THAI NGUYEN UNIVERSITY
UNIVERSITY OF INFORMATION AND COMMUNICATION TECHNOLOGY

PROGRAMME SPECIFICATION
OF SOFTWARE ENGINEERING EDUCATION PROGRAMME

THAI NGUYEN - 2021

CONTENTS

PROGRAMME SPECIFICATION OF SOFTWARE ENGINEERING EDUCATION PROGRAMME
Decision No 566/QĐ-ĐHCNTT&TT dated on August 30th, 2021 by the Rector of TNU - University of Information and Communication Technology

I. GENERAL INFORMATION

1. Introduction

The curriculum of a training program is a system of subjects expressing training objectives, defining standards of knowledge, skills, ethical qualities, scope and structure of training content, methods and forms of training, methods of evaluating training results for each subject, discipline, and training level in the training system.

The software engineering program is designed according to the CDIO approach to train students comprehensively in both professional knowledge, skills and ethical qualities, with emphasis on practical competence and awareness social responsibility, ensuring students have active learning and practical experience. After graduation, students can meet the need of knowledge, professional qualifications of employers and society.

The curriculum is designed on the basis of compliance with the regulations and guidelines of the Ministry of Education and Training, Thai Nguyen University of Information and Communication Technology to match the development orientation of information technology and software industry, human resource needs, local labor market, economic region, reference to national and international quality assurance standards. The curriculum is referenced and compared with the programs of other in the country and international universities.

2. General information

2.1. Name of training:

+ Vietnamese: Kỹ thuật phần mềm
+ English: Software Engineering

2.2 Training code: 7480103

2.3 Specialization: **Software Engineering Engineer.**

2.4. Type of training: formal

2.5. Diploma Name:

- Bachelor of Software Engineering (4 years training system).
- Engineer of Software Engineering (5 years training system).

2.6. Training and degree place:

University of Information and Communication Technology - Thai Nguyen University.

II. PROGRAM OBJECTIVES

The objectives of the training program in Software Engineering are built in accordance with the Vision - Mission - Educational Philosophy of the University of Information and Communication Technology; aimed at fostering people and developing applied scientific research to meet the needs of socio-economic development and international integration.

1. Vision - Mission - Educational philosophy of the school

1.1. Vision

University of Information and Communication Technology becomes the leading applied, multidisciplinary and digital-based university in Vietnam's higher education system

1.2. Mission

The university's mission is to train human resources at undergraduate and postgraduate levels; short-term fostering; scientific research and technology transfer to meet the needs of the labor market and in line with the National Strategy on the Fourth Industrial Revolution and the National Digital Transformation Program, serving economic development - the country's culture and society.

2. Training Objectives

2.1. General objective

Training bachelors/engineers in Software Engineering with basic scientific knowledge, foundational knowledge of the field of information technology, solid professional knowledge in software engineering; Having skills in problem analysis, defining requirements, then designing, building, testing and operating a program, a software to meet the desired needs; Having communication skills, teamwork, professional attitude and working style to meet the development requirements of the domestic and international software industry.

2.2. Detail objective:

By the end of the course, graduates have the knowledge, skills and qualities:

O1. Have general knowledge of political theory, natural and social sciences, knowledge of foreign languages

O2. Have background knowledge in the field of information technology such as: basic programming techniques, data structures and algorithms, system analysis and design, computer networks and operating systems, software development process.

O3. Have the ability to analyze, design, program, test, deploy software projects, applications, websites; Have the ability to apply modern methods, techniques and tools in software development.

O4. Have professional skills in software engineering, have understanding of the external social and business context to analyze, apply, design and produce integrated software products..

O5. Have a professional attitude in work, communication and teamwork. Able to use English at work.

3. Program Learning Outcomes

Notation PLO		PLOs of SE programme	Proficiency level
1		**Technical knowledge and reasoning**	
1.1	*L1*	***Apply general knowledge in social and natural science (such as political theory, mathematics, physics) to solve problems in specialization, career, and daily life.***	***2.5***
1.1.1		Apply knowledge of Marxism-Leninism, Ho Chi Minh's thought and the Party's viewpoints to perceive scientific, technical and technological issues; build political bravery and develop moral values, responsibility to self, family, social community.	2.5
1.1.2		Apply basic knowledge of mathematics, physics, and logical thinking as the foundation for studying, researching and solving professional and professional problems.	2.5
1.1.3		Apply knowledge of national defense and security and physical education to realize the responsibility for the cause of national defense and health training to ensure the assigned tasks.	2.5
1.2	*L2*	***Achieve a foreign language proficiency level of 3/6 (B1) with the six-level Foreign Language Proficiency Framework For Vietnam or other equivalent international foreign language certificates.***	***4***
1.2.1		Apply basic knowledge of vocabulary and grammar to meet the acquisition of specialized knowledge.	3
1.2.2		Synthesize learned knowledge and language skills to listen, speak, read and write on familiar topics in life and work.	4
1.3	*L3*	***Apply fundamental knowledge in the IT field for implementing practical applications.***	***3***
1.3.1		Apply knowledge of basic programming methods, tools and source code in developing software products.	3
1.3.2		Apply knowledge of mathematics to computers to solve problems in system architecture and operation.	3
1.3.3		Apply knowledge of data structures and algorithms to solve problems during the design and construction of software products.	3
1.3.4		Apply knowledge of computer architectures, operating systems, and networks to deploy information technology applications	3
1.3.5		Apply knowledge of software development processes, system analysis, and database design in software development.	3

Notation PLO		PLOs of SE programme	Proficiency level
1.4	*L4*	*Apply professional knowledge of software engineering in building, deploying and operating software*	*3*
1.4.1		Apply knowledge of object-oriented software development methods to solve software system development problems.	3
1.4.2		Apply knowledge of software requirements specification analysis to solve problems in the software development process	3
1.4.3		Apply modern software design and architecture knowledge to develop software products.	3
1.4.4		Apply knowledge of testing and software quality assurance in the software product quality assurance process.	3
1.4.5		Apply knowledge of software operation and maintenance in the deployment stages of the software lifecycle.	3
1.4.6		Apply the knowledge of software project management to organize and produce software products.	3
1.4.7		Apply knowledge of artificial intelligence and machine learning to solve problems in the process of operating and developing software products	3
1.4.8		Apply knowledge of information safety and security to solve related problems in the process of operating and developing software products.	3
1.4.9		Apply knowledge and technology to design and develop web applications.	3
1.4.10		Apply Java technologies to solve problems in the development of software products	3
1.4.11		Apply and exploit Microsoft technology proficiently to solve problems in the process of developing software products	3
1.4.12		Apply application development for mobile devices to solve problems in the process of developing software applications for mobile devices	3
1.5	*L5*	*Synthesize specialized knowledge of Software Engineering for future career development*	*4*
1.5.1		Synthesize and propose solutions to handle big data systems effectively applying machine learning and artificial intelligence tools	4
1.5.2		Synthesize tools to find vulnerabilities, propose information security solutions for information technology systems	4
1.5.3		Synthesize and exploit Microsoft, Java and open source technology platforms to develop software projects.	4
2		***Personal and professional skills and attributes***	

Notation PLO		PLOs of SE programme	Proficiency level
2.1	*L6*	*Apply critical thinking and problem-solving skills in building and consulting software application solution*	*3*
2.1.1		Define and state a software problem	3
2.1.2		Modeling software systems	3
2.1.3		Estimate and analyze software projects	3
2.1.4		consulte solutions software application	3
2.2	*L7*	*Apply systematical thinking in organization and deployment of software systems*	*3*
2.2.1		Think globally and holistically about the system	3
2.2.2		Perceive the interactions between components and arise in the system	2
2.2.3		Sort sequence of Prioritize and focus	3
2.2.4		Analyze the different factors in the way of problem solving.	3
2.3	*L8*	*Use creativity, critical thinking and self-confidence, ability to work independently in software project management*	*3*
2.3.1		Demonstrate confidence, willingness and ability to work independently	3
2.3.2		Apply creative thinking in software project management	3
2.3.3		Apply Critical thinking in software project management	3
2.3.4		Adapt to a new environment	3
2.3.5		Apply project management knowledge	3
2.4	*L9*	*Apply professional ethics in implementation and deployment of software systems*	*3*
2.4.1		Recognize and behave in accordance with ethical principles and standards.	2
2.4.2		Define roles, responsibilities and professional behavior in implementing the system	3
2.4.3		Apply information security skills to systems	3
2.4.4		Show honesty and credibility in work	3
3		**Communication and teamwork skills**	
3.1	*L10*	*Use teamwork skills effectively*	*3*
3.1.1		Identify the process of forming and working principles of the group	3

Notation PLO		PLOs of SE programme	Proficiency level
3.1.2		Apply motivation, plan activities, monitor, adjust and evaluate the group's performance results.	3
3.1.3		Apply skills of personal development and team development	3
3.2	*L11*	*Practice communication skills in idea explanation, representation, review, and developing communication relationships in professional life*	*3*
3.2.1		Apply communication skills, from forming coherent and logical ideas to supporting evidence, the ability to present, listen to and respect others' opinions.	3
3.2.2		Edit scripts and exploiting supporting tools in presentation.	3
3.2.3		Identify and suggest solutions to resolve conflicts in negotiations.	2
3.2.4		Build relationships with friends, colleagues and social networks	3
4		**Competencies of conceiving, designing, implementing, and operating application software in the enterprise and societal context**	
4.1	*L12*	*Recognize the enterprise, organization, and societal context*	*3*
4.1.1		Analyze the impact of software industry on society	3
4.1.2		Apply government regulations in the field of information technology and software sector	3
4.1.3		Recognized of social, economic and environmental issues in the field of information technolog	2
4.1.4		Understand the culture of the organization and the business	2
4.1.5		Analyze the goals, strategies and regulations of organizations and businesses on information technology investment	3
4.1.6		Apply start-up skills to develop product ideas, services, business plans and form a software-assisted business	3
4.2	*L13*	*Conceive ideas*	*3*
4.2.1		Identify project objectives, collect requirements based on technical methods and tools to collect requirements classification.	3
4.2.2		Analyze project feasibility and suitability.	3
4.2.3		Specify the project's objectives and requirements	3
4.3	*L14*	*Design systems*	*3*
4.3.1		Apply knowledge and skills in designing application software solutions	3

Notation PLO		PLOs of SE programme	Proficiency level
4.3.2		Apply processes, methods, and tools to software development	3
4.3.3		Design software application systems suitable for different goals: speed, cost, maintenance, evolution...	3
4.3.4		Design the architecture and components of the system (functions, databases, ...)	3
4.4	*L15*	*Deploy software projects (Elective)*	*3*
4.4.1		Apply processes, methods, tools, and environments to deploy software systems.	3
4.4.2		Apply knowledge and techniques to implement software system design.	3
4.4.3		Apply knowledge to integrate system components and functions during deployment.	3
4.5	*L16*	*Test, operate, and maintain software*	*3*
4.5.1		Apply product verification processes and methods.	3
4.5.2		Verify requirements, components or the entire system	3
4.5.3		Apply knowledge, system organization and operation skills based on knowledge of operating procedures, system capabilities, relationships, costs, quality and safety.	3
4.5.4		Develop documentation and user training for the product.	3
4.5.5		Apply product maintenance processes	3
4.5.6		Identify problems, unreasonable details to indicate possible improvements based on the operation of the system.	2
4.5.7		Identify problems, situations, and residual value when discarding or dismantling the system	2

4. The volume of knowledge of the whole course:

120 credits for bachelor and 150 credits for engineering (excluding Physical Education, Defense Education and extracurricular subjects)…

5. Mass distribution of knowledge blocks

Name	No. of credits		
	Total	Obligatory	Elective
General curriculum	32	32	0
Political theory		11	11
English		12	12

Math and Natural courses		6	6
Informatics		3	3
Professional knowledge block	88	79	9
Interdisciplinary foundational	30	30	
Disciplinary foundational	15	15	
Specialized	31	22	9
Graduation internships	5	3	
Graduation project	7	7	
Additional knowledge for engineering degree	30		
Intensive courses	25		
Engineer Internship	5		
Block of knowledge of physical education and defense education	(None)		
Physical Education 1			
Physical Education 2			
Defense Education			
Extracurricular	(None)		

6. Admission Criteria

According to the general regulations of the Ministry of Education and Training, Thai Nguyen University and the University of Information and Communication Technology.

7. Training process, graduation conditions

7.1. Training method

According to the credit system (Regulated by the Ministry of Education and Training).

7.2. Organize classes

According to the current credit training regulations of the Ministry of Education and Training, Thai Nguyen University, University of Information and Communication Technology.

7.3. Graduation conditions

Apply university training regulations according to the credit system of the Ministry of Education and Training, Thai Nguyen University, University of Information and Communication Technology.

8. Assessment scale

Evaluation according to the training scale of the credit system is prescribed by the Ministry of Education and Training.

9. Career prospects

Job positions:

  - Application development engineer.

  - Engineer: Software production process; Software system; Software Testing; Software quality;

  - Administrator: Software and IT project management; Database systems.

  - Expert: Business Analyst; Analysis and design of information systems; Data analysis and design.

  - Lecturers and researchers in the field of software engineering and information technology; can continue to study intensively at the graduate level.

Job positions are available at:

  - Field: Software industry; Digital content industry; Game Industry.

  - Consulting companies and system building solutions.

  - Companies dealing in software products and information technology.

  - Software and IT services.

10. Teaching, learning and assessment methods

Trainers participating in the training program are regularly trained to approach new teaching methods; cooperate with businesses in specialized fields to enhance the reality for lecturers and students. In which, the lecturers are focused on practical applicability and focus on students. The assessment method is carried out on the basis of the requirements in the output standards of the training program of each module and according to the accreditation standards issued by the Ministry of Education and Training, towards regional and international standards. like AUN-QA.

11. Programma Content (Name and volume of required courses)

No.	Courses name	Number of Credits	Practice credits	Semester	1 / 15	2 / 17	3 / 17	4 / 14	5 / 17	6 / 16	7 / 15	8 / 12	9 / 15	10 / 15	Course TQ/HT/SH (0)/(2)/(1)	Core Courses (*)
	General knowledge category (Total credits: 32 credits / 12 Course)															
1	English 1	3		1	3											
2	English 2	3		2		3									English 1(1)	
3	English 3	3		3			3								English 2(2)	
4	English 4	3		4				3							English 3(2)	
5	Scientific socialism	2		3			2								Marxist-Lenninist political philosophy (2)	
6	Marxist-Lenninist political philosophy	2		2		2									Marxist – Leninist Philosophy (2)	

No.	Courses name	Number of Credits	Practice credits	Semester	1 (15)	2 (17)	3 (17)	4 (14)	5 (17)	6 (16)	7 (15)	8 (12)	9 (15)	10 (15)	Course TQ/HT/SH (0)/(2)/(1)	Core Courses (*)
7	History of Vietnamese Communist Party	2		4				2							Scientific socialism (2)	
8	Marxist – Leninist Philosophy	3		1	3											
9	Ho Chi Minh's Ideology	2		5					2						History of Vietnamese Communist Party (2)	
10	General Informatics	3	1	1	3											
11	Physics	2		1	2											
12	Advanced Mathematics	4		1	4											
Interdisciplinary foundational knowledge category (Total credits: 30 credits / 10 Course)																
13	Discrete Mathematics	3		2		3									Advanced Mathematics (2)	
14	Statistics-Probability	3		2		3									Advanced Mathematics (2)	
15	Computer Network	3	1	3			3								General Informatics (2)	
16	Computer Architecture and Operating System	3		2		3									General Informatics (2)	
17	System design analysis	3		4				3							Database (2)	*
18	Database	3	0.5	3			3									
19	Introduction to Software Engineering	3		4				3							General Informatics (2)	*
20	Programming techniques	3	1	2		3									General Informatics (2)	*
21	Data structure and algorithms	3	1	3			3								General Informatics (2)	*
22	Object-Oriented Programming	3	1	3			3								General Informatics (2) Programming techniques (2)	*
Disciplinary foundational knowledge category (Total credits: 15 credits / 5 Course)																

No.	Courses name	Number of Credits	Practice credits	Semester	1 / 15	2 / 17	3 / 17	4 / 14	5 / 17	6 / 16	7 / 15	8 / 12	9 / 15	10 / 15	Course TQ/HT/SH (0)/(2)/(1)	Core Courses (*)
23	Analyze-design algorithms	3		5					3						Data structure and algorithms (2)	
24	.NET Technology	3	1	5					3						Object-Oriented Programming (2)	
25	Web design	3	1	5					3						Introduction to Software Engineering (2)	
26	Information Security	3		4				3								
27	Artificial Intelligence	3		5					3							
Specialized knowledge category (Total credits: 31 credits / 10 Course. Of which: 22 credits/7 Course; Elective: 9 credits/3 Course)																
28	Information technology project management	3		6						3					Introduction to Software Engineering (2)	
29	Software requirements analysis and management	3		6						3					Introduction to Software Engineering (2)	
30	Software Architecture and Design	3		7							3				Object-Oriented Programming (2)	
31	Software testing and quality assurance	3	1	6						3					Introduction to Software Engineering (2)	
32	Object oriented software development methodology	3	1	6						3					Object-Oriented Programming (2) Introduction to Software Engineering (2)	
33	Java programming	4	1	6						4					Object-Oriented Programming (0)	
34	Software operation and maintenance	3		7							3				Object-Oriented Programming (2)	
35	Elective subject 1	3	1	7							3					
36	Elective subject 2	3		7							3					
37	Elective subject 3	3	1	7							3					
List of electives subject (9 credits)																

No.	Courses name	Number of Credits	Practice credits	Semester	1 / 15	2 / 17	3 / 17	4 / 14	5 / 17	6 / 16	7 / 15	8 / 12	9 / 15	10 / 15	Course TQ/HT/SH (0)/(2)/(1)	Core Courses (*)
	Elective subject 1															
38	Mobile programming	3	1	7											Object-Oriented Programming (0)	
39	Electronic Commerce	3	1	7	I	I	I	I	I	I	I	I	I	I	Introduction to Software Engineering (2) Web design (2)	I
40	XML and application	3	1	7											Web design (0)	
	Elective subject 2															
41	Cloud Computing	3		7												
42	Programming Methodology	3		7											Introduction to Software Engineering (2)	
43	Design samples	3		7											Object oriented software development methodology (2)	
	Elective subject 3															
44	ASP.Net technology	3	1	7											.NET Technology (0)	
45	Open Source Software Development	3	1	7											Introduction to Software Engineering (2)	
46	Database Management System	3	1	5											Database (2)	
Internships, graduation projects (12 credits)																
47	Graduation internships	5		8								5				
48	Graduation project	7		8								7			Graduation internships (0)	
List of courses to replace the graduation projects (7 credits)																
49	Embedded Application Development	3	1	8											Graduation internships (0)	
50	Software development project	4	1	8												

No.	Courses name	Number of Credits	Practice credits	Semester	1 (15)	2 (17)	3 (17)	4 (14)	5 (17)	6 (16)	7 (15)	8 (12)	9 (15)	10 (15)	Course TQ/HT/SH (0)/(2)/(1)	Core Courses (*)
Total accumulated credits for bachelor's training program — **120**																
List of Engineering Degree Courses (30 credits)																
51	Project on emergency response and handling information security incidents	5		9									5		Graduation project (2)	
52	Knowledge Engineering and Machine learning project	5		9									5		Graduation project (2)	
53	Microsoft technology software development projects	5		9									5		Graduation project (2)	
54	Java technology software development projects	5		10										5	Graduation project (2)	
55	Open source software development project	5		10										5	Graduation project (2)	
56	Engineering internship	5		10										5		
Total accumulated credits of the Engineer training program	**150**															

Note:

- TQ(0) = Prerequisite; SH(1)= Parallel ; HT(2) = Learn first.

- Physical Education module 1 is placed in term 1, Physical Education 2 is placed in semester 2.

- Course of National Defense - Security Education according to the schedule of Thai Nguyen University.

12. Course abstract

No.	Course code	Courses	Number of credits	Description

		1. General knowledge block		
1	ENG131	English 1	3	The module equips students with basic grammar knowledge such as how to use the verb to be, singular and plural nouns, adverbs of frequency, simple present tense and provides related vocabulary. to topics such as personal information, family, everyday objects, colors, how to tell the time, free time, etc. In addition, students are trained to evenly develop four skills of listening, speaking, reading and writing, especially basic communication skills. At the same time, asymptotically the standard test format B1
2	ENG132	English 2	3	The module equips students with basic grammar knowledge such as countable nouns, uncountable nouns, simple past tense, present continuous tense, comparative levels of adjectives and equipped with word system. Vocabulary related to Food, Money, Journeys and Appearance topics. In addition, students are trained to evenly develop the four skills of listening, speaking, reading, and writing and at the same time approaching the standard test format B1 output.
3	ENG136	English 3	3	The module equips students with basic grammar knowledge such as how to use the near future tense, present perfect tense, should/shouldn't, have to/don't have to, can/can't, will/won't and equipped with a vocabulary system related to the topics of Film and the Arts, Science, Tourism and the Earth. In addition, the subject continues to help students become familiar with and competently approach diverse communication situations and evenly develop intermediate-level listening, speaking, reading and writing skills. Besided, students have access to exercise formats according to the standard test format of foreign language ability equivalent to level 3.
4	ENG135	English 4	3	The course equips with grammar knowledge at A2+ level and approaching B1 level (Level 3) such as conditional sentences of type 1, past continuous, passive sentences…. At the same time, it provides a vocabulary system related to the topics of means of transport, health, tourism, technology... Besides, the subject continues to help students familiarize themselves with and approach competently with other topics. diverse communication situations and uniform development of skills in listening, speaking, reading and writing at the pre-intermediate level (B1). In addition, students are reviewed with exercise formats according to the standard test format of foreign language ability equivalent to level 3 (B1).
5	STS121	Science socialism	2	The module provides learners with basic knowledge about the theory of scientific socialism: about the socialist regime that our Party has chosen; on the path, measures and methods of building the socialist regime; thereby, equipping students with a solid political ideology and right actions in accordance with ethical standards, strengthening confidence in the leadership of the Party and management of the State.
6	MPE121	Marxist-Leninist political economy	2	Marxist-Leninist political economy is an economic science that equips students with basic and core knowledge of political economy in the development context of the country and the world today. On that basis, it helps students to form

				thinking, analytical skills, assessment and identification of the nature of economic relations in the country's socio-economic development. The subject contributes to building social responsibility for students suitable to their job position and life after graduation; thereby, forming the school, the Marxist-Leninist ideology
7	PHV121	History of the Communist Party of Vietnam	2	Provides systematic, basic knowledge about the birth of the Communist Party of Vietnam (1920-1930), the leadership of the Communist Party of Vietnam for the Vietnamese revolution during the period of struggle for political power. authority (1930-1945), in two resistance wars against French colonialism and American imperialism (1945-1975), in the cause of national construction and defense during the country's transition to socialism, conducting the doi moi (1975-2018). Thereby, equipping with scientific thinking methods on history, skills, selection of research materials, learning subjects and the ability to apply historical awareness to practical work, criticism of misconceptions. contrary to the history of the Party. At the same time,: to build students a sense of respect for objective truth, to raise pride and belief in the Party's ideals.
8	MPP131	Marxist-Leninist philosophy	3	The subject aims to provide learners with an understanding of the most general principles and laws of nature, society, and thought. On the basis of that knowledge, learners can properly perceive practical problems from the worldview and methodological stance of Dialectical Materialism and Historical Materialism; Develop self-directed thinking and teamwork, critical thinking, and self-responsibility skills.
9	HCM121	Ho Chi Minh Thought	2	The module helps students understand the basic knowledge about the origin, process of formation and development of Ho Chi Minh thought; the basic contents of Ho Chi Minh's thought on the basic issues of the Vietnamese revolution in the people's democratic national revolution and in the socialist revolution. Thereby fostering, consolidating and strengthening the ideals, beliefs and determination to make efforts to contribute to the construction and defense of the Fatherland for students.
10	GIS131	General Informatics	3	The General Informatics module equips students with basic knowledge about computers and the Internet, hardware and software, understanding the basic operation of the Windows operating system, shopping for computers, confident safe and effective computer programming and exploitation. After completing this subject, learners can use computers proficiently in tasks such as drafting documents, using electronic spreadsheets, presentation software, and using the Internet. presentation tools, exploitation and use of other application software. Through this very basic knowledge, students can self-study and apply this knowledge to each specific job later.

11	PHY121	Physics	2	The course consists of two main parts: Electricity and Magnetism. The General Physics module provides basic knowledge about: Currents, Ohm's law with electric circuits, magnetic fields caused by constant currents, electromagnetic induction phenomena, electromagnetic fields and electromagnetic materials. These are the basic knowledge of physics, helping students to continue studying the modules in the basic and specialized fields.
12	MAT140	Advanced math	4	The module provides students with basic knowledge about matrices, determinants, systems of linear equations, vector spaces; linear mapping and quadratic form; partial derivatives and full differentials; extrema of multivariable function; the theory of series of numbers, series of functions; differential equations and some applications of advanced mathematics in engineering. These are the basic knowledge of Advanced Mathematics, serving as the foundation for students to continue studying in the basic and specialized courses.
2. Basic knowledge of information technology				
13	DEM231	Discrete math	3	The module equips students with knowledge and skills to represent and process information in computers, which focuses mainly on the study of discrete objects and processing algorithms on this object. in order to help students have the foundation knowledge to access the knowledge of other modules in the training program and develop their algorithmic and programming skills when solving real-world problems.
14	PRS221	Probability statistics	3	The course provides basic knowledge about probability, random quantities, rules of probability distribution, sample theory, estimation, statistical hypothesis testing and regression analysis.
15	CON131	Internet	3	The course helps students to familiarize themselves with the basic knowledge of computer networks, including knowledge of network infrastructure, protocols, systems, and software. Students will be equipped with basic skills to build a basic home computer network and serve other related learning content.
16	CAS131	Computer Architecture and Operating System	3	The course covers the most basic knowledge of computer architecture and understanding of the roles and activities of computer components. - Students learn and practice skills in installing and configuring basic features on Windows, and at the same time exploiting available tools thoroughly to optimize and secure and maintain the operating system. . With the Linux operating system, students learn and practice basic system administration skills such as understanding the file system organization structure, user management, file and directory management, software packages and practice basic programming on the bash shell
17	ASD232	System analysis and design	3	The course aims to provide students with basic knowledge as a foundation for structured and object-oriented systems analysis and design approaches. During the learning process, students are used to do large exercises with the following contents: survey, analysis and system design. After completing this course, students will be able to apply the knowledge they have learned to analyze and design a real system.

18	BAD131	Database	3	The course aims to provide students with basic knowledge about databases, understand the meaning and role of databases, knowledge about relational databases, relational algebra operations, Standardize databases, master the knowledge of SQL language. Using SQL Server as a tool to install, manipulate, and query data. As a premise for the next courses in database analysis, design and implementation
19	ISE131	Introduction Software Technology	3	The course provides students with basic knowledge related to key subjects in the field of software engineering such as software development processes, tools and software development environments... can build software systematically and methodically
20	PTE231	Programming techniques	3	The subject of Programming Techniques aims to provide students with basic knowledge of structured programming through the C programming language. The main contents include: Concept of algorithms and algorithmic representation language. ; The concept of programming languages; The concept of data types; Overview of the C programming language; Data types in C; Control structures; How to design and use functions in C; Some data structures in C. This subject provides background knowledge, creating a premise for students to absorb other subjects in the training program.
21	DAS231	Data structures and algorithms	3	The module provides students with knowledge of data models along with methods of representing and implementing them such as list, stack, queue, tree, binary search tree, graph, and table models. and dictionary. At the same time, the course provides some basic algorithms such as searching and sorting along with algorithms on each of the above data models. From there, students have the ability to analyze and choose the representation structure and algorithm for a specific problem. In particular, this is also a subject that develops programming thinking and algorithmic thinking
22	OOP231	Object Oriented Programming	3	This course introduces the fundamentals of object-oriented programming, important concepts and principles of this programming method: such as data abstraction, encapsulation, inheritance, and polymorphism. In addition, students will be equipped with other knowledge such as error handling techniques (exceptions), generating and handling events, memory management and using some built-in data structures programming language to write application programs according to object-oriented programming method.
3. Basic knowledge of software engineering				
23	AAA131	Algorithm analysis and design	3	Equiping students with basic knowledge of algorithms, principles and methods of evaluating the complexity of algorithms, basic techniques for designing and building algorithms. From there, students have the ability to analyze, evaluate and choose the most suitable algorithm to solve the problem posed

24	TEC131	Technology .Net	3	This module provides basic knowledge about C# programming language, developing object-oriented programming capabilities on the basis of .NET programming libraries, progressing to building complete applications. Most of the course time is devoted to content on object-oriented programming, manipulating databases with the ADO.NET library, and building web applications using MVC architecture. The course also introduces some advanced technologies such as WPF, LINQ, Entity Framework...
25	WED331	Web designing	3	Providing knowledge of principles of interface design for web applications. Provide web interface design skills based on images, Css, Html, JavaScript and front-end programming. After completing this course, learners can join the front-end project team
26	SIF131	Safety information	3	The course provides students with basic knowledge in the field of information security such as: the role of data, the need to protect personal data, privacy, virus and malware issues. In addition, the course content also introduces information technology law, information security law and cyber security law, these are important legal policies, necessary for Internet users and working in the Internet. digital environment. In addition, the course also provides learners with knowledge to self-prevent attacks on the network environment, to be more conscious in using social networks and digital devices.
27	ARI231	Artificial intelligence	3	The course aims to provide students with core concepts and knowledge about algorithms that use knowledge to solve problems as intelligently as humans. The course provides knowledge about guided knowledge search algorithms, representation methods, and knowledge reasoning. Students learn skills to analyze problems using knowledge to solve, choose appropriate smart algorithms and build smart applications to solve problems.
4. Specialized knowledge				
28	ITP331	IT project management	3	The module provides basic project concepts, especially information technology projects. Implement, execute and control the project plan. Manage project scheduling, cost, quality, resources, risk, and project integration management. In addition, the course also introduces some supporting software for project management. In addition, the module also provides students with skills in document retrieval, team management, effective project management and control, as well as professional sense when participating in Information Technology projects.
29	AMS431	Software requirements analysis and management	3	The course provides students with the knowledge and skills to reason, organize, document, and track all requirements. Requirements management helps to verify and validate the software system, manage any changes so that the state of the system can be analyzed effectively, especially for large and complex software systems.

30	KTV332	Software architecture and design	3	This course introduces the concepts and theoretical foundations of software architecture. Based on that, aspects of software architecture are introduced in both theoretical, foundational, and practical perspectives. The course also outlines methods of building, documenting, evaluating software architecture, and the importance of architecture in ensuring that the non-functional requirements of the system are met. Next, the systematic application of the classic and some modern architectures, the advantages and disadvantages of each method, and with what requirements and situations, which architectural model should be chosen accordingly.
31	STA131	Software testing and quality assurance	3	This course provides students with an overview of the software testing phase; grasp the rules governing the testing process; testing support tools; test status, test acceptance. In addition, the course also provides in-depth knowledge of software quality control in both the development and operation of the software; Current software standards apply in the software life cycle
32	OSE131	Object-oriented software development methodology	3	The course equips students with knowledges, methods and skills to capture requirements, specify, analyze and design, install and deploy an object-oriented software system, using Unified Modeling Language
33	JAR141	Java Application Programming	4	This course aims to consolidate knowledge about object-oriented programming and core java language, Equip advanced Java technologies in building applications using graphical interfaces, database connection and programming, network, multithreading in programming. The course delves into some of the fundamental skills and technologies of Java including frameworks (such as Java Swing); data processing technologies with Java (such as Java IO/NIO; Java DataBase Connectivity (JDBC)), and some common technology architectures that allow different types of applications to be built in Java (such as JavaServer Pages (JSP), Enterprise JavaBeans (EJB), Java Web Service)
34	BTP325	Software operation and maintenance	3	The course plays an important role in the software development process. The course helps students to have a basic knowledge of the software operation and maintenance phase. Through the methods, techniques, and tools at each stage introduced in the course, student will apply to solve specific issues of release, actual deployment, operation and maintenance in the process, software development, while recognizing the important role the design phase plays in the software development, testing, and maintenance phases
5. Selective coures/modules				
35	***Selective courses 1***			

	LTT332	Mobile Programming	3	This course provides knowledge of mobile development environments. Students have access to basic and advanced knowledge of Android platform: building GUI applications, programming with SQLLite database, designing Web Service applications..
	ELC331	E-commerce	3	This course provides students with foundational knowledge of e-commerce, business models, profit models, business processes; identify opportunities of domestic and international e-commerce, provide basic knowledge of e-commerce infrastructure, knowledge of selling on website, knowledge of e-commerce technology, secure e-commerce, payment system in e-commerce. In addition, the course also provides methods to integrate e-commerce planning in business, e-commerce website development strategies, e-commerce project management, application of e-commerce. for businesses or individuals who want to engage in online business
	XTA332	XML and application	3	Student can learn the basics of XML, definition, and control to create XML documents. Use the XSLT formatting language to perform the display of documents or dynamically transform the XML document structure. Query method to get data from XML document. XML document processing models: DOM, SAX
36	*Selective courses 2*			
	CCP421	Cloud computing	3	The course presents, first of all, the basic and fundamental concepts of cloud computing (ĐTĐM), its important technical characteristics and possible application possibilities. Then, the module presents knowledge about basic models of cloud computing, algorithms and large solutions to control virtual server systems, current cloud systems such as Azure, GAE, IBM, Amazon, etc.
	PRM331	Programming methodology	3	The course provides basic programming principles, level-based program implementation methods. From there, creating a foundation for writing good programs, clarifying the basic problem posed for programming theory is "how to master the complexity of programming operations".
	MTK231 DES131	Pattern design	3	The course introduces some groups of design patterns such as: Initialization Patterns, Structure Patterns, and Operational Patterns. These patterns are applied during the software analysis phase for the purpose of helping to build better scalable, legacy, and evolving software.
37	*Selective courses 3*			
	ASP432	ASP.Net Technology	3	This course provides students with an overview of web technology, programming knowledge and web development with the .NET platform from basic to advanced. In addition, the module also provides skills for students to build a complete ASP.NET web application, focusing on practical applications that students can apply in their work.

	OSD331	Open source software development	3	Equip students with basic knowledge about open source software, how to apply open source software in website design. The knowledge of basic languages to build and develop websites based on open source software. Help students have web programming skills, and apply web programming skills to build websites with open source content management systems
	DMS231	Database management system	3	This course provides basic knowledge about MS SQL server database management system such as: presenting concepts, roles and functions; create a relational database and related objects in the relational database; query on the database; define and use Store Procedure, Function and Triger; create and manage users
6. Internship/Graduation Project				
38	GRP451	Internship	5	A course for students who have accumulated enough credits or more. Students can perform project at units of the school, organizations, agencies and businesses that have needs for information systems and software development. Students analyze a real problem or a research problem; Proposing solutions to solve the problem posed; Learn and grasp the theoretical problems as well as the necessary technologies for solving problems…
39	GRA975	Graduation project	7	Graduation theses are applied research topics to solve a specific technical technical problem related to the field of study chosen by the student or suggested by the instructor. The graduation project aims to equip students with skills to apply learned knowledge to solve a specific problem in practice. Content includes synthesizing learned knowledge as a basis for problem solving; analysis and selection of options and ways to solve problems; evaluate the results and defend the results made
7. List of courses for engineering degrees				
40	PIR251	Project on Emergency Response and Handling of Safety Incidents	5	The course provides professional skills to solve problems in the field of information security
41	KEM251	Knowledge Technology and Machine Learning Project	5	The course helps students familiarize themselves with the operation of artificial intelligence application systems, exploiting big data in practice and in businesses. Students are organized to work directly at institutions with big data processing systems and artificial intelligence applications.
42	MTS251	Microsoft technology software development project	5	Equip knowledge about project process, new Microsoft technology and project implementation
43	JTS251	Java technology software development project	5	Equip knowledge about project process, new Java technology and project implementation
44	OSS251	Open - source software development project	5	Equip knowledge about project process, new open - source technology and project implementation

45	TKS251	Engineer Internship	5	Synthesize knowledge and skills to solve IT projects effectively
Total			**150**	

13. Facilities for training

13.1. Workshops, laboratories and important laboratory equipment systems

- Samsung lab

- Computer room

- Data science lab

13.2. Libraries, Websites

- Library of the University of Information and Communication Technology

- List of websites (see detailed outline set)

14. Instructions for implementing the program

14.1 The training program is implemented according to the university training regulations of the regular system of the current credit system of the Ministry of Education and Training and of the University of Information and Communication Technology, Thai Nguyen University.

Scheduled hours are as follows:

1 Credit = 15 periods of theory teaching or class discussion

=30 hours of experimentation or practice

= 45 hours of self-study

= 45 - 90 hours of internship at the facility.

= 45 - 60 hours of project implementation, graduation thesis. Course hours are multiples of 15.

14.2 The foreign language output standards are decided by the School's Science and Training Council. During the study period, the School will control the development of students' foreign language proficiency over each academic year to decide the number of credits of subjects in the semester that students are allowed to register. Students can study on their own or register for a foreign language development program according to the University's project.

VICE RECTOR	HEAD OF IT FACULTY
Ph.D Do Dinh Cuong	**Ph.D Nguyen Hai Minh**

III. CONTRIBUTION MATRIX/CORRELATION MATRIX OF THE COURSE TO THE PROGRAMME LEARNING OUTCOMES

(Show the contribution of each module in achieving the output standards of the training program)

(Decision No. 566/QĐ-ĐHCNTT&TT dated August 30th, 2021 of the Rector of the University of Information and Communication Technology)

PLOs / Courses (List of courses in the programme by semester)	1					2				3		4				
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	4.1	4.2	4.3	4.4	4.5
Semester 1																
English 1		3								3	3					
Marxist – Leninist Philosophy	3							3	3		3					
General Informatics			3													
Physics	3															
Advanced Mathematics	3												2			
Semester 2																
English 2		3								3	3					
Marxist-Lenninist political philosophy	3							3	3							
Discrete Mathematics			2											3		
Statistics-Probability	3												2			
Computer Architecture and Operating System			3													
Programming techniques			3												2	
Semester 3																
English 3		3								3	3					
Scientific socialism	3							3	3							
Computer Network			3											2		
Database			3											2		
Data structure and algorithms			3											3		
Object-Oriented Programming			3												2	
Semester 4																
English 4		3								3	3					
History of Vietnamese Communist Party	3							3	3							
System design analysis			3			3	3							3		
Introduction to Software Engineering			3	3						2			2			
Information Security			3					3	3							
Semester 5																
Ho Chi Minh's Ideology	3							3	3							

Courses (List of courses in the programme by semester)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	4.1	4.2	4.3	4.4	4.5
PLOs (group)	1					2				3		4				
Analyze-design algorithms			3	3		3							3			
.NET Technology				**2**							**3**				**3**	
Web design				3											3	
Artificial Intelligence				3		3								3		
Semester 6																
Information technology project management				3				3		3	3					
Software requirements analysis and management				3		3				3	3	3	3			
Software testing and quality assurance				3						3	3					2
Object oriented software development methodology				3						3	3			3		
Java programming				3						3	3				3	
Semester 7																
Software Architecture and Design				3			3			3	3		3	3		
Software operation and maintenance				3						3	3					3
Elective subject 1																
Mobile programming				3						3	3				3	
Electronic Commerce				3						3	3				3	
XML and application				3						3	3				3	
Elective subject2																
Cloud Computing				3						3	3					
Programming Methodology				3						3	3					
Design samples				3						3	3			3		
Elective subject3																
ASP.Net technology				3						3	3				3	
Open Source Software Development				3						3	3				3	
Database Management System				3						3	3					
Semester 8																
Graduation internships					3		3				3	3	4	3	3	
Graduation project					3		3				3		4	4	4	4
Semester 9																
Project on emergency response and handling information security incidents					3	3							3	3	4	4
Knowledge Engineering and Machine learning project					3	3							3	3	4	4

PLOs	1					2				3		4				
Courses (List of courses in the programme by semester)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	4.1	4.2	4.3	4.4	4.5
Microsoft technology software development projects				3	3								3	3	4	4
Semester 10																
Java technology software development projects				3	3								3	3	4	4
Open source software development project				3	3											
Engineering internship				3						3	3	3	3	3	4	4

<div style="display:flex">

VICE RECTOR

Ph.D Do Dinh Cuong

HEAD OF IT FACULTY

Ph.D Nguyen Hai Minh

</div>