[2] Michael Dawson, *Python Programming for the Absolute Beginner, 3rd Edition*. Course Technology, 2010.

[3] <http://www.cs4fn.org/computationalthinking/>

2 Course name: Introduction to Programming

Credits: 4

Course description:

This course provides 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 also 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.

Main textbooks:

[1] Brian W. Kernighan, Dennis M. Ritchie, *The C programming language*, Prentice Hall International Editions, 1997.

[2] K.N.King, *C Programming: A Modern Approach, 2nd Edition*, W.W. Norton, 2008.

References:

[1] Peter Prinz, Ulla Kirch-Prinz, *A Complete Guide to Programming in C++*, Jones and Bartlett Publishers, 2002.

[2] Rajar Raman, *Fundamentals of Computers*, Prentice Hall, 2002.

[3] Zed A. Shaw, *Learn C The Hard Way*, Addison - Wesley, 2016.

3 Course name: Programming Techniques

Credits: 4

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.

Main textbooks:

[1] Donald E. Knuth, *The Art of Computer Programming – Vol. 2*, 3rd Edition, Addison Wesley, 1997.

References:

[1] Thomas H. Cormen et al., *Introduction to Algorithms (3rd Edition)*, The MIT Press, 2009.

[2] Steven S. Skiena, Miguel A. Revilla, *Programming Challenges*, Springer, 2003.

[3] Brian W. Kernighan, Dennis M. Ritchie, *The C programming language*,

Prentice Hall International Editions, 1997.

[4] Lê Minh Hoàng, *Algorithms and Programming*, University of Pedagogy, Hanoi, 2006.

4 Course name: Discrete Mathematics and Graph Theory Credits: 4

Course description:

The discrete math part provides students with the basic knowledge of sets, propositional logic, predicates and quantifiers, rules of inference, equivalence relations, partial orderings, Boolean functions, representing Boolean functions, logic gates, minimization of circuits.

The graph theory part provides students with the 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.

Main textbooks:

[1] Kenneth H. Rosen, *Discrete Mathematics And Its Applications, Seventh Edition*, The McGraw-Hill Companies, Inc, 2012.

References:

[1] Dang Truong Son, Le Van Vinh, Tran Cong Tu, Nguyen Quang Ngoc, Nguyen Thanh Son, Nguyen Phuong, *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., Marc L., *Discrete Mathemetics*, The McGraw-Hill Companies, Inc, 2007.

[4] Tran Ngoc Danh, *Advanced Discrete Mathematics*, Vietnam National University, Ho Chi Minh City Publishing Company, 2004.

5 Course name: Artificial Intelligence Credits: 3

Course description:

- Provide students with knowledge on AI applications.
- Provide students with knowledge on search methods for solving problems (blind, experience, optimization, competition)
- Provide students with knowledge on knowledge representation and argument, semantic network, expert system, machine learning.
- Provide students with knowledge and skills relating to develop smart applications.

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

B. Department of Software Engineering

1 Course name: Data Structures and Algorithms

Credits: 4

Course description:

This course provides students with specialized knowledge in data structures and algorithms used for developing computer programs. Students are able to analyze and describe algorithms using pseudo codes as well as develop the algorithms on computer using C/C++ programming language. Furthermore, this course also provides students with the ability of applying data structures and algorithms to solve real-world problems. Besides, students can work in groups and develop their presentation skills through seminars.

Main 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*, 2013. NXB Đại học Quốc gia TP. Hồ Chí Minh.

[2] Trần Hạnh Nhi, *Nhập môn cấu trúc dữ liệu và giải thuật*, Đại học Khoa học Tự nhiên TP. HCM, 2000.

[3] Nguyễn Hồng Chương, *Cấu trúc dữ liệu – Ứng dụng và cài đặt bằng C*, NXB TP HCM, 2005.

2 Course name: Object-Oriented Programming

Credits: 4

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 of applying OOP to solve real-world problems. Besides, students can develop their teamwork and presentation skills through seminars.

Main Textbook:

[1] B. M. Harwani, *Learning Object-Oriented Programming in C# 5.0*, Cengage Learning PTR, 2015.

References:

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

3 Course name: Information Security

Credits: 4

Course description:

This course provides students with a consideration of security problems in computing. Topics include: security mindset, essential concepts (policy, CIA, etc.); Software security: vulnerabilities and protections, malware, program analysis; Practical cryptography: encryption, authentication, hashing, symmetric and asymmetric crypto; Networks: wired and wireless networks, protocols, attacks and countermeasures; Applications and special topics: databases, web apps, privacy and anonymity, voting, public policy.

Main textbook:

- [1] Matt Bishop, *Introduction to Computer Security*, Prentice Hall, 2004.

References:

- [1] W. Stallings, *Cryptography and Network Security - Principles and Practices*. 5th edition, Pearson, 2011
- [2] Michael E Whitman, Herbert J Mattord, *Principles of information security* - Course Technology, CENGAGE Learning, 2012.

4 Course name: Web Programming

Credits: 4

Course description:

This course provides students with fundamental knowledge used to develop web applications based on the Servlet and JSP technology. The main content includes:

- Servlet;
- JSP and JSTL (JSP Standard Tag Library - a collection of useful JSP tags that encapsulate core functionality common to many JSP applications);
- JDBC;
- Some front-end technologies such as JavaScript, JQuery.

Main textbooks:

- [1] Marty Hall, Larry Brown. *Core Servlets & JSP, Second Edition*. Prentice Hall,

2003.

References:

[1] Bryan Basham, Kathy Sierra, Bert Bates. *Head First Servlets and JSP, 2nd Edition*. O'Reilly Media, 2008.

[2] Joel Murach and Michael Urban. *Murach's Java Servlets and JSP, 3rd Edition*. Murach, 2014.

5 Course name: Windows Programming

Credits: 4

Course description:

This course provides students with specialized knowledge and methods in programming on windows systems. Students are also provided with 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, graphic controls, LINQ to SQL, Entity framework, Microsoft report. This course also provides students with the ability of applying .NET technologies to solve real-world problems. Besides, students can work in groups and develop their presentation skills through seminars.

Main textbooks:

[1] Chris sells, Windows Form programming in C Sharp, Addison-Wesley Professional, 2003.

[2] Erik brown, Windows Form programming with C Sharp, Manning, 2002.

[3] Andrew Troelsen, C# 5.0 and the .NET 4.5 Framework, apress, 2012.

6 Course name: Software Engineering

Credits: 4

Course description:

Provide the knowledge and skills about processing of building software: Receiving requests, Modeling the requirement, Analyzing the requirements, Designing the requirements, Building a software, Testing a software.

Main textbooks:

[1] Roger S. Pressman, *Software Engineering*, Education publisher, 2001.

References:

[1] Dương Anh Đức, *Object-oriented analysis and design with UML*, Statistical publisher, 2002.

[2] Nguyễn Tiến Huy, *Introductory syllabus for software engineering*, HCMUS, 2002.

[3] Nguyễn Minh Đạo, *Education publisher*, FIT - HCMUTE, 2004.

[4] Craig Larman, *Applying UML and Pattern*, Prentice Hall, 1998.

[5] *Software Engineering: A Practitioner's Approach*, Author: Roger S. Pressman, Publication Information: Fourth Edition, McGraw-Hill, 1997

[6] *The Mythical Man-Month: Essays on Software Engineering*, Author: Frederick P. Brooks Publication Information: 20th Anniversary Edition, Addison-Wesley, 1995

[7] *Software Engineering*, Ian Sommerville, ninth Edition, Addison-Wesley 2011.

7 Course name: Object-Oriented Software Design

Credits: 3

Course description:

This course provides students with fundamental knowledge about software analysis and design using object-oriented techniques, Unified Modeling Language (UML) and UML tools, as well as design patterns and their applications in software development. After the course, students are equipped with analysis and design skills; the ability to use UML tools to create software design components; together with 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 focused.

Main textbooks:

[1] Kim Hamilton, Russell Miles, *Learning UML 2.0*, O'Reilly, 2006.

[2] E. Gamma, R. Helm, R. Johnson, J. Vlissides, *Design Patterns - Elements of Reusable Object-Oriented Software*, Addison-Wesley, 2005.

References:

[1] James W. Cooper, *The Design Patterns Java Companion*, Addison-Wesley, 1998.

[2] Horstmann, Cay, *Object-Oriented Design & Patterns*, Second Edition, John Wiley & Sons, 2006.

[3] Craig Larman, *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/>

8 Course name: Software Testing

Credits: 3

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 course, student can understand terms, definitions,

concepts in Software testing and they can apply knowledge to design, execute, analyse and evaluate software quality. Besides that, students will practice to use bug management tools and automation testing tools.

Main textbooks:

[1] Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press, 2008.

References:

[1] Hung Q.Nguyen, Testing Application on the Web: Testing planning for mobile and Internet – based System, Wiley publishing, 2003.

[2] Glenford J.Myers, the art of Software Testing, John Wiley & Sons, 2004.

[3] Elfriede Dustin, Effective Software Testing: 50 specific ways to improve your testing, Wiley publishing, 2002.

9 Course name: Modern Technologies on Software Engineering Credits: 3

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. They're going to stand on the shoulders of giants and use as many abstractions and templates as possible.

MEAN is an acronym for the four main technologies that it is comprised of:

- MongoDB: A non-relational database
- ExpressJS: A node framework that has powerful middleware features
- AngularJS: A frontend JavaScript library created and maintained by Google that is used to create single page applications
- Node.JS: A server-side JavaScript environment based on V8

Main Textbook:

[1] Simon Holmes, *Getting MEAN with Mongo, Express, Angular, and Node*, Manning Publications Co, 2016.

References:

[1] Amos Q. Haviv, *MEAN Web Development*, 1st Edition, Packt Publishing, 2014.

10 Course name: Programming for Mobile Devices Credits: 3

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, Android User Interface Design. After finishing this course, student can analyze, design and choose appropriate libraries for developing full - stack Android Applications.

Main textbooks:

[1] Ian F. Darwin, *Android Cookbook*, O'Reilly Media, 2012

[3] Wei Meng Lee, *Beginning Android Development*, Wrox, 2012.

References:

[1] Wei Meng Lee, *Beginning Android Development*, Wrox, 2012.

11 Course name: Web Security

Credits: 3

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 attack. The course also equips students with knowledge and the ability to identify threats and use appropriate tools and techniques to build a safe web application and protect it from attacks.

Main textbooks:

[1] Bryan, .S, 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] Dafydd Stuttard, Marcus Pinto. *The Web Application Hacker's Handbook*. Wiley.

2011.

[2] OWASP Top 10 - 2013.

12 Course name: Software project management

Credits: 3

Course description:

This course provides students with basic terminologies 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. With this course, students are also equipped with basic skills in project planning and various project management activities.

Main textbooks:

[1] Project Management Institute, *A Guide to Project Management Body of Knowledge 5th Edition*, PMI, 2013.

References:

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

13 Course name: Advanced Programming for Mobile Devices

Credits: 3

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.

Main Textbook:

- [1] Arvind Ravulavaru, *Learning Ionic*, FIRST EDITION, Packt Publishing, 2015.

References:

- [1] Michael Bohner, *Building mobile apps with Ionic Framework*, Michael Bohner, 2015.
- [2] Jeremy Wilken, *Ionic in Action*, Manning Publications Co, 2016

C. Department of HỆ THỐNG THÔNG TIN

1. Course name: Database Systems

Credits: 4

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.

Main textbook:

- [1] Ramez Elmasri, Shamkant Navathe, *Fundamentals of Database System*, 7th Edition, Texas. Addison-Wesley, 2015.

References:

- [1] Silberschatz, Korth and Sudarshan, *Database System Concepts (6th Edition)*. New York. McGraw-Hill, 2010.
- [2] Garcia-Molina, H., Ullman J.D., Widom J., *Database Systems - The Complete Book (2nd Edition)*. New Jersey, Pearson Prentice Hall, 2008.

2. Course name: Database Management Systems

Credits: 4

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. Relational database management system is the main focus. Practical design of databases and developing database applications will be focused.

Main textbooks:

[1] Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, 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] Ramez Elmasri, Shamkant Navathe, *Fundamentals of Database System*, 7th Edition, Texas. Addison-Wesley, 2015.

[2] Silberschatz, Korth and Sudarshan, *Database System Concepts (6th Edition)*. New York. McGraw-Hill, 2010.

[3] Garcia-Molina, H., Ullman J.D., Widom J., *Database Systems - The Complete Book (2nd Edition)*. New Jersey, Pearson Prentice Hall, 2008.

3. Course name: Data Warehouse

Credits: 3

Course description:

This course provides the basic knowledge of the data warehouse. In this course, the learners will learn the basic concepts of data warehouse, data warehouse architectures and multidimensional models. They will have hands-on experience for data warehouse design and use open source products for manipulating pivot tables and creating data integration workflows. Besides, the learners will also learn how to use analytical elements of SQL supported by relational database management systems for answering business intelligence questions.

Main textbooks:

[1] Christian S. Jensen et al., *Multidimensional Databases and Data Warehousing*, Morgan & Claypool, 2010.

[2] Paul Lane et al., *Oracle Database Data Warehousing Guide, 12c Release 1 (12.1)*, Oracle, 2014.

References:

[1] Ralph Kimball and Margy Ross, *The Data Warehouse Toolkit: the Definitive Guide to Dimensional Modeling*, 3rd Edition, Wiley, 2013.

- [2] Matt Casters et al., *Pentaho Kettle Solutions: Building Open Source ETL Solutions with Pentaho Data Integration*, Wiley, 2010.
- [3] Microsoft, *SQL Server 2012 Tutorials: Analysis Services - Multidimensional Modeling*, SQL Server 2012 Books Online, 2012.
- [4] Ramez Elmasri and Shamkant Navathe, *Fundamental of Database Systems, 6th Edition*, Addison-Wesley, 2011.

4. **Course name: Information Retrieval**

Credits: 3

Course description:

This course provides 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:

- General architecture of an information retrieval system.
- Text pre-processing and indexing.
- Important information retrieval models: vector space models, probabilistic models, language models
- Methods to evaluate the accuracy of an information retrieval system.
- Relevance feedback and query expansion techniques.
- The mechanism in which a web search engine works and link analysis algorithms.

Main textbooks:

- [1] ChengXiang Zhai and Sean Massung, *Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining*, ACM Books, 2016.
- [2] Christopher D. Manning et al., *Introduction to Information Retrieval*, Cambridge University Press, 2008. <http://nlp.stanford.edu/IR-book/>

References:

- [1] Bruce Croft et al., *Search Engine: Information Retrieval in Practice*, Pearson, 2009. <https://ciir.cs.umass.edu/irbook/>
- [2] Ricardo A. Baeza-Yates and Berthier A. Ribeiro-Neto, *Modern Information Retrieval, 2nd Edition*, Addison-Wesley, 2010. <http://www.mir2ed.org/>
- [3] Stefan Büttcher and Charles L. A. Clarke, *Information Retrieval: Implementing and Evaluating Search Engines*, 2010. <http://www.ir.uwaterloo.ca/book/>

5. **Course name: Data Mining**

Credits: 3

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.

Main textbook:

[1] Jiawei Han. *Data Mining: Concepts and Techniques (3rd edition)*, 2011.

References:

[1] Xindong, Wu et al, Knowl Inf Syst. *Top 10 algorithms in data mining*. Springer, 2008.

[2] Daniel T. Larose. *Data mining methods and models*. John Wiley & Sons, 2006.

[3] Mehmed Kantardzic. *Data Mining: Concepts, Models, Methods, and Algorithms*. John Wiley & Sons, 2003.

6. Course name: Information Systems Analysis and Design Credits: 3

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.

Main textbook:

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

References:

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

[2] S. Bennett, S. McRobb and R. Farmer. *Object-Oriented Systems Analysis And Design using UML (4th edition)*. McGraw Hill, 2010.

[3] G. Booch, I. Jacobson and J. Rumbaugh. *The Unified Modeling Language for Object-Oriented Development*. Documentation set, version 1.0, Rational Software Corporation, 1997.

7. Course name: Database Security Credits: 3

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. After this course, students are able to implement security mechanisms in database management systems. Moreover, the course offers students with such soft skills as teamwork and public presentation.

Main textbooks:

- [1] Matt B., *Computer Security: Art and Science*, Addison Wesley, 2002.
- [2] Ron B. N., *Implementing Database Security and Auditing*, Elsevier, 2005.

References:

- [1] Justin C., *SQL Injection Attacks and Defense*, Syngress, 2012.
- [2] Robert W., Grant F., *Beginning SQL Server 2012 Administration*, Apress, 2012.
- [3] Ron B., *How To Secure and Audit Oracle 10g & 11g*, CRC Press, 2009.
- [4] Sam Afyouni, *Database Security and Auditing: Protecting Data Integrity and Accessibility*, Course Technology Press Boston, 2005.
- [5] Michael Gertz, Sushil Jajodia, *Handbook of Database Security: Applications and Trends*, Springer, 2009.
- [6] Elisa Bertino, Gabriel Ghinita, Ashish Kamra, *Access Control for Databases: Concepts and Systems*, Now Publishers, 2011.

D. Department of computer networks

1. Course name: Computer Architecture and Assembly Languages Credits: 4

Course description:

This course provides students with basic knowledge in Computer Architecture, those attributes that have 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; assembling a program with assembly language and debug low-level language program.

Main textbooks:

- [1] William Stallings, *Computer Organization and Architecture*, 9th Edition, Pearson Education, Prentice-Hall, 2013, ISBN-13: 978-0-13-293633-0

References:

- [1] Nguyễn Đăng Quang, *Computer Organization and Architecture*, 2015
- [2] Đinh Công Đoan, *Bài giảng Cấu trúc máy tính và hợp ngữ*, khoa CNTT trường, ĐH. SPKT Tp. HCM, 2008

2. Course name: Operating Systems Credits: 4

Course description:

This course provides students with basic knowledge of the operating system, including the general model, structure, functions, basic components of operating system. Basic principles for building an operating systems. The students also get to know the structure and application of basic principles in specific operating systems. Research and simulate OS device drivers through system programming.

Main textbooks:

[1] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, *Operating System Concepts Sixth Edition*, Wiley, 2001.

References:

[1] William Stallings, *Operating Systems: Internals and Design Principles 8th Edition*, Pearson, 2014.

3. Course name: Networking Essentials Credits: 4

Course description:

This course provides students with knowledge in 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] Wendell Odom, *CCENT/CCNA ICND1 – Official Cert Guide*, Cisco Press, 2016.

[2] Wendell Odom, *CCNA Routing and Switching – Official Cert Guide*, Cisco Press, 2016

[3] Mitch Tulloch, *Training Guide: Installing and Configuring Windows Server 2012 R2*, Microsoft Press, 2014

[4] Orin Thomas, *Training Guide: Administering Windows Server 2012 R2*, Microsoft Press, 2014

[5] Roderick W.Smith, *LPIC-1 Linux Professional Institute Certification Study Guide*, 3rd edition, Sybex, 2013

[6] Christin Bresnahan and Richard Blum, *LPIC-2 Linux Professional Institute Certification Study Guide*, 2nd Edition, Sybex, 2016.

4. Course name: Data Communications Credits: 3

Course description:

This course introduces concepts, terminologies, and approaches used in data transmission systems. The course also helps students to comprehend the mechanism of data transfer between two devices via network protocols; multiplexing/demultiplexing techniques; methods of error detection and correction; and data-flow controls.

Main textbooks:

[1] Behrouz A. Forouzan, *Data Communication and Networking 5th Edition*, McGraw Hill International Edition, 2012.

References:

[1] Fred Halsall, *Data Communications, Computer Networks and Open Systems 4th Edition*, Addison – Wesley, 1995.

[2] William Stallings, *Data and Computer Communications*, 10th Edition, Prentice hall, 2014.

5. Course name: Advanced Networking Technology

Credits: 3

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, the course offers students to understand the core issues, be aware of proposed solutions so they can actively follow and participate in the development of the network technologies. This course also offers students with such soft skills as teamwork and public presentation

References:

[1] Wendell Odom, *CCENT/CCNA ICND1 – Official Cert Guide*, Cisco Press, 2016

[2] Wendell Odom, *CCNA Routing and Switching – Official Cert Guide*, Cisco Press, 2016

6. Course name: Unix Operating System

Credits: 3

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 supported 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 can discuss the various aspects of the problem, various possible solutions, and try them all.

Main textbooks:

[1] Nguyen Thi Thanh Van, *Unix Network Operation System*, 2008

References:

[1] Graham Glass, King Ables, 2006, *Linux for Programmers and Users*, Prentice Hall

[2] Roderick W. Smith, Third Edition, 2013, *LPIC-1: Linux Professional Institute*

[3] Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, 4th Edition, 2010, *UNIX and Linux System Administration Handbook*. Pearson Education Inc

7. Course name: Computer Networks Design Credits: 3

Course description:

This course provides students with knowledge in network design, processes and phases in designing networks, 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] Anthony Bruno, *CCDA Official Cert Guide*, Cisco Press, 2016.

[2] Sean Wilkins, *Designing for Cisco Internetwork Solutions (DESIGN)*, Cisco Press 2011.

8. Course name: Networks Security Credits: 3

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] William Stallings, *Network Security Essentials*, Prentice Hall, 4th Edition, 2011.

[2] Eric Maiwald, *Fundamentals of Network Security*, McGraw Hill, 2010.

[3] Chris McNab, *Network Security Assessment – 3rd Edition*, O'Reilly Media, 2016.

[4] Darril Gibson, *CompTIA Security+: Get Certified Get Ahead*, CompTIA, 2014.

[5] Chris Chapman, *Network Performance and Security*, SynGress, 2016.

9. Course name: Networks Programming Credits: 3

Course description:

The course is designed to provide knowledge and skills in 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.

Main textbooks:

[1] Elliott Rusty Harold. *Java Network Programming*. 4th Edition, O'Reilly Media Inc, 2014.

[2] Richard Blum. *C# Network Programming*, SYBEX, 2003.

10. Course name: Embedded Systems

Credits: 3

Course description:

This course provides students with basic knowledge in embedded systems, including: the basic concepts about embedded systems, the properties, embedded applications; basic components of an embedded system; embedded system design process; ARM microcontroller; ARM instruction set; C programming language for embedded system; and embedded programming for arm microcontroller.

Main textbooks:

[1] Edward A. Lee, Sanjit A. Seshia, "Introduction to embedded systems – A cyber physical systems approach", 2014.

[2] Patrick Crowley, Peter Barry, "Modern Embedded Computing – Designing Connected, Pervasive, Media-Rich Systems", 1st Edition, MORGAN KAUFMANN PUBLISHERS, INC. 2012.

References:

[1] Frank Vahid and Tony Givargis , *Embedded System Design: A Unified Hardware/Software Approach*, John Wiley & Sons, Inc. 2002

[2] Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Elsevier Newnes, 2007

[3] Jonathan W Valvano, *Embedded Systems: Introduction to Arm® Cortex(TM)-M Microcontrollers(Volume 1)*, 2012

[4] Jonathan W Valvano, *Embedded Systems: Real-Time Interfacing to Arm® Cortex™-M Microcontroller*, 2012

11. Course name: Network Monitoring Systems

Credits: 3

Course description:

This course provides students with knowledge in the components of a network monitoring system; knowledge in implementing a network monitoring system, network monitoring protocols, network monitoring tools, alert systems.

References:

[1] Richard Bejtlich, *The Practice of network Security monitoring*, No Starch press, 2013

[2] Rihards Olups, *Zabbix Network Monitoring - Second Edition*, PACKT, 2016

[3] Dinangkur Kundu, S.M. Ibrahim Lavlu, *Cacti 0.8 Network Monitoring*, PACKT Publishing, 2009

[4] Tom Ryder , *Nagios Core Administration cookbook - Second Edition*, PACKT, 2016

12. Course name: Wireless Networks

Credits: 3

Course description:

This course provides students with basic knowledge in Wireless and mobile network, including: applications, history of wireless network, Future wireless network applications; Features of wireless environment and signal modulation techniques; Multi-access methods; Cell phone network; Wireless LAN.

Main textbooks:

[1] Jochen H Schiller, *Mobile Communication Third Edition*, Prentice Hall, 2007.

References:

[1] William Stallings, *Wireless communications and Networks*, Prentice Hall, 2005

[2] Theodore S.Rappaport, *Wireless communications : Principle and practice*, 2nd, Prentice Hall.

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