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**THAI NGUYEN UNIVERSITY
UNIVERSITY OF INFORMATION AND COMMUNICATION
TECHNOLOGY
FACULTY OF INFORMATION TECHNOLOGY**

PROGRAM DESCRIPTION FOR UNIVERSITY DEGREE

I. BASIC INFORMATION ABOUT THE TRAINING PROGRAM

1. Name of training:

+ Vietnamese name: Công nghệ thông tin.

+ English name: Information Technology

2. Training code: 7480201

3. Type of training: Formal

4. Diploma name: Information technology engineer.

5. Place of training and certification: University of Information and Communication Technology - Thai Nguyen University

II. DESCRIPTION OF TRAINING PROGRAM

1. Training Objectives

1.1. General objective

Training engineers so that students have comprehensive professional knowledge, master the principles and laws of nature-society, have basic practical skills, can work independently and creatively, and solve problems in the information technology industry.

1.2. Specific objectives.

- Understand and apply knowledge of the Basic Principles of Marxism-Leninism, Ho Chi Minh Thought, Revolutionary Way of the Communist Party of Vietnam. Understand Vietnamese Law and National Security; Have the knowledge and ability to train themselves physically.
- Ability to apply basic mathematical and scientific knowledge to study and research in the field of information technology.
- Mastering techniques, languages, and programming tools, knowing how to analyze and design algorithms.

- Master the knowledge of computer networks, information safety, network security, and operation and maintenance of information systems.
- Master the knowledge of databases and database management systems.
- Master the information system analysis, design, database construction, system integration, and software development techniques.
- Master the knowledge of machine learning and big data to create intelligent software products.
- Attain foreign language level 3 in the 6-level foreign language competency framework prescribed by the Ministry of Education and Training, and have basic knowledge of foreign languages in information technology.
- Strong presentation, communication, and teamwork skills.

2. Program learning outcomes standards

The program learning outcomes of the Information Technology Training Program issued under Decision No. 690/QĐ-ĐHCNTT&TT expressed through the following contents (encoded: L1 ÷ L14):

Abbreviation PLO	Program learning outcomes standards (PLOs)	Capacity scale
<i>L1</i>	Applying knowledge of natural sciences to solve scientific and technical problems in the Information Technology industry and can study at high levels.	3
<i>L2</i>	Understand general educational knowledge of the Theory of Marxism-Leninism and Ho Chi Minh Thought, the revolutionary line of the Communist Party of Vietnam, the Party's policy and law of the State, national security room.	2
<i>L3</i>	Attain foreign language ability (English) level 3/6 Vietnam's Foreign Language Competency Framework; specialized English skills.	3
<i>L4</i>	Apply data structure models and programming techniques to build computer software.	3
<i>L5</i>	Understand the fundamentals of computer operating systems, computer networks, and programming platforms for software development.	2
<i>L6</i>	Apply basic knowledge of databases and database management systems in software development.	3
<i>L7</i>	Apply specialized knowledge to analyze, design and build management information systems, intelligent systems, data management and processing, multimedia data.	3
<i>L8</i>	Systematize application programming skills in software development platforms: Windows, web, mobile, and open-source applications.	4
<i>L9</i>	Applying knowledge of the operating principles of network devices, switching equipment, routing equipment, and communication media to design, configure, and manage network systems; Understanding knowledge of network security and authentication protocols to ensure network and system security.	3

Abbreviation PLO	Program learning outcomes standards (PLOs)	Capacity scale
L10	Applying learned knowledge to explore, research, and discover new knowledge in information technology.	3
L11	Applying machine learning and big data knowledge to create intelligent software products that meet market demands.	3
L12	Be aware of the context of businesses and organizations to deploy information technology applications in line with reality.	3
L13	Applying communication skills in presenting ideas, giving presentations, giving criticism, and working as a team in the implementation and deployment of information technology systems	3
L14	Apply machine learning fundamentals and pattern design principles in intelligent application development.	3

3. The mapping matrix between courses and learning outcomes of the training program.

ID	Course	PLO													
		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14
1.	English 1			x											
2.	Linear algebra	x													
3.	General law		x												
4.	General Information					x					x				
5.	General Physics	x													
6.	English 2			x											
7.	Analytics	x													
8.	Marxist-Leninist philosophy		x												
9.	English 3			x											
10.	Marxist-Leninist political economy		x												
11.	Probability Statistics		x									x			
12.	English 4			x											
13.	Science socialism		x												
14.	History of the Communist Party of Vietnam		x												

ID	Course	PLO													
		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14
15.	HCM's Thought		x												
16.	Soft skills											x		x	
Basic knowledge of information technology															
17.	Introduction to programming					x			x						
18.	Operating System					x								x	
19.	Computer architecture					x					x				
20.	Advanced Programming					x			x						
21.	Database						x	x							
22.	Object Oriented Programming					x		x							
23.	Discrete Math				x				x						
24.	Data structures and algorithms				x				x						
25.	Computer network					x			x	x					
26.	System design analysis						x	x							
27.	Numerical methods				x			x							
28.	Dot NET Technology					x			x					x	
29.	Software technology							x				x	x		
30.	Database management system						x	x				x			
31.	Java programming				x				x						
32.	Optional														
	ASP.NET Technology				x				x						
	Web Programming				x				x						
33.	Advanced computer network									x	x				
34.	Artificial intelligence							x				x			
Specialized knowledge block															
35.	Advanced Database Management System						x	x							

ID	Course	PLO													
		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14
36.	Multimedia Database							X				X			
37.	Distributed database							X				X			
38.	Expert System							X				X			
39.	Building information systems							X	X			X			
40.	Internet of things									X	X				
41.	Data mining							X				X			
42.	Big data analytics							X				X			
43.	Cloud computing									X	X				
44.	Neural networks and applications							X				X			
45.	Natural language processing							X				X			
Internship/Graduation Project															
<i>Required module</i>															
46.	Internship					X	X	X							
47.	Vocational internship							X	X	X	X				
48.	Graduation thesis										X	X	X	X	
List of specialized courses for engineering degrees															
<i>Required module</i>															
49.	Machine learning application development														X
50.	Game development														X
51.	Design pattern														X

4. Training time

5 years, including 10 semesters.

5. The volume of knowledge of the course

- The volume of knowledge of the course: 140 credits (excluding Physical Education, National defense – Security modules).

- Structure of the training program:

ID	Knowledge group	Credits
1	General knowledge	41
1.1	Political Science: 11 credits	
1.2	Natural/social sciences, informatics: + Mandatory: 18 + Elective: 0	
1.3	Foreign Language: 12	
2	Basic major knowledge + Mandatory: 48 + Elective: 3	51
3	Specialized knowledge + Mandatory: 22 + Elective: 0	29
4	Internship, Graduation Project + Mandatory: 20 + Elective: 0	20
Total		140
5	List of subjects in engineering degree + Mandatory: 10 + Optional: 0	10
Total (Engineering System)		151

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 (specified by the Board of Education and Training)

7.2. Class organization

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

7.3. Graduation Conditions

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

8. Point ladder

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

9. Career prospects

Job positions:

- Programmers, design analysts, builders, and system integrators at software companies.
- Consultants in building information systems, managing information systems, or administering networks at agencies and enterprises.
- Participating in teaching at Information Technology training schools and researchers at research institutes.

Job positions are available at:

- Software development companies and corporations
- Companies that provide integrated solutions.
- Companies that provide network and network security solutions.
- Management department and information technology department at companies, including companies operating in the technology and other fields such as banking, healthcare, education, entertainment, etc.

10. Teaching, learning and assessment methods

Approach and orientation of the training program:

- Taking learners as the center, Teachers are guides, providing students with references, theoretical bases, and problem-solving thinking methods and exploiting and using modern means to improve the quality of teaching and learning, vivid and intuitive teaching and learning.

- Learning and teaching in a positive, proactive way, associated with reality, high applicability.

- Guide students to think logically and scientifically in building learning plans and solving problems.

Specify the blocks of knowledge that students need to master, including:

- General knowledge of math and natural sciences: Linear algebra, analysis and statistical probability.

- General knowledge of sectoral and major foundations: data structures and algorithms; Internet; computer architecture; operating system;
- Basic knowledge of network systems, about network security: Computer networks, Advanced computer networks, Cloud computing, Internet of things.
- Basic and in-depth knowledge of Programming techniques and technologies: Java Programming, Dot NET Technology, ASP.NET Technology, Web Programming.
- Basic and in-depth knowledge of databases, database management systems, and building information systems: multimedia databases, distributed databases, database management systems, Advanced database management systems, and building information systems.
- Basic and in-depth knowledge of big data and data processing: Expert systems, Data mining, Big data analysis, Natural language processing, Neural networks, and applications

Linking partners and business cooperation to bring students closer to the reality of social needs; looking for many job opportunities to ensure student output; at the same time as a basis to adjust and standardize the training program towards high quality, close to the actual needs of businesses and society.

11. Description of the modules in the curriculum

ID	Course code	Course name	Credit	Description
1. General knowledge block				
1	ENG131	English 1	3	The course consists of 7 lessons with 7 basic grammar and vocabulary topics at the beginner level. Grammar topics in this module include: verb to be, article a, an, quantifier some, pronouns, countable and uncountable nouns, singular, plural, present simple, simple past, present continuous. These contents are associated with familiar vocabulary topics in daily life to help students have basic language knowledge and necessary vocabulary. In addition, students are trained to evenly develop four skills of listening, speaking, reading and writing, especially basic communication skills. At the end of the module, students can communicate at a simple level with the vocabulary and grammar materials provided in this module.

ID	Course code	Course name	Credit	Description
2	DST131	Linear algebra	3	Provides basic knowledge of linear algebra such as: Sets, maps and complex numbers, Matrix and determinant, System of linear equations, Vector space, Linear mapping and quadratic form
3	FOL121	General law	2	Equip with basic and important contents about the state and law as well as mention some basic branches of law in Vietnam today
4	GIS131	General Informatics	3	Equip for students with the most basic knowledge in informatics. Create conditions for students to apply manipulation and proficient use of computers. Specific contents include: Windows operating system; Word editing system; Electronic spreadsheet Excel; Build Powerpoint presentations.
5	VLD121	Physics	2	Equip with basic knowledge of General Physics of electricity and magnetism; understand physical phenomena in nature, practice calculation skills and solve basic physics problems
6	ENG132	English 2	3	The course consists of 7 lessons with 7 basic grammar and vocabulary topics at the beginner level. Grammar topics in this module include: present continuous, present perfect, near future, comparative level, article. These contents are associated with familiar vocabulary topics in daily life to help students have basic language knowledge and necessary vocabulary. In addition, students are trained to evenly develop the four skills of listening, speaking, reading and writing, especially basic communication skills. At the end of the module, students can communicate at a simple level with the vocabulary and grammar materials provided in this module.
7	GTT141	Analytics	4	Provide basic knowledge of analysis such as: Functions and limits of functions of one variable, Differential Calculus of Functions of One Variable, Integral Calculus of Functions of One Variable, Series of Numbers and Series of Functions; Functions of many variables, partial derivatives, full differentials and extremes of functions of many variables
8	MOL131	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.

ID	Course code	Course name	Credit	Description
9	ENG136	English 3	3	The course consists of 5 lessons with 5 basic grammar and vocabulary topics at intermediate level. Grammar topics in this module include: Present simple, simple past, present continuous, present perfect, past continuous, have to, can. These contents are associated with familiar vocabulary topics in daily life to help students have basic language knowledge and necessary vocabulary. In addition, students are trained to evenly develop four skills of listening, speaking, reading and writing, especially basic communication skills. At the end of the module, students can communicate at a simple level with the vocabulary and grammar materials provided in this module.
10	POE121	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
11	PRS221	Statistical probability	2	Equip for students with knowledge about: Basic concepts of probability, Probability formulas and its applications, Random quantity and its probability distribution laws, Sample theory and the problem of parameter estimation, Statistical hypothesis testing.
12	ENG135	English 4	3	The course consists of 5 lessons with 5 basic grammar and vocabulary topics at the Pre-intermediate level. Grammar topics in this module include: comparative level, will, might, may, real conditional, some, any, passive voice, present perfect tense, near future tense. These contents are associated with familiar vocabulary topics in daily life to help students have basic language knowledge and necessary vocabulary. In addition, students are trained to evenly develop the four skills of listening, speaking, reading and writing, especially basic communication skills. At the end of the module, students can communicate at a simple level with the vocabulary and grammar materials provided in this module.
13	STS121	Science socialism	2	The module provides learners with basic knowledge about the theory of scientific socialism:

ID	Course code	Course name	Credit	Description
				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.
14	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.
15	HCM121	HCM's Thought	2	Provide systematic insights into Ho Chi Minh's ideology, morality and cultural values; Basic knowledge of Marxism-Leninism
16	SSK221	Soft skills	2	The course aims to equip students with the basic knowledge of soft skills. In addition to training students' communication ability, the course also forms and develops self-awareness skills, critical thinking skills, teamwork skills, presentation skills and job interviewing skills. . They can stand their ground to present clearly, effectively, accurately in technical work, in business, in conferences, scientific seminars, etc., and activities. other societies.
2. Basic knowledge of the major				
17	PIN231	Introduction to programming	3	Equip for students with basic knowledge of programming. Facilitate students to get acquainted and use the C programming language. Specific content includes: Introduction to programming; C programming language; C data types; Commands in C.
18	OTS131	Operating system	2	Provide to students with basic knowledge of the organization and operating principles of computer operating systems. Learn how to choose Windows and Linux operating systems for experimentation. The main contents include:

ID	Course code	Course name	Credit	Description
				<ul style="list-style-type: none"> - Operating system organization and operating principle: General organization of operating systems; Scheduler; Manage processes; Synchronize and share system resources - Windows operating system: Use system tool applications; Account management and Remote service; Manage applications, services, directories, system libraries, and devices; Network configuration and data sharing techniques; Maintain and upgrade operating system; Data backup and recovery techniques - Linux operating system: Organize data on the system; Manage user accounts; Manage and share system data; Techniques using the bash shell.
19	COA221	Computer architecture	2	<p>Provide to students with the most basic knowledge about the architecture and functions of the basic components of a computer system, the organization of hardware and software, techniques for installing and optimizing computer operating systems. The main contents include:</p> <ul style="list-style-type: none"> - Basic components of a computer system - Architecture and function of CPU internal components - Organize MainBoard - Organize memory in the computer - Technical hard disk partitioning according to FAT and NTFS standards - Maintain, fix and handle some common errors on computer systems.
20	ADP321	Advanced programming	2	<p>Equip for students with advanced knowledge about programming. Facilitate students to use C programming language fluently. Specific content includes: Dynamic data and pointers in C; Structured data types in C; File Type File in C; Graphics in C.</p>
21	BAD131	Database	3	<p>Relational databases, relational operations, relational data normalization, and data manipulation languages. Practice on SQL</p>
22	OOP231	Object Oriented Programming	3	<p>Equip students with basic knowledge of object-oriented programming. Facilitate students to use C++ programming language fluently in object-oriented programming. Specific contents include: Overview of object-oriented programming; Functions in C++; Class, constructor, destructor, derived, inheritance; File manipulation; Direct access to memory; Streams.</p>
23	DEM231	Discrete math	3	<p>The course is equipped with mathematical methods of thinking, logical reasoning & proof; basic knowledge of algorithms, algorithms, and discrete structures & processing techniques on those</p>

ID	Course code	Course name	Credit	Description
				structures; algorithms, algorithm design techniques; advanced counting principles and techniques.
24	DSA231	Data structures and algorithms	3	Equip knowledge from general to in-depth knowledge of common data models (lists, stacks, queues, trees, graphs, sets, dictionaries, ...) as well as operations on each element of the model. On that basis, it is possible to apply the learned knowledge to programmatically solve problems using specific programming languages.
25	CON231	Computer network	3	Overview of computer network systems: network architecture, protocols, devices, technology
26	ASD232	System design analysis	3	The module provides learners with the ability to survey, analyze, design and install information management systems, and at the same time train learners in object-oriented analysis and design skills based on the UML language and Rational Rose tool.
27	NUM321	Numerical methods	2	Equip students with knowledge about errors, approximation methods and algorithms of advanced mathematics applied in information technology.
28		Optional	3	
	ASP432	ASP.NET Technology		Equip students with basic knowledge of ASP.NET technology. Facilitate students to use C# programming language fluently in ASP.NET programming, Specific contents include: overview of .NET Framework, C# programming language, MVC architecture in ASP.NET, query data with ASP.NET
	LTW131	Web Programming		The course provides students with basic and advanced knowledge of programming and Web application development, including knowledge of the basic PHP programming languages, PHP and MySQL databases, oriented programming. object with PHP as well as the MVC pattern in web application development.... Besides, students also practice confidence and creativity in learning and surveying, analyzing, researching and deploying web applications. At the end of the course, students can build small and medium-sized websites for individuals, organizations or businesses.
	CNA431	Advanced computer network	3	The Advanced Computer Networking module familiarizes students with more in-depth knowledge of computer networking, focusing on the application and transport layer protocols of the TCP/IP protocol suite or Application-> LLC Datalink (OSI) sublayer. Approaching the network system in an academic direction.

ID	Course code	Course name	Credit	Description
	SOE232	Software technology	3	Equip students with an overview of software engineering: fundamentals of software specification, development, evaluation, operation and maintenance processes, project management and organization principles sentence
	ARI231	Artificial intelligence	3	Provide students with machine learning techniques that are being widely used to develop intelligent systems today: Conceptual learning; Decision Trees, Neural Networks, Hypothesis Evaluation, Bayesian Learning, Case Based Learning, Support Vector Machines, Undirected Graph Models...
	DMS231	Database management system	3	This module 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 Trigger; create and manage users
	DOT331	Dot NET Technology	3	This module provides basic knowledge about C# programming language, develops object-oriented programming capabilities on the basis of .NET programming libraries, progress to building complete applications. Most of the course time is devoted to content about object-oriented programming, manipulating databases using the ADO.NET library, and building web applications using MVC architecture. The course also introduces some advanced technologies such as WPF, LINQ, Entity Framework...
	PJA241	Java programming	3	The module provides students with knowledge about object-oriented methods (OPP) and how to apply them to Java programming; Java language syntax and usage; creating objects and adding behaviors, working with collections, handling errors; tips for writing better code
3. Block of specialized knowledge				
29	LNC332	Advanced Database Management System	3	The course aims to provide students with knowledge about complex SQL commands, manipulation of large numbers of records (Transactions), complex procedures, and SQL objects such as Report, Full-Text. Guide students to know how to configure SQL SERVER, backup and restore data, manage SQL Server databases. - Create background knowledge for the subject: the process of building an information system.
30	MMD321	Multimedia database	2	The module provides students with an overview of multimedia databases, multidimensional data structures, indexing and retrieval techniques for image, text, audio, and video databases. and

ID	Course code	Course name	Credit	Description
				associated databases. Help students understand how to organize, store, and search today's multimedia systems.
31	DBD321	Distributed database	2	The module provides students with basic knowledge about distributed data, distributed database system design, querying on distributed database. The module also provides practical content to help students familiarize themselves with and use the distributed data management system Hadoop.
32	EXS331	Expert system	3	The module provides students with the core concepts and knowledge to build a software that simulates the effective problem solving of an expert. Provide knowledge about types of knowledge, ways of reasoning, ways of learning knowledge and algorithms to find solutions to problems to be solved. Students learn skills to analyze problems using knowledge to solve, choose an appropriate representation of knowledge, choose the corresponding reasoning method, and build an expert system for a specific field.
33	XDH341	Building information systems	3	The course provides students with the core concepts and knowledge of information systems software. Objectives, principles and methods of information survey at an enterprise or a non-business unit. Technical models analyze survey information to provide functions to meet system user needs (functional model, object-oriented model). Models for designing solutions and operating technology of the system; Data model; working interface. Method of selecting tools to install and test the system. Some aspects related to system safety. - Apply knowledge of programming languages, data structures to build system management applications.
34	IOF332	Internet of Things	2	The foundation for this connectivity is called the Internet of Things (IoT). This is a combination of many technologies including wireless sensor networks, Pervasive (Ubiquitous) systems, Aml (ambient intelligence, distributed and contextual systems). This course provides students with IoT concepts with a focus on platforms (applicable hardware and software platforms in IoT), M2M protocols (communication protocols that can be used in IoT). IoT applications: Zigbee, Bluetooth, IEEE

ID	Course code	Course name	Credit	Description
				802.15.4, IEEE 802.15.6, IEEE 802.15.11) and data and information processing mechanisms.
35	DTM331	Data mining	3	The course aims to provide students with the basics of knowledge discovery, data mining and data mining methods, the main stages of data mining and discovery. Knowledge. The course also provides learners with data mining methods such as classification, clustering, association rules to build data mining applications.
36	DLL333	Big data analytics	3	The course introduces big data and current big data storage platforms, providing the concepts and structure of the HDFS (Hadoop Distributed File System) distributed data storage system. Through the module, students can understand the architecture and algorithms in big data processing in the Hadoop ecosystem - Ecosystem, through the module students can learn about the technologies used to store data. store and process distributed data in this ecosystem. In the last part of the module, students get acquainted with the R language for big data processing.
37	CCP431	Cloud computing	3	The course provides learners with some general knowledge about cloud computing, virtualization, and private cloud implementation skills based on an overview of computer networks and network device technology. Upon completion of the course, students are able to deploy cloud computing services, install private clouds, and develop basic cloud computing applications.
38	NNA331	Neural networks and applications	3	The Neural Network module aims to provide computer science students with basic knowledge about Neural Networks and some applications in Machine Learning, Identity Theory, Interpolation Theory, Parallel Computing. The course content focuses on the analysis of 1-layer and multi-layer Neural network design model analysis, Unsupervised and supervised learning principles, 1-layer and multi-layer network training algorithms, Regression networks, Neural network application to solve interpolation and identification problems, optimization problems,... Simulate algorithms in Matlab language.

ID	Course code	Course name	Credit	Description
39	NLP333	Natural Language Processing	2	The Natural Language Processing module belongs to the specialized knowledge block, in order to provide students with basic knowledge about natural language processing methods through computers such as word separation, word type analysis, and analysis. syntax analysis, semantic analysis, new research directions in natural language processing. It is the basic knowledge, which is the means by which students can understand and build practical applications in the topics of natural language processing.
6. Internship/Graduation Project				
40	BAP441	Basic Internship	4	The basic internship is a prerequisite for students to transition from the fundamental courses to the specialized courses of their major. It is organized after the last semester of the fundamental courses. Completing this internship is a requirement for students to be eligible to study the subjects in the specialized courses.
41	TNN561	Vocational internship	6	Internship at a company is undertaken after completion of all specialized coursework according to each student's individual professional orientation.
42	GRA905	Graduation thesis	10	Synthesizing knowledge to carry out a complete research project based on a specific professional orientation can be done either at a company or at an educational institution
Total			140	
43	UMH241	Machine Learning Application Development	4	<p>The Machine Learning Application Development course focuses on instructing students on how to apply machine learning techniques to solve real-world problems. This subject provides students with the knowledge and skills to develop machine learning applications that meet the needs of businesses and organizations.</p> <p>The course covers topics such as:</p> <ul style="list-style-type: none"> - Basic concepts of machine learning, including machine learning model types, model training methods, and performance evaluation. - Collect and prepare data for machine learning model building, including data preprocessing and analysis. - Build machine learning models from data, including classification, prediction, clustering, and association models. - Deploy and test machine learning applications, including techniques for implementing machine

ID	Course code	Course name	Credit	Description
				<p>learning models and testing application performance.</p> <ul style="list-style-type: none"> - Solve real-world problems using machine learning applications, including applications in the business, medical, financial and other sectors. <p>Students will be required to engage in hands-on activities to build machine learning applications, using popular tools and libraries such as Python and machine learning frameworks such as Scikit-Learn, Tensorflow, and PyTorch. The course will provide students with the skills needed to develop real-world machine learning applications and solve tough business and organizational problems.</p>
44	DGA231	Game Development	3	<p>Game Development focuses on helping students understand and develop the skills needed to design, develop, and implement video games. This course will help students gain an understanding of the game development process and the skills needed to create a successful game.</p> <p>The course covers topics such as:</p> <p>Game planning and design: Students will be taught how to plan and design games, including generating ideas, selecting key game elements, and constructing schematic designs. and drawings.</p> <p>Game Development Technologies: Students will be introduced to popular game development technologies, including programming languages such as C++, Java, Python, JavaScript, and game development tools and libraries. such as Unity, Unreal Engine, Godot and Adobe software.</p> <p>Graphic and Sound Design: Students will receive instruction on how to design graphic and sound elements for games, including drawings, photos and sounds, and tools and software to create them.</p> <p>Game Programming: Students will be taught how to program games, including building features and integrating graphics and sound elements.</p> <ul style="list-style-type: none"> - Testing and Deployment: Students will receive instruction on how to test and deploy the game, including testing for features, performance and stability, and building the final version of the game.

ID	Course code	Course name	Credit	Description
				Students will be required to engage in hands-on activities to develop video games, using popular technologies and tools such as Unity, Unreal Engine, and graphics and sound engines such as Adobe Photoshop. and Audacity. The course will help students develop the skills needed to design and develop games.
45	MTK233	Software Design Patterns	3	<p>Software Design Patterns is a subject in the field of Information Technology that focuses on helping students understand and apply software design patterns to solve common problems in Software Development.</p> <p>This course will help students understand the basics of software design and software design patterns such as Singleton, Factory Method, Observer, Decorator and many more. It will also enable students to apply these design patterns to the design and development of real-world software applications.</p> <p>Key topics in the Software Design Patterns course include:</p> <ul style="list-style-type: none"> - Software Design: Students will be introduced to the basic concepts of software design, including design principles, characteristics and elements of a good software design. - Software Design Patterns: Students will be introduced to software design patterns such as Singleton, Factory Method, Observer, Decorator and many more. Students will learn about the structure, applications, and benefits of these design patterns. - Application of design patterns: Students will be taught how to apply software design patterns to the design and development of real software applications. Students will be asked to do exercises and projects to apply these design patterns. <p>The Software Design Patterns course will help students understand and apply software design patterns to solve complex problems in software development, and help students improve their design and development capabilities. its software.</p>

12. Output standards, training program framework, and a detailed course outline:

- Output standards of the training program:

(link: <https://fit.ictu.edu.vn/wp-content/uploads/2023/04/a2.PLOs-of-SEP-version-2020.pdf>).

- Detailed training program framework:

(link: <https://fit.ictu.edu.vn/wp-content/uploads/2023/04/c2.-Programme-specification-version-2020.pdf>).

- Detailed course outline:

(link: <https://fit.ictu.edu.vn/aun-information-technology/>).