MINISTRY OF EDUCATION AND TRAINING

DALAT UNIVERSITY

CREDIT-BASED HIGHER TRAINING PROGRAM

(APPLYING CDIO OUTCOME STANDARDS)

ACADEMIC DISCIPLINE: INFORMATION TECHNOLOGY

Lam Dong – 2020

OVERVIEW

The Bachelor of Engineering in Information Technology program is designed according to the CDIO outcome standard, based on the basis of the Revised 2018 Law on Higher Education; Decree 99/2019/NĐ-CP of December 30, 2019 of the Prime Minister detailing and guiding the implementation of some provisions of the Revised Law on Higher Education and Notification 1047/TB-ĐHĐL of Dalat University regarding reviewing and building training programs according to CDIO standards. The training program is also developed with reference to the IT undergraduate programs of some prestigious universities at home and abroad. The program has been modified and improved based on reasonable feedback and contributions from stakeholders (education experts, educational managers, lecturers, alumni, students...) through various forms such as online, email, direct submission, and feedback from the Appraisal Council.

The Bachelor of Engineering in Information Technology program consists of 150 credits, divided into two blocks:

1. General knowledge block including Political Theory, Foreign Languages, Physical Education, National Defense and Security Education, and Natural and Social Sciences.

2. Professional education block includes Foundational, Major, and Complementary Knowledge. In the Foundational Knowledge section, students are equipped with basic knowledge of computer science, operating systems, data structures and algorithms, and object-oriented principles, along with foundational courses in Information Technology. In the Major Knowledge section, students are provided with in-depth IT-related courses. In the Professional Knowledge and Skills block, there are elective courses that delve into practical IT aspects in various fields, such as Computer Networks and Communications, Software Engineering, and Data Science. This block will provide opportunities for students to update their knowledge, develop their career and professional skills, and pursue further degrees after graduation.

The training program pays much attention to comprehensive knowledge, skills, and attitudes development, along with experiential internships at institutions to help students accumulate additional work skills in a real-world environment. With regular hands-on experiences and practical training, students can access and grasp job opportunities more easily after graduation.

The Bachelor of Engineering in Information Technology program ensures legality, science, and modernity, with a focus on practical training, flexibility, and up-to-date knowledge to create conditions for students to develop vocational skills, enhance creativity, and work quality after graduation.

Lam Dong, day ... month ... year 20.....

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MINISTRY OF EDUCATION AND TRAINING
DALAT UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

BACHELOR PROGRAM
CREDIT-BASED SYSTEM

Major: Information Technology

English name: Information Technology

Training level: Bachelor of Engineering

Training form: Full-time

Training code: 7480201

Training duration: 4 years

Total program credits: 150

1. TRAINING OBJECTIVES

General objectives

To train high-quality human resources, cultivate talents, conduct scientific research and technology to create new knowledge and new products, serve the requirements of human and social development, and ensure national defense, security, and international integration.

To educate students with political and moral qualities, strong foundational and professional knowledge, practical skills, research capacity, and creativity to solve problems related to analysis, design, construction, deployment, and operation of information technology systems; professional responsibility, readiness to adapt to diverse work environments, and awareness and ability to self-study to adapt to the continuous development of science and technology.

Specific objectives

Graduates from the Information Technology program will be able to:

- M01: Possess good political qualities, the consciousness of organization and discipline, scientific working style, professional ethics, and communication skills.
- M02: Be equipped with fundamental knowledge of natural sciences, social sciences, and basic and advanced knowledge of information technology, as well as being directed towards the future development of information technology.
- M03: Be trained in practical skills in the fields of information technology, equipped with self-learning and research skills that allow graduates to easily integrate and develop in the working environment.

- M04: Be trained in soft skills such as teamwork, management, leadership, situation analysis, decision-making, presentation, and support for job development.
- M05: Have sufficient language skills to meet job requirements.

In addition to the above general specific objectives, students trained in each major can:

Specialization in Computer Networking:

- M06A: Master the basic and advanced knowledge of Computer Networks and Communications: designing and developing applications on the network and mobile systems; designing, deploying, and operating Computer Networking systems; constructing and deploying system security and information security solutions.

Specialization in Software Engineering:

- M06B: Master the basic and advanced knowledge of software technology: software development processes, requirements analysis, design, and construction of software systems, testing and quality assurance, maintenance, and software project management.

Specialization in Data Science:

- M06C: Master fundamental and advanced knowledge; able to analyze, research, and solve professional issues in Data Science, applied in various fields such as management, teaching, research, production, and business: plan, collect, and exploit data (especially big data); apply data management models, statistical techniques, machine learning methods, and data analysis tools.

Job Opportunities

In the era of technology and the internet, the information technology industry has become a top choice for the future careers of many young people. It is a particularly attractive field of study for those who are passionate about technology, want to have early access to advanced achievements, and have the opportunity to work in dynamic and creative environments but also with many challenges.

Today, every profession requires the contribution and application of information technology. The social demand for products of this industry is large and diverse, from personal phone applications to management software for organizations, businesses or systems related to security and national defense.

More importantly, the development process of every business, organization, or individual in the modern economy cannot be without information technology solutions. In Vietnam, the number of information technology companies is growing rapidly. Projects

from foreign companies or foreign-invested ones are also constantly developing, opening attractive career opportunities, without limits for young people who are determined to pursue information technology.

After graduation, information technology engineers can work in many positions such as software programmers, system design and analysis specialists, information security, network administration, data analysis and mining, at software companies, information technology solution providers, as well as organizations and businesses that apply information technology. Graduates can also become IT project managers, coordinators at corporations, businesses, e-commerce organizations in and outside the country, or participate in teaching and research at other universities, colleges, and research institutes as well as continuing to study at higher levels of education.

An advantage of the students of the Faculty of Information Technology - Dalat University is that the faculty aims to train students to be closely connected with the practical needs of society. The Faculty of Information Technology - Dalat University has many cooperation programs with leading Vietnamese and international information technology companies such as TMA, FSoft Da Nang, CISCO, IBM, KMS, TDA... This cooperation is implemented through the integration of subjects in the training program of the faculty with the content built from the practical aspects of the companies. In addition, many students of the Faculty of Information Technology can participate in internships, attend seminars on modern technologies, and participate in recruitment interviews.

2. ADMISSION REQUIREMENTS

Implementing the current regulations of the Ministry of Education and Training and Dalat University.

3. TRAINING PROCESS AND GRADUATION REQUIREMENTS

Implementing the Regulations on the University and College Credit-Based Training System of Dalat University.

4. ASSESSMENT

Implementing the Regulations on the University and College Credit-Based Training System of Dalat University.

5. COMPARISON OF LEARNING OUTCOMES WITH TRAINING OBJECTIVES

Learning outcomes		Training objectives							
		01	02	03	04	05	6A	6B	6C
1	**Industry knowledge and reasoning**								
1.1	**General education knowledge**								
1.1.1	Understanding the basic principles of Marxism-Leninism. Understanding the	x							

	basic life, career, and thoughts of President Ho Chi Minh. Having a clear understanding of the fundamental role of Ho Chi Minh's ideology, theory, and the Party's application of it in the Vietnamese revolution.								
1.1.2	Understanding national defense policy and security issues, mastering basic military techniques to be ready to participate in safeguarding national security and sovereignty when the country needs it.	x							
1.1.3	Understanding basic sports techniques and knowing how to choose suitable physical training methods to maintain good health and strengthen physical fitness.	x							
1.1.4	Understanding several types of spoken and written English texts at the intermediate level. Applying language knowledge such as vocabulary, semantics, phonetics, and intermediate-level grammar to use in areas related to information technology. Having the ability to communicate through listening, speaking, reading, and writing about professional topics.		x			x			
1.1.5	Understanding basic knowledge of sets and functions, logic, and graph theory. Understanding basic knowledge of algorithms and computational complexity of algorithms; counting methods for elements; relationships and Boolean algebra.		x						
1.1.6	Understanding the origin of the state, the origin of the law in general, introducing basic issues of the socialist Republic of Vietnam; Understanding basic regulations of Vietnam's legal sectors, such as criminal law and criminal procedure law, civil law and civil		x						

	procedure law, constitution law, administrative law and administrative procedure law, marriage and family law, commercial law, labor law.								
1.1.7	Understanding an overview of computers and computer data representation techniques.		x						
1.1.8	Being aware of career opportunities and career development trends in the future of the Information Technology industry.	x							
1.1.9	Being proficient in fundamental knowledge of computer system architecture and instruction set architecture. Understanding the operating principles of computer components: buses, processors, memory, input/output systems. Being capable of programming low-level languages (assembly) to simulate the instruction set of some common processors.		x	x	x				
1.1.10	Understanding the principles of structured programming in program design, how to describe, implement algorithms and present basic contents of programming languages to illustrate the organization of structured programs. Being able to build structured programs in the form of libraries.		x	x	x				
1.1.11	Understanding the principles of disassembling computer systems; being able to create installation disks and install operating systems in many ways; being able to detect and troubleshoot hardware and software-related issues.		x	x	x				
1.1.12	Understanding the knowledge in graphic design principles and being able to apply the learned knowledge to use graphic design tools to process images, combine images, create effects and colors for websites, design banners for websites.		x	x	x				

1.1.13	Understanding the basic concepts of economics such as the laws of supply and demand, competition in the market mechanism, the optimal choice principle of consumers and producers, inflation, unemployment, economic cycles, financial and monetary systems, as well as the macroeconomic policies of the country.		x						
1.1.14	Understanding the foundational knowledge and skills for composing administrative documents. Being able to compose, process, and manage several types of administrative documents in real life.		x						
1.1.15	Understanding the role of accounting, the products of accounting, the basic techniques in accounting and the operating environment of accounting. Having basic skills in reading, understanding, and using accounting information, performing basic tasks in the accounting process.		x						
1.1.16	Understanding the basic concepts of human psychology and psychological science. Explaining the nature, laws, mechanisms of the formation and manifestation of psychological phenomena, the relationship between specific psychological phenomena in the unified psychological life of human beings.		x						
1.1.17	Understanding the concept of entrepreneurship and the entrepreneurship ecosystem, being able to recognize the characteristics, qualities, and entrepreneurial spirit. Being able to develop creative and innovative ideas. Being able to evaluate and determine the strengths, weaknesses, opportunities, and challenges of entrepreneurial ideas.	x	x						

1.1.18	Understanding the basic concepts in linear algebra, calculus, series, and function series. Knowing how to proficiently use mathematical software for calculations. Applying mathematical knowledge to the field of information technology.		x						
1.2	**Foundational Knowledge**								
1.2.1	Being able to solve problems, evaluate algorithm complexity; use search and sorting algorithms in dynamic data structures: singly linked lists and their applications of stacks, queues; circularly linked lists, doubly linked lists; tree structures, binary search trees and balanced trees.		x	x					
1.2.2	Understanding the foundation of object-oriented programming. Mastering basic concepts and principles such as class, object, method, attribute, encapsulation, inheritance, polymorphism. Being able to analyze and model problems to be solved in an object-oriented approach.		x	x					
1.2.3	Understanding the concepts of databases, components of a database. The concepts of functional dependency, minimal coverage, key, normalization, and database normalization. Understanding and using query languages, updating databases.		x	x					
1.2.4	Understanding and applying database design models. Being able to analyze, design, and implement databases.		x	x					
1.2.5	Understanding the architecture and components of Computer Networking systems. OSI and TCP/IP models. Understanding the basic operating mechanisms of communication protocols on the network.		x	x					
1.2.6	Understanding the basic concepts of operating systems, operating system		x	x					

	principles. The main components of an operating system, ability to use and program interfaces with some common operating systems.								
1.2.7	Proficiently building applications on a graphical user interface (GUI). Being able to program connections and interactions with databases; building simple management software.		x	x					
1.2.8	Applying the knowledge learned in the basic knowledge block to perform projects, enhancing the ability to work according to plans and schedules. Enhancing the ability to present problems and present effectively.	x	x	x	x				
1.3	**Major Knowledge**								
	Compulsory knowledge								
	Specialization in Computer Networking								
1.3.1	Understanding open-source operating systems and having the ability to install, deploy, and administer basic services on popular open-source platforms.		x	x	x	x	x		
1.3.2	Understanding networking concepts. Having the ability to select an appropriate network management model for each organization. Knowing the process for deploying a network management system. Having the ability to use necessary tools to deploy a network management system.		x	x	x	x	x		
1.3.3	Understanding the principles of routing device operation and function, as well as routing algorithms. Having the ability to apply and implement appropriate routing solutions for different network models.		x	x	x	x	x		
1.3.4	Mastering network administration on the Linux operating system. Having the ability to deploy and manage network services such as Active Directory,		x	x	x	x	x		

	OpenVPN, Web Server, Email Server, Clustering, Load balancing, VPS.								
1.3.5	Understanding the architecture of enterprise networks. Having the ability to design, deploy, and operate enterprise network systems. Having the ability to install and configure switching and routing protocols in a layered network model, such as VLAN, HSRP, GLBP.		x	x	x	x	x		
1.3.6	Mastering general knowledge about distributed systems, such as remote function calling, distributed data exchange standards, distributed database systems, and distributed file systems. Having the ability to explain the organization and operation of systems such as Google, Facebook, or the torrent network in storing and processing data.		x	x	x	x	x		
1.3.7	Understanding common network security techniques, solutions, and technologies, such as authentication, encryption, firewalls, and virtual private networks. Having the ability to use some system scanning and testing tools. Understanding the principles of security protocols. Having the ability to apply system reinforcement solutions. Understanding and applying security solutions for network transmission and network services on the Internet		x	x	x	x	x		
1.3.8	Applying Computer Networking knowledge into the development of an information technology application or deployment of a network service system to meet practical needs at a deep level.		x	x	x	x	x		
	Specialization in Software Engineering								
1.3.9	Being able to understand the knowledge of software development stages. Having the ability to apply the appropriate software product development process for a real project.		x	x	x	x		x	

1.3.10	Having the ability to program, test, and deploy specific applications.		x	x	x	x		x	
1.3.11	Understanding the multi-tier model used in web application development. Knowing how to use and combine tools, techniques, and technologies to develop, build, install, and deploy a full-stack web application. Being able to secure a web application at a basic level.		x	x	x	x		x	x
1.3.12	Understanding in-depth knowledge of web programming, choosing a web server. Being able to choose the appropriate framework to build a website. Mastering ways to promote a website through SEO techniques.		x	x	x	x		x	x
1.3.13	Mastering the general knowledge of open-source applications. Understanding the principles, distribution processes, collaboration, and development of open-source software. Differentiating between copyright licenses used in open-source applications. Having the ability to install, build, and develop some open-source applications.		x	x	x	x		x	
1.3.14	Understanding some concepts of design patterns. Mastering and applying common design patterns in software design and construction.		x	x	x	x		x	
1.3.15	Mastering basic concepts of project management, especially information technology project management. Being able to implement, execute, control project plans, manage scheduling, costs, quality, resources, and project risks, and manage project integration. Knowing how to use some project management software tools.		x	x	x	x		x	
1.3.16	Understanding fundamental knowledge of programming for mobile devices, with the ability to construct and develop applications that run on multiple cross-		x	x	x	x		x	x

	platform mobile operating systems using React Native and Ionic. The course also provides knowledge on programming mobile device communication, using combined platforms to construct and develop interactive applications								
1.3.17	Applying the knowledge of software engineering to construct an application that meets real-world needs at an advanced level.		x	x	x	x		x	
	Specialization in Data Science								
1.3.18	Using the tools and probability calculations of the experimental model. Understanding common types of discrete and continuous random variables and using probability distributions and probability density functions.		x	x	x	x			x
1.3.19	Understanding the concept, significance, and tools for calculating conditional expectations. Acquiring the stages and tools of descriptive statistics.		x	x	x	x			x
1.3.20	Understanding the fundamental knowledge of the structure of large datasets, abstract and numerical data. Being able to use data visualization tools, effectively presenting data. Acquiring skills in using graphs and images to represent information.		x	x	x	x			x
1.3.21	Mastering techniques for mining big data such as statistics, rule extraction, big data search, and big data storage. Being able to build knowledge-based advisory systems based on big data.		x	x	x	x			x
1.3.22	Understanding the basics of artificial intelligence: problem representation and solving methods, knowledge representation and processing methods. Developing skills in applying problem representation and solving methods to solve practical problems.		x	x	x	x			x

1.3.23	Understanding the idea and algorithm of linear regression, decision tree classification method, k-nearest neighbor method, clustering method based on centroid and density-based clustering method.		x	x	x	x			x
1.3.24	Being able to use data mining algorithms and tools to develop applications.		x	x	x	x			x
1.3.25	Mastering methods and techniques of machine learning. Understanding and applying supervised and unsupervised machine learning methods for prediction, classification, and clustering tasks. Understanding methods for evaluating and comparing models.		x	x	x	x		x	x
1.3.26	Applying data science knowledge to build an application that meets deep practical needs.		x	x	x	x			x
1.3.27	Understanding the data structure of hash tables, graphs, and basic algorithm design methods such as divide and conquer, backtracking, branch and bound, greedy algorithms, and dynamic programming. Being able to apply knowledge of hash tables, graphs, and algorithm design methods to build related applications.		x	x	x	x			x
1.3.28	Mastering methods and techniques for processing digital images such as image correction, edge detection, image enhancement, and image transformation in the frequency domain. Being able to use image processing techniques and tools to participate in building, developing, and applying practical applications related to image processing.		x	x	x	x			x
	Elective Knowledge								
1.3.29	Mastering the knowledge of new generation network technologies such as Software-Defined Networking (SDN), network automation. Applying knowledge of common programming to		x	x	x	x	x		

	build centralized network controllers based on SDN theory platform.								
1.3.30	Understanding the foundational knowledge of security such as cryptography, hashing algorithms, encryption algorithms, secret keys, public keys, digital signatures, digital certificates, public key infrastructure.		x	x	x	x	x		
1.3.31	Understanding the knowledge of new generation network technologies such as multi-protocol switching, IPv6, new wireless standards, and modern network infrastructure.		x	x	x	x	x		
1.3.32	Mastering the knowledge of system security and network security, basic requirements of a secure network system. Understanding the risks, types of attacks, and some computer and network intrusion techniques. Having a general knowledge of network security laws, professional ethics in information security.		x	x	x	x	x		
1.3.33	Understanding the overview of cloud computing and cloud computing services. Ability to deploy cloud computing infrastructure on Hyper-V and VMware technology platforms.		x	x	x	x	x		
1.3.34	Mastering blockchain technology platform: model, design, practical application of technology. Proficiently working with the Bitcoin core system, the Ethereum platform system, and smart contracts. Developing distributed applications on the blockchain platform. Developing and building own blockchain applications (private blockchain).		x	x	x	x	x		
1.3.35	Understanding the fundamental knowledge of the Internet of Things (IoT) such as IoT architecture, the potentials, and challenges of applying IoT in practice. Grasping the process of		x	x	x	x	x		x

	developing IoT applications and being capable of designing and constructing IoT applications.								
1.3.36	Deploying a network system for small and medium-sized enterprises that use Windows and Linux infrastructure. Having enough ability to install and configure all network services in the Windows environment (AD, Mail, Web, VPN, etc.) using Linux open-source system without licensing costs. Being able to implement the Campus network system and build the High Availability system.		x	x	x	x	x		
1.3.37	Understanding the infrastructure of VOIP telephone services, telephone exchange systems, applications, and VOIP transmission devices.		x	x	x	x	x		
1.3.38	Understanding the knowledge of network system development through software and the technologies used in API, Python in designing applications for network infrastructure automation.		x	x	x	x	x		
1.3.39	Understanding the basic knowledge of Java programming language, basic command structures, and event processing models. Basic and in-depth knowledge of object-oriented programming with Java programming language as well as related knowledge of practical application development. Being able to design basic Java applications to applications with a graphical user interface that connects to a database, web application.		x	x	x	x		x	
1.3.40	Understanding the overview of some modern technologies that are being formed and applied in one or more software development stages, including technologies that are being applied in the		x	x	x	x		x	

	analysis, design, installation, testing, or deployment of the system.								
1.3.41	Being able to install and apply modern technologies to a specific project so that learners can apply these technologies to their practical working environment.		x	x	x	x		x	
1.3.42	Understanding the knowledge related to game programming, emphasizing the technologies and techniques that help program games installed on the Internet environment, enabling many people to play. Being able to create an online game product.		x	x	x	x		x	
1.3.43	Understanding the knowledge related to software requirement modelling, common software architectures, software requirement analysis process. Understanding the knowledge of software design such as data design and interface design, analyzing and designing software objects using UML diagrams to analyze and design practical applications.		x	x	x	x		x	
1.3.44	Understanding the general knowledge of designing and building user interfaces, the stages in the process of designing software interfaces, the components of user interfaces, and the factors for evaluating interface quality. Understanding the process of designing an interface.		x	x	x	x		x	
1.3.45	Being able to brainstorm, plan, analyze, and design graphic screen interfaces for users effectively. Being able to choose appropriate design methods for practical problems, plan and implement the construction of user interfaces.		x	x	x	x		x	
1.3.46	Explaining the components and roles of e-commerce environments. Explaining how to conduct business transactions for goods and services online. Describing the		x	x	x	x		x	

	quality and impact of businesses operating on the internet.								
1.3.47	Understanding important e-commerce systems such as e-government, e-banking, online business transactions, and online education. Being capable of planning and implementing an online business system and generating ideas or consulting with clients to select solutions, deploy and operate an e-commerce platform.		x	x	x	x		x	
1.3.48	Understanding basic concepts, terminology, principles, and components of games. Applying knowledge of game tools for design. Being capable of programming 2D and 3D games using Unity. Understanding mobile game programming knowledge.		x	x	x	x		x	
1.3.49	Understanding an overview of web services. Being familiar with concepts and tools for deploying web services on SOAP and REST platforms. Being able to illustrate web services based on SOAP, including XML, SOAP, WSDL, UDDI. Being able to illustrate web services based on REST, including JSON/XML, Web API, Uniform Interface, URI, Stateless, Cacheable. Being capable of building a simple and complete web application based on REST platform.		x	x	x	x		x	
1.3.50	Understanding software testing overview. Applying testing methods. Understanding and applying testing levels, testing types, testing processes, and automated testing.		x	x	x	x		x	
1.3.51	Being familiar with distributed data and system concepts; concepts and characteristics of distributed databases; distributed database management systems and their components.		x	x	x	x	x		

1.3.52	Mastering and applying fragmentation methods in designing distributed databases. Proficiently using query language, updating databases (relational algebra, SQL).		x	x	x	x	x		
1.3.53	Understanding (processing) queries and optimizing queries in distributed databases: decomposing query sentences, optimizing query sentences, localizing distributed queries. Understanding (identifying) integrity constraints on distributed databases.		x	x	x	x	x		
1.3.54	Mastering the theory of parallel algorithms, parallel processing models, parallel processing architectures such as array processors, multiprocessing, multi-machines, SIMD/MIMD; organizing processor connections and mappings; accelerating; mapping and scheduling. Being capable of proficiently using environments and tools that support parallel programming.		x	x	x	x			x
1.3.55	Mastering the principles of natural language processing. Being able to build intelligent systems that use natural language processing in real-life applications.		x	x	x	x			x
1.3.56	Understanding the concepts and architecture of semantic web. Being able to apply ontology technology to build semantic web systems.		x	x	x	x			x
1.3.57	Understanding advanced knowledge in Python. Being able to build dynamic web applications, connect to databases, visualize data, and apply machine learning using the Python language.		x	x	x	x			x
1.3.58	Understanding the basic knowledge of the R programming language. Being able to analyze, statistically process, graphically represent, and report using the R programming language. Being able		x	x	x	x			x

	to build machine learning applications using the R programming language.								
1.3.59	Understanding data collection and pre-processing methods. Applying data pre-processing methods to standardize and extract data to improve the effectiveness of statistical machine learning models.		x	x	x	x			x
1.3.60	Mastering the basics of artificial neural network algorithms. Knowing how to execute, train, and evaluate artificial neural network models using tools and libraries. Being able to apply deep learning and reinforcement learning algorithms to build and develop intelligent applications.		x	x	x	x			x
1.3.61	Understanding the basics of computer vision, such as edge detection, image segmentation, and object recognition. Being able to develop object recognition and pattern recognition applications.		x	x	x	x			x
1.3.62	Understanding deep learning methods. Being able to use tools to apply deep learning methods in the fields of image processing and natural language processing.		x	x	x	x			x
1.4	**Complementary Knowledge**								
	Compulsory Knowledge								
1.4.1	Grasping some concepts about the Web. Implementing a Web system on a Server. Designing Websites based on HTML and CSS. Using the Bootstrap library in Web design. Understanding and using the programming language JavaScript. Using the jQuery library in web programming.		x	x					
	Elective Knowledge								
1.4.2	Mastering the concept of scientific research methods and research processes. Understanding ethical issues in research.	x	x	x	x	x			
1.4.3	Being able to design research: identify problems, set hypotheses, design hypothesis testing. Capable of searching	x	x	x	x	x			

	and synthesizing documents. Knowing and using data collection, sampling methods, and data processing. Knowing how to write and present scientific articles: scientific style, outline, report. Understanding how to check and approve basic research content.								
1.4.4	Mastering the concepts and characteristics of sockets. Building Client-Server applications using diverse types of sockets such as connection-oriented and non-connection-oriented sockets, synchronous and asynchronous sockets.		x	x					
1.4.5	Understanding the basics of the Python programming language and its application in building applications.		x	x					
2	**Personal skills and qualities for the profession**								
2.1	**Argumentation, analysis and problem-solving**								
2.1.1	Having the ability to identify and articulate problems, model issues, and evaluate and analyze basic research and application problems in the field of information technology.			x			x	x	x
2.1.2	Having skills in researching and discovering knowledge such as forming hypotheses, searching, and synthesizing information.			x		x			x
2.1.3	Having analytical skills to compare qualitative and quantitative issues related to information technology.	x					x	x	x
2.1.4	Having the ability to diagnose and solve problems.						x	x	x
2.1.5	Having skills to provide conclusions and recommended solutions to problems.						x	x	x
2.2	**Experimenting, researching, and exploring knowledge**								
2.2.1	Being capable of formulating hypotheses.	x	x	x			x	x	x

2.2.2	Applying knowledge to analyze, select, and systematize information, data from traditional sources, and digitization related to information technology.	x	x	x			x	x	x
2.2.3	Having the skills to collect, analyze and process information.							x	x
2.2.4	Being capable of building experimental models and verifying hypotheses.							x	x
2.2.5	Being capable of applying research in practice as well as forming new knowledge.		x	x			x	x	x
2.3	**Systematic thinking**								
2.3.1	Having an overall view of the problem, the system of related fields, and specialties in information technology and computer science.		x				x	x	x
2.3.2	Having the ability to identify issues and correlations among issues in the system.		x	x			x	x	x
2.3.3	Having the ability to organize and determine focal issues in the information technology system.		x	x			x	x	x
2.3.4	Having the ability to evaluate the information technology system, analyze advantages and disadvantages, and select balanced solutions.		x	x			x	x	x
2.4	**Personal skills and qualities**								
2.4.1	Demonstrating innovation and a readiness to make decisions and deal with risks.	x	x	x	x				
2.4.2	Demonstrating perseverance, flexibility, confidence, diligence, enthusiasm, and passion for work.	x	x	x	x				
2.4.3	Applying creative thinking.		x	x	x		x	x	x
2.4.4	Applying critical thinking.		x	x	x		x	x	x
2.4.5	Having the ability to be self-awareness about oneself and one's knowledge, as well as the ability to integrate knowledge.		x	x	x		x	x	x
2.4.6	Demonstrating a desire to learn, a consciousness of learning, and lifelong learning.	x	x	x	x		x	x	x

2.4.7	Having the ability to manage time and resources.	x	x	x	x		x	x	x
2.5	**Professional skills and qualities**								
2.5.1	Demonstrating professional ethics, honesty, and responsible work.	x							
2.5.2	Demonstrating a professional attitude.	x							
2.5.3	Having the ability to plan career.	x	x	x	x				
2.5.4	Having the ability to recognize and update new knowledge in the IT field.	x	x	x	x				
2.5.5	Demonstrating fairness and respect for diversity.	x							
2.5.6	Demonstrating trust and loyalty.	x							
2.5.7	Having the ability to use specialized English.					x			
2.5.8	Having the ability to take care of customers and partners.	x					x	x	x
3	**Teamwork and Communication Skills**								
3.1	**Teamwork Skills**								
3.1.1	Having the ability to analyze, evaluate to select, gather, and mobilize personnel, colleagues, and related parties to form study groups, groups to implement/conduct research, and professional activities related to information technology.				x		x	x	x
3.1.2	Having the ability to analyze, evaluate to organize, allocate tasks, schedule team activities, and carry out issues in the professional field.				x		x	x	x
3.1.3	Having the ability to manage the team's activities process, use tools to support team management, and collaborate on network environments.				x		x	x	x
3.1.4	Having the ability to collaborate effectively with members of the same information technology profession and collaborate with other professions in information technology.				x		x	x	x
3.2	**Communication Skills**								
3.2.1	Being able to analyze and evaluate partners to choose communication	x					x	x	x

	strategies to present and negotiate issues related to information technology and related issues.								
3.2.2	Being able to analyze to understand and grasp the target of communication and systematize issues related to information technology to share, discuss, present, and negotiate to build communication structure and transmit information and ideas effectively.	x					x	x	x
3.2.3	Having the ability to establish/build appropriate documents with content and level of formality required to communicate effectively in writing.	x					x	x	x
3.2.4	Being able to present issues, research, and implementation plans clearly, concisely, persuasively, and effectively based on scientific and practical theoretical foundations.	x					x	x	x
3.2.5	Being able to establish graphics to present issues in the field of information technology effectively and persuasively.	x					x	x	x
3.2.6	Being able to analyze and evaluate issues to negotiate, compromise, and resolve conflicts, and disagreements in scientific perspectives, as well as conditions to implement research, apply information technology to practice	x					x	x	x
3.2.7	Being able to establish diverse links and networks to communicate effectively	x					x	x	x
3.3	**Communication in a foreign language**								
3.3.1	Having the ability to communicate in English at a common level of proficiency equivalent to level 4/6 according to the Vietnamese foreign language proficiency framework.					x			
3.3.2	Having the ability to use specialized tools to search for and understand technical terms, read, and comprehend technical documents related to information technology, communicate with partners,					x			

	and compose simple articles in the field of information technology in English.								
4	**Formulating ideas, designing, implementing, and operating in the context of business and society**								
4.1	**Social Context**								
4.1.1	Understanding the role and responsibility of information technology engineers towards society and the community.			x			x	x	x
4.1.2	Understanding the benefits of applying scientific and technological advancements in the field of information technology to real-life situations, and the pivotal role and influence of ICT in the era of Industry 4.00			x			x	x	x
4.1.3	Understanding and applying state regulations on information technology, specialized legal knowledge related to information technology, professional ethics, and the involvement of Vietnam in ICT applications.			x			x	x	x
4.1.4	Having the ability to analyze and evaluate to grasp current issues related to scientific and technological advancements in the field of information technology and the application of these advancements to ensure security, promote socio-economic development, major achievements of information technology, artificial intelligence, and data science in Vietnam and the world.			x			x	x	x
4.1.5	Having the ability to analyze and evaluate to understand the rapid changes and advancements in science and technology in information technology and the comprehensive impact of the industry on the domestic and global professional structure, production methods, and consumption patterns of society.			x			x	x	x
4.1.6	Having the ability to analyze and evaluate combined with entrepreneurial			x			x	x	x

	awareness, creativity based on knowledge and skills in information technology, and understanding of the context and needs of society.								
4.2	**Career context**								
4.2.1	Having the adaptability to practical situations and understanding of cultural diversity in enterprises, institutions, research institutes, and educational institutions operating in the field of information technology and applications of information technology.			x			x	x	x
4.2.2	Having the ability to analyze and evaluate to understand the level of technology and scientific and technical advances in the field of information technology, apply them to the context and problems that need to be solved by businesses to provide technical solutions and deployment methods to solve problems and improve the efficiency of business operations.			x			x	x	x
4.2.3	Having the ability to analyze to understand the strategy, objectives, and business plans of the employer or business where one works to build strategies, objectives, and business plans in the field related to information technology.	x		x			x	x	x
4.2.4	Having the ability to assess the value of products and the ability to commercialize information technology products.			x			x	x	x
4.2.5	Having the ability to observe and analyze flexibly in work to quickly grasp emerging or new issues, thereby adapting in different work environments, including high-pressure environments.			x			x	x	x
4.3	**Formulating ideas, developing plans, and building information technology systems**								

4.3.1	Having the ability to identify project goals and gather requirements for information technology projects.							x	
4.3.2	Having the ability to identify the function, principles, and architecture of information technology systems.						x		
4.3.3	Having the ability to analyze and study the feasibility of information technology systems.						x	x	x
4.3.4	Having the ability to describe specifications of the objectives and requirements of information technology systems.						x	x	x
4.4	**Designing**								
4.4.1	Understanding and applying the process and methods of designing information technology systems.						x	x	x
4.4.2	Understanding and applying the design architecture and components of information technology systems.						x	x	x
4.4.3	Designing for scalability, security, reliability, flexibility, and other objectives for applications and information technology systems.						x	x	x
4.5	**Implementing**								
4.5.1	Having the ability to design and build the implementation process of applications and information technology systems.						x	x	x
4.5.2	Understanding and applying the processes of implementing applications and information technology systems.						x	x	x
4.5.3	Applying knowledge to test, verify, and certify information technology systems.						x	x	x
4.5.4	Having the ability to verify and evaluate components or entire systems.						x	x	x
4.6	**Operating**								
4.6.1	Having the ability to manage the operation and optimize information technology systems.						x	x	x

4.6.2	Having the ability to train, educate, and operate applications and information technology systems.						x	x	x
4.6.3	Having the ability to maintain systems and resolve issues related to information technology systems.						x	x	x

6. FRAMEWORK OF TRAINING PROGRAM

The Information Technology discipline training program is designed for the entire course to be 150 credits (excluding the credits of the Physical Education and Defense Education courses).

The structure of knowledge that makes the Information Technology discipline and the number of credits distributed to the knowledge blocks are as follows:

Knowledge block		Number of credits		
		Total	**Compulsorily**	**Electively**
A – General education knowledge		46	31	15
A1	Political Theory	11	11	0
A2	Physical Education	(3)	(3)	0
A3	Military Education	(8.5)	(8.5)	0
A4	Overview Industry	3	3	0
A5	Specialized foreign language	3	3	0
A6	Mathematics, Informatics, and Natural Sciences	20	11	9
A7	Social and Humanities Sciences	9	3	6
B – Professional education knowledge		104	73	31
B1	Foundational knowledge	25	25	0
B2	Major knowledge	69	44	25
B3	Complementary knowledge	10	4	6
Total		**150**	104	46

7. TRAINING PROGRAM CONTENTS

No	Course code	Course name	Number of credits	Credits		
				Theory	**Ex.**	**Pract.**
		A - GENERAL EDUCATION	**26**			
		A1 - Political Science	**11**			
1	LC1101	Philosophy of Marxism-Leninism	3	3	0	0

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
2	LC1102	Political Economy of Marxism-Leninism	2	2	0	0
3	LC2101	Scientific socialism	2	2	0	0
4	LC2102	History of the Vietnamese Communist Party	2	2	0	0
5	LC3101	Ho Chi Minh's Ideology	2	2	0	0
		A2 - Physical Education	**(3)**			
6	TC1001	Physical Education 1	1	0	0	1
7	TC1002	Physical Education 2	1	0	0	1
8	TC2003	Physical Education 3	1	0	0	1
		A3 - National Defense and Security Education	**(8,5)**			
9	QP2101	National Defense and Security Education 1	(3)	(3)	(0)	(0)
10	QP2102	National Defense and Security Education 2	(2)	(2)	(0)	(0)
11	QP2103	National Defense and Security Education 3	(1.5)	(1)	(0)	(0.5)
12	QP2104	National Defense and Security Education 4	(2)	(0)	(0)	(2)
		A4 – Introduction to Information Technology	**3**			
13	20CT1101	Introduction to Information Technology	3	2	0	1
		A5 – Specialized foreign language	**3**			
14	20CT2103	English for Information Technology	3	1	2	0
		A6 – Mathematics, Informatics, and Natural Sciences	**20**			
		Compulsorily	**11**			
15	20TN0002	Discrete Mathematics	4	3	0	1
16	20CT1102	Principles of Structured Programming	4	2	0	2
17	20CT2102	Computer Architecture	3	2	0	1
		Electively	**9**			
18	20CT1103	Computer Maintenance	3	1	0	2

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
19	20CT1203	Applied Graphics	3	1	0	2
20	20TN1001	Advanced Mathematics B1	3	3	0	0
21	20TN1002	Advanced Mathematics B2	3	3	0	0
		A7 – Social and Humanities Sciences	**9**			
		Compulsorily	**3**			
22	20LH0001	General Law	3	2	1	0
		Electively	**6**			
23	20NV0002	Writing skills for administrative documents	3	2	1	0
24	20SP0001	General Psychology	3	2	1	0
25	20QT0006	Innovation and entrepreneurship	3	1	1	1
26	20QT0001	Introduction to Economics	3	2	1	0
27	20QT0004	Principles of Accounting	3	2	1	0
		B - PROFESSIONAL EDUCATION				
		B1 - Foundational Courses	**25**			
28	20CT1201	Data structures and algorithms	3	2	0	1
29	20CT1202	Principles of object-oriented programming	4	2	0	2
30	20CT2201	Database	4	3	0	1
31	20CT2202	Desktop application development	4	2	0	2
32	20CT2203	Computer Networking	4	2	0	2
33	20CT2204	Operating system	3	2	0	1
34	20CT2205	Basic Project	3	1	0	2
		B2 - Major Courses				
		Specialization in Computer Networking				
		Compulsorily	**44**			
35	20CT3120	Open-source Operating System	3	1	0	2
36	20CT3121	Windows Network Management	4	2	0	2
37	20CT3122	Network Routing	3	2	0	1
38	20CT3202	Major Project	3	1	0	2

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
39	20CT3221	Linux Network Management	3	1	0	2
40	20CT3220	Network Design	3	2	0	1
41	20CT3204	Career Visiting	1	0	0	1
42	20CT4120	Distributed System	3	2	0	1
43	20CT4121	Network Security	3	2	0	1
44	20CT4201	Internship	8	0	0	8
45	20CT4202	Thesis	10	0	0	10
		Electively – Choosing at least 25 credits from the listed below	**25/39**			
46	20CT3222	System Safety and Security	3	2	0	1
47	20CT3103	Web application development	4	2	0	2
48	20CT3123	Cryptography and information coding	4	3	0	1
49	20CT3124	Thematic network 1	4	2	0	2
50	20CT3223	Virtualization Technologies	3	2	0	1
51	20CT3224	Blockchain	3	2	0	1
52	20CT3225	Internet of Things	3	2	0	1
53	20CT4122	Integrated System Deployment	3	1	0	2
54	20CT4107	E-commerce	3	2	0	1
55	20CT4126	Voice over IP	3	2	0	1
56	20CT4125	Next Generation Network	3	2	0	1
57	20CT4124	Thematic Network 2	3	2	0	1
		Specialization in Software Engineering				
		Compulsorily	**44**			
35	20CT3101	Software engineering	3	2	0	1
36	20CT3102	Mobile application development	3	1	0	2
37	20CT3103	Web application development	4	2	0	2
38	20CT3203	Design Patterns	3	2	0	1
39	20CT3201	Advanced web application development	3	2	0	1
40	20CT3202	Major Project	3	1	0	2

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
41	20CT4101	Information Technology Project Management	3	2	0	1
42	20CT4102	Open-source application development	3	2	0	1
43	20CT3204	Career Visiting	1	0	0	1
44	20CT4201	Internship	8	0	0	8
45	20CT4202	Thesis	10	0	0	10
		Electively – Choosing at least 25 credits from the listed below	**25/37**			
46	20CT3104	User Interface Design	3	2	0	1
47	20CT4105	Web services	3	2	0	1
48	20CT3205	Software Analysis and Design	3	2	0	1
49	20CT4107	E-commerce	3	2	0	1
50	20CT3208	Game application development	3	2	0	1
51	20CT3206	Software testing	3	2	0	1
52	20CT3113	Machine learning methods	4	2	0	2
53	20CT4103	Advanced game application development	3	2	0	1
54	20CT4104	Advanced Topics in Software Development Technology	3	2	0	1
55	20CT3105	Java Programming	3	2	0	1
56	20CT3207	Advanced Java programming	3	2	0	1
57	20CT4106	Advanced mobile application development	3	2	0	1
		Specialization in Data Science				
		Compulsorily	**44**			
35	20TN3111	Probability and statistics	3	2	0	1
36	20CT3112	Advanced Data structures and Algorithms	3	2	0	1
37	20CT3113	Machine learning methods	4	2	0	2
38	20CT3211	Artificial Intelligence	3	2	0	1
39	20CT3212	Image Processing	3	2	0	1

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
40	20CT3202	Major Project	3	1	0	2
41	20CT4111	Data mining	3	2	0	1
42	20CT4112	Big Data	3	2	0	1
43	20CT3204	Career Visiting	1	0	0	1
44	20CT4201	Internship	8	0	0	8
45	20CT4202	Thesis	10	0	0	10
		Electively – Choosing at least 26 credits from the listed below	**26/48**			
46	20CT3123	Cryptography and information coding	4	3	0	1
47	20CT3103	Web application development	4	2	0	2
48	20CT3102	Mobile application development	3	1	0	2
49	20CT3213	Parallel Programming	3	2	0	1
50	20CT3225	Internet of Things	3	2	0	1
51	20CT3214	Advanced Machine Learning	3	2	0	1
52	20CT3215	Data Pre-processing and Analysis	3	2	0	1
53	20CT3216	Advanced Python programming	3	2	0	1
54	20CT4113	Computer Vision	4	2	0	2
55	20CT4114	Natural Language Processing	3	2	0	1
56	20CT4115	Neural Network	3	2	0	1
57	20CT4116	Cloud Computing	3	2	0	1
59	20CT4117	Thematic	3	2	0	1
60	20CT4118	R Programming for Data Science	3	2	0	1
61	20CT4119	Semantic Web	3	2	0	1
		B3 - Complementary Courses				
		Compulsorily				
63	20CT2101	Web design	4	2	0	2

No	Course code	Course name	Number of credits	Credits		
				Theory	Ex.	Pract.
		Electively – Choosing at least 6 credits from the listed below	**6/9**			
64	20CT3108	Methods of scientific research	3	1	0	2
65	20CT3107	Network programming	3	2	0	1
66	20CT3106	Python Programming	3	2	0	1
		Total	**150**			

8. TEACHING PLAN

8.1. Combination of General education knowledge and Professional education knowledge

S1	S2	S3	S4	S5	S6	S7	S8
General education knowledge							
	Professional education knowledge						
				Major knowledge			
							Graduation thesis

8.2. Teaching plan by semesters

1st SEMESTER								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	LC1101	Philosophy of Marxism-Leninism	3	3	0	0	3	
2	TC1001	Physical Education 1	(1)				(1)	
3	20CT1101	Introduction to Information Technology	3	2	0	1	3	
4	20CT1102	Principles of Structured Programming	4	2	0	2	4	
5	20CT1103	Computer Maintenance	3	1	0	2		3
6	20LH0001	General Law	3	2	1	0	3	
		Total	**16**	**11**	**0**	**5**	**13**	**3**

2nd SEMESTER								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	LC1102	Political Economy of Marxism-Leninism	2	2	0	0	2	
2	TC1002	Physical Education 2	(1)		0		(1)	
3	20CT1201	Data structures and algorithms	3	2	0	1	3	
4	20CT1202	Principles of object-oriented programming	4	2	0	2	4	
5	20TN0002	Discrete Mathematics	4	3	0	1	4	
Choosing at least 6 credits from the listed below			**6/12**					
6	20CT1203	Applied Graphics	3	1	0	2		3
7	20TN1001	Advanced Mathematics B1	3	3	0	0		3
8	20SP0001	General Psychology	3	2	1	0		3
9	20QT0004	Principles of Accounting	3	2	1	0		3
		Total	**19**	**15**	**0**	**4**	**13**	**6**

3rd SEMESTER								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	LC2101	Scientific socialism	2	2	0	0	2	
2	TC2003	Physical Education 3	(1)	(0)	(0)	(1)	(1)	
3	QP2101	National Defense and Security Education 1	(3)	(3)	(0)	(0)	(3)	
4	QP2102	National Defense and Security Education 2	(2)	(2)	(0)	(0)	(2)	
5	QP2103	National Defense and Security Education 3	(1.5)	(1)	(0)	(0.5)	(1.5)	
6	QP2104	National Defense and Security Education 4	(2)	(0)	(0)	(2)	(2)	
7	20CT2101	Web design	4	2	0	2	4	
8	20CT2102	Computer Architecture	3	2	0	1	3	
9	20CT2103	English for Information Technology	3	1	2	0	3	

Choosing at least 6 credits from the listed below			**6/12**					
10	20TN1002	Advanced Mathematics B2	3	3	0	0		3
11	20NV0002	Writing skills for administrative documents	3	2	1	0		3
12	20QT0006	Innovation and entrepreneurship	3	1	1	1		3
13	20QT0001	Introduction to Economics	3	2	1	0		3
		Total	**18**	**14**	**1**	**3**	**12**	**6**

4th SEMESTER								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	LC2102	History of the Vietnamese Communist Party	2	2	0	0	2	
2	20CT2201	Database	4	3	0	1	4	
3	20CT2202	Desktop application development	4	2	0	2	4	
4	20CT2203	Computer Networking	4	2	0	2	4	
5	20CT2204	Operating system	3	2	0	1	3	
6	20CT2205	Basic Project	3	1	0	2	3	
		Total	**20**	**12**	**0**	**8**	**20**	

5th SEMESTER								
SPECIALIZATION IN COMPUTER NETWORKING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	LC3101	Ho Chi Minh's Ideology	2	2	0	0	2	
2	20CT3120	Open-source Operating System	3	2	0	1	3	
3	20CT3121	Windows Network Management	4	2	0	2	4	
4	20CT3122	Network Routing	3	2	0	1	3	
Choosing at least 4 credits			**4/12**					

5	20CT3103	Web application development	4	2	0	2		4
6	20CT3123	Cryptography and information coding	4	3	0	1		4
7	20CT3124	Thematic Network 1	4	2	0	2		4
Choosing at least 6 credits (complementary knowledge)			**6/9**					
8	20CT3106	Python Programming	3	2	0	1		3
9	20CT3107	Network programming	3	2	0	1		3
10	20CT3108	Methods of scientific research	3	1	0	2		3
		Total	**22**	**14**	**0**	**8**	**10**	**10**

SPECIALIZATION IN SOFTWARE ENGINEERING

No	COURSE CODE	COURSE NAME	NUMBER OF CREDITS	CREDITS			CREDITS	
				T	E	P	C	E
1	LC3101	Ho Chi Minh's Ideology	2	2	0	0	2	
2	20CT3101	Software engineering	3	2	0	1	3	
3	20CT3102	Mobile application development	3	1	0	2	3	
4	20CT3103	Web application development	4	2	0	2	4	
Choosing at least 3 credits			**3/6**					
5	20CT3104	User Interface Design	3	2	0	1		3
6	20CT3105	Java Programming	3	2	0	1		3
Choosing at least 6 credits (complementary knowledge)			**6/9**					
7	20CT3106	Python Programming	3	2	0	1		3
8	20CT3107	Network programming	3	2	0	1		3
9	20CT3108	Methods of scientific research	3	1	0	2		3
		Total	**21**	**14**	**0**	**7**	**12**	**9**

SPECIALIZATION IN DATA SCIENCE

No	COURSE CODE	COURSE NAME	NUMBER OF CREDITS	CREDITS			CREDITS	
				T	E	P	C	E
1	LC3101	Ho Chi Minh's Ideology	2	2	0	0	2	
2	20TN3111	Probability and statistics	3	2	0	1	3	
3	20CT3112	Advanced Data structures and algorithms	3	2	0	1	3	

4	20CT3113	Machine learning methods	4	2	0	2	4	
Choosing at least 3 credits			**3/10**					
5	20CT3103	Web application development	4	2	0	2		4
6	20CT3102	Mobile application development	3	1	0	2		3
7	20CT3123	Cryptography and information coding	4	3	0	1		4
Choosing at least 6 credits (complementary knowledge)			**6/9**					
8	20CT3106	Python Programming	3	2	0	1		3
9	20CT3107	Network programming	3	2	0	1		3
10	20CT3108	Methods of scientific research	3	1	0	2		3
		Total	**21**	**14**	**0**	**7**	**12**	**9**

6th SEMESTER								
SPECIALIZATION IN COMPUTER NETWORKING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT3220	Network Design	3	2	0	1	3	
2	20CT3202	Major Project	3	1	0	2	3	
3	20CT3204	Career Visiting	1	0	0	1	1	
4	20CT3221	Linux Network Management	3	1	0	2	3	
Choosing at least 9 credits			**9/12**					
5	20CT3222	System Safety and Security	3	2	0	1		3
6	20CT3223	Virtualization Technologies	3	2	0	1		3
7	20CT3224	Blockchain	3	2	0	1		3
8	20CT3225	Internet of Things	3	2	0	1		3
		Total	**19**	**12**	**0**	**7**	**10**	**9**
SPECIALIZATION IN SOFTWARE ENGINEERING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT3201	Advanced web application development	3	2	0	1	3	

2	20CT3202	Major Project	3	1	0	2	3	
3	20CT3203	Design Patterns	3	2	0	1	3	
4	20CT3204	Career Visiting	1	0	0	1	1	
Choosing at least 9 credits			**9/12**					
5	20CT3205	Software Analysis and Design	3	2	0	1		3
6	20CT3206	Software testing	3	2	0	1		3
7	20CT3207	Advanced Java programming	3	2	0	1		3
8	20CT3208	Game application development	3	2	0	1		3
		Total	**19**	**11**	**0**	**8**	**10**	**9**

SPECIALIZATION IN DATA SCIENCE

No	COURSE CODE	COURSE NAME	NUMBER OF CREDITS	CREDITS			CREDITS	
				T	E	P	C	E
1	20CT3211	Artificial Intelligence	3	2	0	1	3	
2	20CT3202	Major Project	3	1	0	2	3	
3	20CT3212	Image Processing	3	2	0	1	3	
4	20CT3204	Career Visiting	1	0	0	1	1	
Choosing at least 9 credits			**9/15**					
5	20CT3213	Parallel Programming	3	2	0	1		3
6	20CT3225	Internet of Things	3	2	0	1		3
7	20CT3214	Advanced Machine Learning	3	2	0	1		3
8	20CT3215	Data Pre-processing and Analysis	3	2	0	1		3
9	20CT3216	Advanced Python programming	3	2	0	1		3
		Total	**19**	**11**	**0**	**8**	**10**	**9**

7th SEMESTER

SPECIALIZATION IN COMPUTER NETWORKS AND COMMUNICATIONS

No	COURSE CODE	COURSE NAME	NUMBER OF CREDITS	CREDITS			CREDITS	
				T	E	P	C	E
1	20CT4120	Distributed System	3	2	0	1	3	
2	20CT4121	Network Security	3	2	0	1	3	
Choosing at least 12 credits			**12/15**					

3	20CT4122	Integrated System Deployment	3	1	0	2		3
4	20CT4107	E-commerce	3	2	0	1		3
5	20CT4124	Thematic Network 2	3	2	0	1		3
6	20CT4125	Next Generation Network	3	2	0	1		3
7	20CT4126	Voice over IP	3	2	0	1		3
		Total	**18**	**11**	**0**	**7**	**6**	**12**
SPECIALIZATION IN SOFTWARE ENGINEERING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT4101	Information Technology Project Management	3	2	0	1	3	
2	20CT4102	Open-source application development	3	2	0	1	3	
Choosing at least 15 credits			**15/18**					
3	20CT4103	Advanced game application development	3	2	0	1		3
4	20CT4104	Advanced Topics in Software Development Technology	3	2	0	1		3
5	20CT3113	Machine learning methods	4	2	0	2		3
6	20CT4105	Web services	3	2	0	1		3
7	20CT4106	Advanced mobile application development	3	2	0	1		3
8	20CT4107	E-commerce	3	2	0	1		3
		Total	**21**	**14**	**0**	**7**	**6**	**15**
SPECIALIZATION IN DATA SCIENCE								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT4111	Data Mining	3	2	0	1	3	
2	20CT4112	Big Data	3	2	0	1	3	
Choosing at least 15 credits			**15/22**					
3	20CT4113	Computer Vision	4	2	0	2		4
4	20CT4114	Natural Language Processing	3	2	0	1		3
5	20CT4115	Neural Network	3	2	0	1		3
6	20CT4116	Cloud Computing	3	2	0	1		3
7	20CT4117	Thematic	3	2	0	1		3

8	20CT4118	R programming for data science	3	2	0	1		3
9	20CT4119	Semantic Web	3	2	0	1		3
		Total	**21**	**14**	**0**	**7**	**6**	**15**

8th SEMESTER								
SPECIALIZATION IN COMPUTER NETWORKING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT4201	Internship	8	0	0	8	8	
2	20CT4202	Thesis	10	0	0	10	10	
		Total	**18**	**0**	**0**	**18**	**18**	
SPECIALIZATION IN SOFTWARE ENGINEERING								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT4201	Internship	8	0	0	8	8	
2	20CT4202	Thesis	10	0	0	10	10	
		Total	**18**	**0**	**0**	**18**	**18**	
SPECIALIZATION IN DATA SCIENCE								
No	**COURSE CODE**	**COURSE NAME**	**NUMBER OF CREDITS**	**CREDITS**			**CREDITS**	
				T	**E**	**P**	**C**	**E**
1	20CT4201	Internship	8	0	0	8	8	
2	20CT4202	Thesis	10	0	0	10	10	
		Total	**18**	**0**	**0**	**18**	**18**	

9. LIST OF LECTURERS IMPLEMENTING THE PROGRAM

9.1. List of formally available lecturers

(*) Experience of teaching in foreign languages: teaching place, teaching experience, type of language

No.	**FULL NAME**	**YEAR OF BIRTH**	**DIPLOMA, TRAINING ACADEMIC DISCIPLINE**	**TEACHING EXPERIENCE (*)**	**COURSE(S) IN CHARGE**

1	Vo Phuong Binh	1984	M.Sc.: Computer science Ph.D.: Computer science and information engineering	15 years	• Software Engineering • Software Testing • Image Processing • Pre-processing and data analysis
2	Le Gia Cong	1982	Bachelor: Informatics	16 years	• Web design • Web application development • Advanced Topics in Software Development Technology
3	Nguyen Van Huy Dung	1992	Engineer: Computer Networks and Communications	5 years	• Virtualization Technologies • System Safety and Security • Voice Over IP • Thematic Network 2 • Next Generation Network
4	Dang Thanh Hai	1973	M.Sc.: Computer science Ph.D.: Mathematical Basis for Informatics	23 years	• Operating system • Methods of scientific research • Cloud computing • Parallel Programming
5	Nguyen Minh Hiep	1981	M.Sc.: Computer science	17 years	• Design Patterns • Machine Learning methods • Advanced Machine Learning
6	Tran Ngo Nhu Khanh	1982	M.Sc.: Computer science	16 years	• Open-source operating system • Internet of Things • Network programming

			Ph.D.: Information technology		• Computer architecture • Introduction to Information Technology
7	Doan Minh Khue	1989	M.Sc.: Information system	7.5 years	• Network Design • Cryptography and information coding
8	Tran Thi Phuong Linh	1990	M.Sc.: Information system	6.5 years	• Open-source application development • User Interface Design
9	Nguyen Thi Luong	1983	M.Sc.: Computer science Ph.D.: Mathematical Basis for Informatics	15 years	• Information Technology Project Management • Advanced Data Structures and Algorithms • Natural Language Processing • Introduction to Information Technology
10	Phan Thi Thanh Nga	1985	M.Sc.: Information system	11 years	• Desktop Application Development • Advanced Java Programming • R Programming for Data Science
11	Vu Minh Quan	1989	M.Sc.: Computer Networking	8.5 years	• Computer Networking • Windows Network Management • Network Security • Thematic Network 1

12	Pham Duy Loc	1984	M.Sc.: Computer Networking	11 years	• Linux Network Management • E-commerce • Integrated System Deployment • Computer Maintenance • Blockchain
13	Tran Nhat Quang	1991	M.Sc.: Information system	6 years	• Software Analysis and Design
14	Thai Duy Quy	1984	M.Sc.: Computer science	11 years	• Mobile application development • Game application development • Advanced game application development • Computer Vision
15	Ta Hoang Thang	1985	M.Sc.: Computer science	11 years	• Advanced web application development • Web services
16	Tran Thong	1978	M.Sc.: Computer science	21 years	• Network Routing • Distributed System • Principles of object-oriented programming • Semantic Web

9.2. List of invited lectures

No.	FULL NAME	YEAR OF BIRTH	DIPLOMA, TRAINING ACADEMIC DISCIPLINE	TEACHING EXPERIENCE (*)	COURSE(S) IN CHARGE
1	Tran Ngoc Anh	1978	Ph.D.: Computer science	21 years	• Neuron Network

2	Duong Van Hai	1982	Ph.D.: Computer science	16 years	• Artificial Intelligence • Data Mining
3	Dang Tuan Hiep	1983	Ph.D., Mathematics	10 years	• Python Programming • Advanced Python Programming
4	Phan Viet Hoang	1951	Ph.D.: Information Technology	20 years, University of California	• Advanced mobile application development • Big Data
5	Tran Tuan Minh	1953	M.Sc.: Mathematics M.Sc.: Computer science	30 years	• Principles of Structured Programming • Data structures and algorithms
6	Ta Thi Thu Phuong	1977	M.Sc.: Computer science	22 years	• Database
7	Hoang Minh Tien	1977	M.Sc.: Computer science	19 years	• Discrete Mathematics
8	Huynh Bao Tuyen	1984	Ph.D., Statistics	14 years	• Probability and statistics
9	Phan Tuan Anh	1985	Engineer: Computer science M.Sc.: Business Administration	16 years	• Applied Graphics
10	Truong Thi Ngoc Thuyen	1976	Ph.D.: Management	22 years	• Innovation and entrepreneurship
11	Do Trong Hoai	1976	Ph.D.: Finance	22 years	• Introduction to Economics
12	Le Vu Phuong Thao	1979	M.Sc.: Finance - Banking	19 years	• Principles of Accounting
13	Vo Sy Loi	1978	Ph.D.: Psychology	18 years	• General Psychology

14	Nguyen Huu Kim Duyen	1986	M.Sc.: Vietnamese Literature	10 years	• Writing skills for administrative documents
15	Nguyen Van Nghiep	1980	Ph.D.: Laws	10 years	• General Law

9.3. List of learning consultants

No.	FULL NAME	YEAR OF BIRTH	DIPLOMA, TRAINING ACADEMIC DISCIPLINE	TEACHING EXPERIENCE (*)	COURSE(S) IN CHARGE
1	Le Gia Cong	1982	Bachelor: Informatics	16 years	• Web design • Web application development • Advanced Topics in Software Development Technology
2	Nguyen Van Huy Dung	1992	Engineer: Computer Networks and Communications	5 years	• Virtualization Technologies • System Safety and Security • Voice Over IP • Thematic Network 2 • Next Generation Network
3	Doan Minh Khue	1989	M.Sc.: Information system	7.5 years	• Network Design • Cryptography and information coding
4	Tran Thi Phuong Linh	1990	M.Sc.: Information system	6.5 years	• Open-source application development • User Interface Design
5	Pham Duy Loc	1984	M.Sc.: Computer Networking	11 years	• Linux Network Management • E-commerce • Integrated System Deployment

					• Computer Maintenance • Blockchain
6	Thai Duy Quy	1984	M.Sc.: Computer science	11 years	• Mobile application development • Game application development • Advanced game application development • Computer Vision

10. INFRASTRUCTURES FOR LEARNING

10.1. Laboratory and main laboratory equipment system:

No.	LABORATORY/FACTORY	MANAGEMENT UNIT	NOTE
1	Computer practical lab: TV1, TV2, TV3, TV4, A24.1, A24.2	Information Technology Center	
2	Computer practical lab: A6.2	Faculty of Information Technology	

10.2. Library

School library, electronic library of faculty.

10.3. Textbook, Lesson

No.	COURSE NAME	TEXTBOOK, COURSE	AUTHOR NAME	PUBLISHER, PUBLISHING YEAR/WEBSITE
1	Introduction to Information Technology	Introduction to Information Technology	• Dang Thanh Hai • Hoang Manh Hung	Dalat University (Internal circulation), 2008
		Practice computer skills	• Le Gia Cong	Dalat University (Internal circulation), 2008
		Internet and services	• Hoang Manh Hung • Phan Thi Thanh Nga	Dalat University (Internal circulation), 2008
2	Applied Graphics	Photoshop	• Hoang Manh Hung	Dalat University (Internal circulation), 2008

3	Computer Networking	Computer Networking	• Tran Ngo Nhu Khanh	Dalat University (Internal circulation), 2008
4	Database	Database	• Cao Thi Nhan	Dalat University (Internal circulation), 2008
5	Operating System	Operating System	• Dang Thanh Hai	Dalat University (Internal circulation), 2008
6	Principles of object-oriented programming	Object-oriented programming	• Tran Thong	Dalat University (Internal circulation), 2008
7	Principles of Structured Programming	Structured Programming with C++	• Tran Tuan Minh • Nguyen Thi Luong	Dalat University (Internal circulation), 2008
8	Desktop Application Development	Programming tools and environments	• Nguyen Minh Hiep	Dalat University (Internal circulation), 2008
		Desktop Application Development	• Phan Thi Thanh Nga • Thai Duy Quy • Tran Thi Phuong Linh	Dalat University (Internal circulation), 2020
9	Discrete Mathematics	Discrete Mathematics	• Pham Tien Son	Dalat University (Internal circulation), 2008
10	Data structures and algorithms	Data Structures and Algorithms 1	• Tran Tuan Minh • Nguyen Thi Thanh Binh	Dalat University (Internal circulation), 2008
11	Advanced data structures and algorithms	Data Structures and Algorithms 2	• Nguyen Thi Thanh Binh	Dalat University (Internal circulation), 2008
12	Web Design	Web Programming	• Hoang Manh Hung	Dalat University (Internal circulation), 2008
13	Computer Architecture and Organization	Computer Architecture and Organization	• Phan Van Nghia	Dalat University (Internal circulation), 2008
14	Software Engineering	Software Engineering	• Nguyen Van Phuc Nguyen Minh Hiep	Dalat University (Internal circulation), 2017

			Vo Phuong Binh Nguyen Thi Luong Dinh Viet Tuan Thai Duy Quy	
15	Image Processing	Computer Graphics	• Vo Phuong Binh	Ministry-level curriculum, 2010

11. PROGRAM IMPLEMENTATION GUIDELINES

The Information Technology training program is built based on the regulations for university and college training under the credit-based system of Dalat University, with reference to domestic and international Information Technology training programs and the process of building training programs according to the CDIO output standard. The program is designed for a 4-year training period and implemented according to the credit-based training system.

The program content includes General Education and Professional Education. To complete this program, students need to accumulate a minimum total of 150 credits for the entire program, excluding Physical Education, National Defense Education, and Security Education, of which the number of credits for compulsory courses is 104 and the minimum number of credits for elective courses is 46.

In the General Education section, students will study the Introduction to Information Technology course and courses on Political Theory, Physical Education, National Defense Education, and Security Education according to the general regulations of the University. In addition, students will also study some selective courses in Mathematics, Natural Sciences, Social Sciences and Humanities, and IT English.

In the Professional Education section, in the fundamental knowledge section, students are equipped with basic courses on computers, operating systems, data structures and algorithms, object-oriented programming principles, along with foundational courses of the Information Technology field. In the specialized knowledge section, students are equipped with courses related to in-depth practice in Information Technology. The elective courses in the specialized knowledge section are quite diverse, and students can choose courses that they are interested in and passionate about. These could be courses that delve into different aspects of Information Technology practice in various fields such as Computer Networking and Communications; Software Technology; Open-Source Technology; Mobile Technology; Artificial Intelligence; and Data Science.

During the learning process, in addition to studying courses at school, students need to complete an important internship course, which is the Professional Internship course.

This course provides opportunities for students to apply what they have learned in practice, thereby contributing to the development of IT professional skills. With the Professional Internship course, students will intern at IT companies, technology-oriented businesses, and agencies both within and outside Lam Dong province. During the internship, students will receive guidance, supervision, and support from the internship supervisors, who are called Supervising Instructor.

In addition, students must also complete the Graduation Thesis course, which will provide students with the opportunity to specialize in a narrow research direction within the major or the intersection between different majors.

The Information Technology program is designed according to the output standards approach, while balancing between theory and practice, focusing on developing three aspects of knowledge, skills, and attitudes. Thus, the program when implemented will help students develop professional skills that society requires. The program is also compiled with innovative teaching and learning methods at the university level.

Regarding graduation requirements, students will be awarded a Bachelor of Engineering in Information Technology Degree after accumulating a minimum of 150 credits, including accumulating the full number of credits for the courses in the General Education and Professional Education knowledge blocks, obtaining certificates in Physical Education and National Defense Education, and achieving foreign language proficiency standards./.

RECTORATE	**DEPARTMENT OF UNDERGRADUATE ACADEMIC AFFAIRS**	**DEAN**
Dr. Le Minh Chien	Dr. Tran Huu Duy	Dr. Tran Ngo Nhu Khanh

APPENDIX OF COURSES

COURSES BELONG TO THE GENERAL KNOWLEDGE BLOCK

[LC1101] – Philosophy of Marxism-Leninism

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

This course equips students with a worldview and methodology of Marxism-Leninism. The course content includes an introductory chapter introducing a brief description of Marxism-Leninism and some general problems of the course. The rest is structured into three chapters covering the main contents of the Marxist-Leninist worldview and methodology. That are materialism, materialistic dialectic, and historical materialism.

[LC1102] – Political Economy of Marxism-Leninism

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Philosophy of Marxism-Leninism.

This course provides students with a Marxism-Leninism worldview and methodology, which introduces three main contents of the economic theory of Marxism-Leninism about the capitalist mode of production.

[LC2101] – Scientific socialism

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Political Economy of Marxism-Leninism.

This course continues to equip students with a Marxism-Leninism worldview and methodology, presenting the main contents of the theory of Marxism-Leninism about socialism and realism and prospect socialism.

[LC2102] – History of the Vietnamese Communist Party

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course equips students with a basic understanding of the Party's line during the national revolution, people's democracy, and the construction of socialism. The course aims to foster students' belief in the Party's leadership according to the Party's goals and ideals to raise students' sense of responsibility in the face of critical national tasks. The course also helps students apply theoretical political knowledge to solve economic, political, cultural, and social problems proactively and actively according to the Party's lines and policies.

[LC3101] – Ho Chi Minh's Ideology

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course equips students with basic knowledge about the life, career, and thought of Ho Chi Minh President. Through the course, students can realize the fundamental role of Ho Chi Minh's ideology, theory of thought, and the application of the Party in the Vietnamese Revolution. The course is also aimed at fostering students for a revolutionary perspective stance on the foundation of Marxism-Leninism, Ho Chi Minh's ideology; persistently national independence goal associated with socialism; actively fight against wrong views to protect Marxism-Leninism and Ho Chi Minh's thoughts, guidelines, and lines of the Party, laws of the State. Based on the learned knowledge, students apply in their lives, study, cultivate, train themselves, fulfill their duties, and contribute positively and effectively to the revolutionary cause following the path chosen by Ho Chi Minh and the Party.

[TC1001] – Physical Education 1

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

This course equips students with essential knowledge and skills in athletics, including a history of athletics development; some of the basic techniques of athletics like running small steps, running thigh elevation, cycling after, running 100m at the start. Simultaneously, the course also

helps students understand the competition rules, the method of organizing the tournament and being an athletic referee. Through the practice of the athletic exercises designed in the course, students can apply to develop their physical health and improve their motor skills in all aspects, including fastness, power, endurance, finesse, and flexibility.

[TC1002] – Physical Education 2

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

For Physical Education 2, students can choose between badminton, table tennis, soccer, or handball.

For badminton, the course equips students with basic badminton knowledge and skills, including position, effect, and history of badminton development, the badminton basic principles, and techniques. Simultaneously, the course also helps students understand the competition rules, the tournament organizing method, and being a badminton referee. At the same time, the course also helps students understand the competition rules, the method of organizing the tournament and being a badminton referee.

For table tennis, the course equips students with essential knowledge and skills about table tennis, including the history of formation and table tennis development, basic techniques, and tactics. Simultaneously, the course also helps students understand the rules of the competition, methods of organizing the tournament, and being a table tennis referee.

For soccer, the course equips students with essential knowledge and skills about football, including the history and effects of football; principles of football techniques; techniques for moving, kicking, stopping, dribbling, contesting, headers, and boundary throws; Basic tactics individually, team, and as a whole team. At the same time, the course also helps students understand the competition rules, methods of organizing tournaments and refereeing football.

For handball, the course equips students with essential knowledge and skills, including the history of the formation and development of handball, basic handball attack, and defense tactics. At the same time, the course also helps students understand the competition rules, the method of organizing the tournament and being a handball referee.

Through practicing exercises in the badminton, table tennis, soccer, and handball disciplines designed in the course, students can apply them to develop their physical health and improve their athletic abilities in all aspects, including fastness, power, endurance, finesse, and flexibility.

[TC2003] – Physical Education 3

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course equips students with essential knowledge and skills on volleyball, including a history of volleyball development; technical principles; basic techniques such as preparing and moving, rolling over to save the ball; basic techniques such as high-hand passes, low-hand passes, smashing, and blocking; basic offensive and defensive tactics. At the same time, the course also helps students understand the competition rules, the method of organizing the tournament and being a volleyball referee. Through the practice of volleyball exercises designed in the course, students can apply to develop their physical health and improve their motor skills in all aspects, including fastness, power, endurance, finesse, and flexibility.

[QP2101] – Military Education 1

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course equips students with the Party's basic theoretical knowledge system on military policy, including the fundamental issues of Marxist-Leninist doctrine; Ho Chi Minh's ideology on war, the military, and protecting the country; Party's views on the people's war, building the armed forces, the all-people defense, the people's security; the Party's views on combining socio-economic development with strengthening national defense and security. In addition, the course introduces some critical content about the history of Vietnamese military art through many periods.

[QP2102] – Military Education 2

Number of credits: 2 (Theory: 2 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Military Education 1.

The course introduces the theory combined with practice to equip students with basic knowledge of maps, military topography, command facilities to serve the mission of learning tactics and commanding combat; features, effects, structure, use, and preservation of infantry weapons, including AK, CKC, RPD, RPK, B40, B41; feature characteristics, and techniques of using explosives; prevention of nuclear, chemical, biological, fire weapons; war wounds and methods of handling; practice the formation of classes and blocks. In addition, the course also introduces three military coordination subjects so that students can participate in athletics and defense sports.

[QP2103] – Military Education 3

Number of credits: 1.5 (Theory: 1 – Practice: 0.5)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Military Education 2.

The course helps students to comprehend the basics of the defense and security tasks of the Party and State in the new situation, including building the militia, self-defense, and reserve force to increase the potential of infrastructure, defense techniques, and high-tech war prevention to defeat the strategy of "peaceful evolution" and the overthrow of the hostile forces toward the Vietnamese revolution. In addition, this course also mentions several issues: ethnicity, religion, and the struggle to prevent the enemy from taking advantage of the problem of ethnicity and religion against the Vietnamese revolution; building and protecting border sovereignty, sea and island sovereignty, national security, fighting against crime and maintaining social order and safety.

[QP2104] – Military Education 4

Number of credits: 2 (Theory: 0 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Military Education 2.

According to the regulations of Dalat University on teaching common courses for all students.

[20CT1101] – Introduction to Information Technology

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

Introduction to Information Technology is a compulsory course in the general education block, providing students with basic knowledge of informatics, basic components and functions of computers, information processing, and operating systems. It also includes knowledge related to the Internet and services. The course also introduces and helps students practice the applications of office programs (text editing, spreadsheet processing, slideshow presenting), providing knowledge of professional ethics, law, and employment opportunities related to Information Technology. In addition, the course helps students to work in groups and orient their future careers.

[20CT2103] – English for Information Technology

Number of credits: 3 (Theory: 1 – Exercise: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The English for Information Technology is given in the general knowledge block of the second semester. The course teaches students how to apply language knowledge such as vocabulary, semantics, phonetics, and grammar to use in information technology-related fields at an intermediate level and communicate with IT topics through listening, speaking, reading, and writing, which are appropriate for specific purposes in the IT industry.

[20TN0002] – Discrete Mathematics

Number of credits: 4 (Theory: 3 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The Discrete Mathematics course is a compulsory part of the general education knowledge block in the training program, which presents the basic knowledge of Discrete Mathematics. Specifically, the contents such as Basic knowledge of sets and mapping; Logical basis (propositional logic and propositional operations, propositional form, rules of inference, predicate, and quantifier, mathematical induction); Basic knowledge of algorithms and computational complexity of algorithms; Method of counting the elements (the basics of counting, compensation principle, pigeonhole principle, permutations and combinations, and advanced counting techniques such as regression coefficient); Relations (relations and their properties, representing relations, equivalence relations, closures of relations, and partial orderings); Lattices and Boolean Algebra (Boolean function, representing Boolean functions, logic gates, minimization of circuits).

[20CT1102] – Principles of Structured Programming

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course provides students with the main contents: principles of structured programming in program design, how to describe and implement algorithms and present the basic contents of C/C++ programming language to illustrate structured program organization; Structural programming principles were introduced, such as functional decomposition program, top-down program design, gradual smoothing ...; Presents the method of

organizing a structured program in the form of libraries, menus. The course also visually introduces the concept and how to describe simple and recursive algorithms. Students must know how to use Word and Presentation software to present and report exercises.

[20CT2102] – Computer Architecture

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course is a compulsory course of the general knowledge block, providing students with basic knowledge about some model architectures of computers, the organization, and functions of components in computer architecture, such as microprocessors, memory, I/O input systems, and bus lines. The course also equips students with the software architecture and instruction set architecture of the 80x86 microprocessor and assembly language applications to write programs using the instruction sets of this instruction.

In addition, the course also helps students research, synthesize documents, present reports, and presentations, and develop teamwork skills.

[20CT1103] – Computer Maintenance

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

Computer maintenance is an elective course of the general knowledge block, providing students with knowledge and techniques for maintaining computers; detecting and fixing hardware, software, and operating system problems; backup and recovery techniques for local and remote systems and data; system management. In addition, the course also helps students to gain skills in report writing, presentation, and collaboration.

[20CT1203] – Applied Graphics

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Introduction to Information Technology.

Applied Graphics is an elective course allocated within the general knowledge block. The course equips students with knowledge of principles in graphic design, enabling them to apply what they have learned to use graphic design tools such as Photoshop and Corel.

Additionally, the course helps students enhance their teamwork, research, and reporting skills.

[20TN1001] – Advanced Mathematics B1

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Advanced Mathematics B1 is an elective course of the general knowledge block, providing students with knowledge about calculus of one-variable functions, helping students of other majors in Mathematics approach the results of calculus, such as: Functions and Limits, Derivatives and Applications, Integration and Applications.

[20TN1002] – Advanced Mathematics B2

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Advanced Mathematics B1 is an elective course providing students with knowledge of basic algebraic structures (groups, rings, fields), complex number fields, polynomial rings, fields of sub models, matrices, and determinants, system theory of linear equations, vector spaces, linear mapping, bilinear form and global form, Euclidean space.

[20LH0001] – General Law

Number of credits: 3 (Theory: 2 – Exercise: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

General Law is a compulsory course in the knowledge of Social Sciences and Humanities taught in the first semester. The subject provides students with basic and general knowledge about the origin, nature, and form of law in general and the law of the State of the Socialist Republic of Vietnam in particular, the arising and developing laws of the law in general, the arising laws and specific development of the laws of our State in particular, and at the same time provide students with general knowledge about the origin, nature, functions, state apparatus, state form in general and the State of the Socialist Republic of Vietnam in particular. On that basis, students can apply the practice of legal development of our State to form a theoretical basis for policy analysis for the goal of wealthy a rich people, a strong country, democracy, equality, and civilized society in the rule of law of Vietnam of the people, by the people and for the people.

[20NV0002] – Writing skills for administrative documents

Number of credits: 3 (Theory: 2 – Exercise: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: General Law.

The course helps students master the basic knowledge about concepts, functions, roles, and classification of state administrative documents. The course will also provide in-depth knowledge are the style of public administration language, content, and format of drafting administrative documents.

In addition, the course also helps students master how to present, classify, and identify some administrative documents such as minutes, notices, reports, official letters, decisions, and directives. Through that, training students practice skills in drafting several ordinary and special administrative documents.

[20SP0001] – General Psychology

Number of credits: 3 (Theory: 2 – Exercise: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

General Psychology is an elective course in the general knowledge block to provide students with a basic awareness of the objects, tasks, research methods, and history of the formation and development of psychology. Forming for students' concepts and manifestations of psychological phenomena, states of consciousness, and personality attributes; Explain the natural and social basis of psychology, consciousness, and personality. On that basis, students collect, evaluate, and know how to research psychological phenomena, states of consciousness, and personality attributes of themselves and others. Thereby fostering respect for the human psychological nature, attaching importance to applying psychological knowledge in understanding and forming psychology, consciousness, and personality for themselves and others.

[20QT0006] – Innovation and entrepreneurship

Number of credits: 3 (Theory: 1 – Exercise: 1 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Innovation and Entrepreneurship is an elective course of the general knowledge block. Innovation and entrepreneurship are seen as drivers of economic development in the era of

Industry 4.0. This course teaches learners about creative forms, startup ecosystems, design thinking, entrepreneurial thinking, and what entrepreneurs need to know to succeed. The course is designed based on Finnish program transfer. The program uses games and simulations for students to grasp basic knowledge. Through group activities, students experience the general steps of finding ideas, setting up groups, building business projects, and raising capital.

[20QT0001] – Introduction to Economics

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Introduction to Economics is an elective course in the general knowledge block. This subject covers the principles of economics, including the fundamental laws of the market economy, such as the law of supply and demand and the law of competition. It presents the concepts and methods of calculating the macroeconomic indicators as well as the impacts of the government's macroeconomic policies on markets and the economy.

[20QT0004] – Principles of Accounting

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

The Principles of Accounting is an elective course in the basic knowledge of the major, taught in the second semester of the first school year. This course introduces accounting objects such as assets, liabilities, capital sources, revenue, and costs, methods of calculating the prices of accounting objects, and guidance on accounting for arising economic transactions. This course will provide the most basic accounting knowledge as a foundation for specialized accounting subjects.

COURSES BELONG TO THE PROFESSIONAL EDUCATION KNOWLEDGE BLOCK

FOUNDATIONAL KNOWLEDGE

[20CT1201] – Data Structures and Algorithms

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of Structures Programming.

This course approaches problem-solving and evaluates algorithmic complexity. The course presents searching and sorting algorithms; presentation of dynamic data structures: single-linked lists and stack applications, queues; single-loop linked list, double linked list; tree structure, binary tree, binary search tree, and balance tree. Organizing programs according to Win32 Console Applications in Visual Studio environment in library and menus. In addition, the course also helps students practice research skills, synthesize documents, present reports, and presentations, and develop offline and online teamwork skills.

[20CT1202] – Principles of object-oriented programming

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of Structured Programming.

Principles of Object-Oriented Programming is a compulsory course of the professional knowledge block. The course introduces the foundation, essential concepts, and principles of object-oriented programming methods: data abstraction, encapsulation, inheritance, and polymorphism. In addition, students will be equipped with other knowledge such as error handling techniques (exceptions), generating and event handling, memory management, and using some built-in data structures in C# to write application programs according to object-oriented programming methods.

In addition, the course equips students with teamwork, problem analysis, and document lookup skills.

[20CT2201] – Database

Number of credits: 4 (Theory: 3 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Introduction to Information Technology, Discrete Mathematics, Principles of Structured Programming.

Database course is a compulsory subject in the fundamental knowledge of Information Technology. The course introduces basic concepts of databases and database management systems, especially relational databases. Topics include data models (ERM, relational data model); query language (relational algebra, Structured Query Language); integrity constraints, database programming (stored procedures, functions, and triggers); functional dependencies, minimal coverage, normal forms, and database normalization.

The course will provide students with skills in modeling, designing, and implementing relational databases. Students also apply teamwork skills and communication skills in the learning process.

[20CT2202] – Desktop application development

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Database, Principles of object-oriented programming.

The desktop application development course is a compulsory subject of the basic knowledge block, providing students with knowledge and techniques to use graphical user interface (GUI) objects and standard controls in building and developing computer applications. Besides, it also helps students grasp the basic theoretical knowledge about semi-structured data, database programming, and building practical applications that connect and interact with databases. In addition, the course also helps students to gain skills in report writing, presentation, and collaboration.

[20CT2203] – Computer Networking

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

Computer networking is a compulsory subject of the industry's basic knowledge, helping learners acquire important knowledge related to the field of computer networks. Knowledge of protocols, structures, and operations of each component in a computer network (OSI and TCP/IP network models), network models (LAN, MAN, WAN), and operating principles of network systems.

[20CT2204] – Operating System

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Introduction to Information Technology, Computer Architecture.

The operating system course is a compulsory course of the professional knowledge block, presenting the concepts and methods for building an operating system, the principle of operation, and the organization of the operating system: process management, memory management, resource dispute resolution, file management system, and peripheral communications. In addition, the course also equips students with teamwork, report writing, presentations, searching, and using English materials.

[20CT2205] – Basic Project

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: General knowledge courses.

The basic project course is a compulsory course of the basic knowledge block, providing students with knowledge when applying equipped programming techniques, algorithms, databases, computer networking, web design, etc., to carry out a simple actual project. In addition, the course also equips students with skills in problem-solving, doing research as well as communication skills. Moreover, the course also helps students to gain skills in report writing, presentation, and collaboration.

Complementary knowledge:

[20CT2101] – Web Design

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of object-oriented programming.

The Web Design course is a compulsory subject in a specialized knowledge block, equipping students with the basic concepts, knowledge, and skills to develop the front-end for a web application, including Domain Name, Hosting, Browser, Code analysis, rendering a web page in the browser, HTML, CSS, JavaScript, UI pattern. From basic knowledge, students will easily access knowledge related to advanced front-end such as SASS, LESS, Web APIs, Ajax, jQuery, Bootstrap, and Frameworks (Vue, React, Angular).

In addition, the course also equips skills in teamwork, report writing, presentation, document search, and reading technical English documents.

[20CT3108] – Methods of scientific research

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Introduction to Information Technology, Advanced Mathematics B1.

Methods of scientific research is an elective course of professional knowledge block, providing learners with basic knowledge about scientific research, how to collect documents, develop outlines and implement research topics, and write reports and scientific articles.

[20CT3107] – Network Programming

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Principles of object-oriented programming.

Network Programming is an elective in the complementary knowledge block, providing students with knowledge of programming applications to transmit data on the network using sockets. The course helps students understand the concept and operating principles of different sockets. Students can use and program based on basic sockets, such as connection-oriented and connectionless sockets. Students are also equipped with advanced knowledge of asynchronous sockets, the application of primary multitasking to network programming, and broadcast, multicast and application-layer protocols. Through the course, students will understand the process of designing and developing network applications in practice.

In addition, the course also helps students have skills in researching, synthesizing documents, presenting reports and presentations, teamwork skills.

[20CT3106] – Python Programming

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Python programming is an elective course that provides students with basic knowledge of Python programming language and application development in Python language. This course helps students develop their ability to analyze, program applications, divide functional courses, and install basic computational applications.

MAJOR KNOWLEDGE

1. Specialization in Computer Networking

[20CT3120] – Open-source operating system

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Architecture, Operating System.

The course is compulsory in the major knowledge block of Computer Networks and Communications that provides students with basic knowledge of the open-source operating system such as Linux. Through the course, students understand the characteristics, development history, and practical needs of the Linux operating system. Students are also equipped with the knowledge and skills to install and configure several administrative

tasks, such as managing hardware, software, system processes, file systems, and users, and the ability to use scripting languages to automate administrative tasks programmatically. Basic security and network service deployment knowledge are also provided.

In addition, the course also helps students research, synthesize documents, present reports, and presentations, and develop teamwork skills.

[20CT3121] – Windows Network Management

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking.

Network administration is a compulsory course in the major knowledge block, helping learners acquire necessary knowledge related to network administration, an overview of the principles of network administration, components, and interactions between components in the network. Provides a way to administer Workgroup and Domain networks. Provides knowledge of centralized system administration, user administration, policy, software, and service deployment, hosted on the Windows Server platform.

[20CT3122] – Network Routing

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking.

The course provides knowledge about network routing, the principle of operation of router devices, installing and configuring routing protocols. In addition, the course equips students with teamwork, problem analysis, and document lookup skills.

[20CT3221] – Linux Network Management

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

This course is compulsory in the major knowledge block. The course provides knowledge about network administration on the open-source Linux operating system and how to install network services such as Web Server, Mail Server, Web Server, and VPS, etc. The course also allows students to implement high-availability systems and network monitoring systems.

In addition, the course also equips students with teamwork skills, communication skills, and skills to find materials and explore knowledge.

[20CT3220] – Network Design

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking, Network Routing.

The Network Design course is a compulsory subject in the major knowledge block, providing students with knowledge about switching, analyzing, designing, and deploying decentralized network infrastructure: availability, reliability, security, and high fault tolerance. Besides, it also equips students with solutions to analyze, design and build a network system.

In addition, the course also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and team group skills.

[20CT4120] – Distributed System

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking.

This course introduces students to general knowledge of distributed systems such as remote function calls, distributed data exchange standards, distributed database systems, distributed file systems, etc. In addition, the course also explains to students how to organize and operate systems such as Google, Facebook, or torrent network in storing and processing data. During the practical implementation of systems such as Hadoop, load balancing for Web Server, and Database, this course will help students integrate this knowledge into equipped courses such as network administration and open-source operating systems.

[20CT4121] – Network Security

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking, Windows Network Management.

Network security is a compulsory course in the major knowledge block, providing the foundational knowledge of network security, methods of attack, and protection for the

network system, such as man-in-the-middle attacks, exploiting system errors, finding and scanning operating system vulnerabilities, and offering solutions to protect transmission lines, network services, web; investigation number. In addition, the course also provides students with skills in searching and synthesizing documents, as well as skills in communication and teamwork.

[20CT3222] – System safety and security

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Introduction to Information Technology, Computer Networking.

System safety and security is an elective course in the major knowledge block. This course provides knowledge about system safety and security, including basic concepts about the safety of information and computers, operating system security, malware, network security, web security, data encryption, and network topologies. This course also summarizes laws and regulations regarding information technology and the ability to research, compile documents, and write reports and presentations.

[20CT3124] – Thematic Network 1

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Computer Networking, Windows Network Management.

Thematic Network 1 is an elective course of the major knowledge block, which provides basic knowledge of network programming and basic knowledge to operate and automate management tasks on the network based on centralized controllers such as CISCO APIC-EM, Mininet, and others. Students have a basic knowledge of network programming with Python, Git, JSON, Postman, and API. In addition, students are exposed to SDN models that include centralized application and policy management methods.

[20CT3223] – Virtualization Technologies

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Open-source operating system, Windows Network Management.

Virtualization technologies is an elective course in the major knowledge block that provides the necessary knowledge and skills related to the basics of cloud computing, being able to utilize cloud features on different cloud services models such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) and Business Process as a Service (BPaaS). This course also provides the knowledge and skills of virtualization technologies.

After completing this course, students can create solutions using virtualization technologies such as server virtualization, network virtualization, storage virtualization, etc., and apply them to real-life business scenarios.

[20CT3224] – Blockchain

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Database.

Blockchain is an elective subject in the major education knowledge block that provides knowledge about distributed databases, blockchains, consensus mechanisms, how to encrypt information to put on the blockchain, and security against changing the blockchain. The course also provides knowledge about applications of Blockchain technology such as cryptocurrencies, smart contracts, and applications in agriculture, healthcare, education, notary, etc.

In addition, the course also equips students with teamwork skills, communication skills, document searching skills, and knowledge discovery.

[20CT3225] – Internet of Things

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

Internet of Things is an elective course in the major knowledge block that provides students with basic knowledge about the Internet of Things (IoT) and the opportunities and challenges of the Internet of Things applications in practice. The course focuses on hardware and software platforms for developing IoT applications. After completing the course, students can apply basic sensors, single-board computers, and software platforms to design and develop IoT applications to perform monitoring, gather information, and control in many fields.

In addition, the course also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and group skill.

[20CT4122] – Integrated system deployment

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Open-source operating system.

Integrated system deployment is an elective course in the major knowledge block, which provides advanced knowledge about Linux network administration and the ability to merge services of Linux systems or analyze service integration between systems Linux and Windows systems.

In addition, the course also equips students with teamwork skills, communication skills, documentation skills, and knowledge discovery.

[20CT4107] – E-commerce

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

E-commerce is an elective course in the major education block that provides an overview of e-commerce, development history, infrastructure, and application areas of e-commerce. This course helps learners to understand critical in-depth systems applying e-commerce, such as e-banking, buying, and selling an online business, and online education.

Helping learners have in-depth knowledge enough to plan and deploy an online business system, including choosing technical and technological solutions, selecting, and deploying a sales website system, warehouse management system, payment system, and digital marketing system.

Learners can form ideas or advise customers to choose solutions and deploy and operate a business system on an e-commerce platform. In addition, the course also equips students with teamwork skills, communication skills, document searching skills, and knowledge discovery.

[20CT4126] – Voice over IP

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Open-source operating system.

Voice over IP is an elective course in the major knowledge block, which provides knowledge on the components of …, establishing and routing in-land and international calls through VoIP call centers. This course helps students to know how to install and configure call center services for businesses. Students will know how to troubleshoot common problems found in VoIP, securing the process of alerting and transporting users' data.

This course also provides students the skills to work in a team environment, communicate and presentation skills, think like a system administrator, research, and use documentation written in English.

[20CT4125] – Next Generation Network

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Network Design, English for Information Technology, Introduction to Information Technology.

Next generation network is an elective course in the major knowledge block, which provides knowledge on the latest network technologies, IPv6, Quality of Service, and IP Multicast.

This course also provides students the skills to work in a team environment, communicate and presentation skills, think like a system administrator, research, and use documentation written in English.

[20CT4124] – Thematic Network 2

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Open-source operating system, Windows Network Management, English for Information Technology, Introduction to Information Technology.

Thematic Network 2 is an elective course in the major knowledge block, which provides the necessary knowledge and skills to design and develop software along with the software-defined network. Through this course, students will learn about designing, developing, and securing applications; understand and use APIs, basic principles of network infrastructure, and network automation using the Python programming language or other tools such as Ansible, Puppet, Chef, and Cisco NSO. After this course, students can program network applications, automated infrastructures, IoT, DevOps, and Cloud.

This course also provides students the skills to work in a team environment, communicate and presentation skills, think like a system administrator, research, and use documentation written in English.

[20CT3123] – Cryptography and information coding

Number of credits: 4 (Theory: 3 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Advanced Mathematics, Principles of Structured Programming, Data Structures and Algorithms.

Cryptography and information coding is an elective course in the major knowledge block, providing students with the basic concepts of information encryption, introducing their encryption methods, decoding and application in information encryption, security mechanisms, etiquettes such as authentication, and digital signatures. In addition, this subject also provides the ability to apply the knowledge of encrypting learned information to solve some security problems in practice.

In addition, the course also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and group skill.

2. Specialization in Software Engineering

[20CT3101] – Software Engineering

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of object-oriented programming.

Software Engineering is a compulsory course in the major knowledge block that equips students with knowledge of terms used in software engineering. Understand the phases of making a software product and their roles in the software development process. Firmly grasp the definitions and concepts in different models of object-oriented analysis and design languages and apply them to specific contexts close to reality. The course also aims to help students enhance their ability to work in groups, search for documents, and report results.

[20CT3102] – Mobile application development

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of object-oriented programing.

Mobile Application Development is a compulsory course in the major knowledge block taught in the 5th semester of the training program framework. The course gives students a general understanding of mobile operating systems and fundamental knowledge of programming interfaces on mobile devices, methods for installing emulators, and some interaction with mobile devices. The course equips students with teamwork skills, the ability to design and implement simple applications on mobile devices, and skills in reading and searching for English-language documentation.

[20CT3103] – Web application development

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Web Design, Principles of object-oriented programming, Database.

The course is a compulsory subject in the specialized knowledge in the software engineering major, which trains students with basic concepts, knowledge, and skills for back-end web development, specifically including setting up working environments, mastering programming languages, basic server-side processing techniques, framework-based programming, and Content Management System-based web application. From the acquired knowledge, students can make a web application with basic functions using only programming languages (with or without using a framework, CMS). In addition, the course also improves skills in teamwork, writing reports, presenting, searching documents, and reading technical English documents.

[20CT3203] – Design Patterns

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of object-oriented programming.

The Design Patterns course is a compulsory course in the major knowledge block. The course introduces some groups of design patterns, such as Creational Patterns, Structural Patterns, and Behavioral Patterns. These patterns are applied during the software analysis phase to help to build better scalable, legacy, and evolving software.

[20CT3201] – Advanced web application development

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Web application development.

Advanced Web Application Development is a compulsory course in the major knowledge block, which helps students to understand some in-depth knowledge about Web application development such as data authentication, user authentication (user-side data) and application access permission management, methods for encrypting Web data, integration of popular JavaScript frameworks into Web applications, filter management, and website log management. Besides, students can also analyze and choose frameworks and servers to deploy Website applications and can learn some SEO techniques and Google tools to promote websites.

In addition, the course also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and group skill.

[20CT4101] – Information Technology Project Management

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Software Engineering.

Information Technology Project Management is a compulsory course in the major knowledge block, which provides the basic concepts of projects, especially information technology projects. This course also introduces implementing, executing, and controlling the project plan, managing project schedules, costs, quality, resources, risks, and project integration management. In addition, the course also introduces some supporting software for project management and provides students with skills in document retrieval, effective team management, project management, and control, as well as professional sense when participating in Information Technology projects.

[20CT4102] – Open-source application development

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Web Design, Database.

Open-source Application Development is a compulsory course in the major knowledge block, which provides students with knowledge about open-source code, common types of open-source copyright licenses; the distribution, collaboration, and development of open-source software; and several popular open-source communities. The course also introduces several open-source programming languages, how to program in the open-source language, and use open-source database management systems. Besides, it also helps students learn how to build, deploy, and develop several open-source applications.

In addition, the course also helps students practice and strengthen teamwork, research, document synthesis, report presentation, and presentation skills.

[20CT3104] – User Interface Design

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Applied Graphics, Web Design, Software Engineering.

User Interface Design is an elective course in the major knowledge block, which provides students with an overview of user interface design and construction, introducing the content of the stages in the software interface design, UI interface components, and interface quality assessment elements. This course helps learners understand the process of designing an interface so that students can form ideas, plan analysis, and effectively design graphical user interfaces for users. Ability to select design methods suitable to real problems and plan and implement the construction of user interfaces.

In addition, the course also helps students practice and strengthen teamwork, research, document synthesis, report presentation, and presentation skills.

[20CT4105] – Web Services

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Web application development.

Web Services is an elective course in a major knowledge block, which helps students gain an overview and basic knowledge of web services, concepts, and tools to deploy web services such as SOAP and REST with illustrative examples. Students also learn how to build common Web service features and some Web service security techniques.

In addition, the course also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and group skill.

[20CT3205] – Software Analysis and Design

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principle of object-oriented programming, Software Engineering.

Software Analysis and Design is an elective course in the major knowledge block, which introduces concepts, methods, and tools for object-oriented software analysis and design. Besides, the well-known software structures, software structure design, user interface design, database design, and behavior design are discussed. This course introduces design principles for maintainable, reusable, and extensible software. Finally, the course provides guidelines for illustrating the analysis and design process using UML models.

[20CT3208] – Game application development

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of object-oriented programming.

Game application development is an elective course that provides students with basic knowledge of game programming principles and the components and main objects needed to create a game that runs on computers and mobile devices. The course introduces the Unity software, the basic components of Unity 2D, and programming methods with C# code. The course also equips students with teamwork skills, the ability to design and implement simple applications that can be compiled and run on various devices, and the ability to read and search for English-language materials.

[20CT3206] – Software Testing

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Desktop application development, Software Engineering, Principles of object-oriented programming.

Software Testing is an elective course in the major knowledge block that equips students with knowledge of terms used in software testing. Understand test levels, test types, test processes, and test automation. The course also aims to help students enhance their ability to work in groups, search for documents, and report results.

[20CT4103] – Advanced game application development

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of object-oriented programing, Game application development.

Advanced Game Application Development is an elective course that provides students with knowledge and principles of 3D game programming with Unity and knowledge of components and main objects to create a game running on the internet network system that uses artificial intelligence algorithms. The course introduces Unity software, advanced components of Unity 3D, and programming methods with C# code. The course also equips students with teamwork skills, designing and implementing 3D applications, compiling, and running them on various devices, and English document reading and searching skills.

[20CT4104] – Advanced Topics in Software Development Technology

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Software Engineering.

Advanced Topics in Software Development Technology is an elective course in the major knowledge block, providing an overview of several modern technologies being formed and applied in one or more stages of software development. This course includes the technologies being applied in the system's analysis, design, installation, testing or implementation phase. Learn and illustrate technologies related to Docker, Git, DevOps, Microservices, Serverless, and CI/CD.

In addition, the course also equips skills in teamwork, report writing, presentation, document search, and reading technical English documents.

[20CT3105] – Java Programming

Number of credits: 3 (Theory: 3 – Practice: 0)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of Structured Programming, Data Structures and Algorithms, Object-oriented Programming.

Java programming is an elective course in the major knowledge block that provides students with basic and in-depth knowledge of programming techniques using the Java language. In addition, it also equips students with analysis and design methods to build the most basic Java program.

Besides, the subject also helps students to have skills in research, synthesis of documents, presentation of reports and presentations, and group skill.

[20CT3207] – Advanced Java Programming

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Java programming, Desktop application development, Network programming, Web design.

The Advanced Java Programming is an elective course of the major knowledge block, providing students with advanced AWT/SWING methods, methods of building and developing applications with database connectivity, network application, Servlets, and JSP services. In addition, the course also introduces security mechanisms and methods for Java applications. Moreover, the course also helps students to gain skills in report writing, presentation, and collaboration.

[20CT4106] – Advanced mobile application development

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of object-oriented programming.

Advanced mobile application development is a compulsory course in the major knowledge block that provides students with the knowledge and techniques to develop Mobile applications using Web Hybrid and in TypeScript, SCSS, and HTML 5 languages on the Ionic 5 platform and Angular 9/10.

The principles of automated testing on mobile tools such as end-to-end (E2E) will be presented to increase student knowledge in product quality assessment. In addition, students will learn how to approach Ionic Cloud AppFlow to build and download applications directly to the device.

During the learning process, students will develop a simple individual application and a complex group application to deepen their understanding of the theories.

At the end of the course, students can develop mobile application programs running on mobile tools using Android and iOS operating systems in areas such as ‘solution delivery’, ‘e-commerce’, etc.

3. Specialization in Data Science

[20TN3111] – Probability and Statistics

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Advanced Mathematics B1, Discrete Mathematics.

Probability – Statistics is a compulsory course of major knowledge block that equips basic knowledge and tools of probabilistic and statistical methods. The content consists of two main parts: the probability section provides basic concepts and calculations of random events and probabilities; probability distribution - characteristic numbers of random variables and random points; application of the law of large numbers and the Central Limit theorem. The Statistics section provides basic data processing tools and deductions specific to statistical science, including descriptive statistics; estimating and testing statistical assumptions; regression analysis; analysis of variance. The course also gives students a hands-on experience in basic statistical calculation with software support. Thereby, students can learn other related subjects and apply this theory's method to apply, analyze and solve problems in practice.

[20CT3112] – Advanced data structures and algorithms

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Principles of structured programming, Data structures and algorithms.

The course is compulsory in the major knowledge block, providing students with basic knowledge of hash table data structures, graphs, and basic algorithm design methods such as divide-and-conquer, backward, proximity, greed, and dynamic planning. In addition, the subject also helps students have skills in researching, synthesizing documents, presenting reports and presentations, and teamwork skills.

[20CT3113] – Methods of Machine Learning

Number of credits: 4 (Theory: 2 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: Data Structures and Algorithms, Principles of object-oriented programming, Database.

Methods of Machine Learning is a compulsory course of major knowledge block that provides students with basic knowledge of machine learning: learning concepts, components of a machine learning system, supervised and unsupervised learning methods and applications of machine learning in practice. This course also equips students with different approaches and algorithms to solve three tasks in machine learning, including classification, clustering, and prediction.

[20CT3211] – Artificial Intelligence

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course provides students with basic knowledge of artificial intelligence, research fields, applications, and techniques of artificial intelligence that integrate human experience or additional knowledge to improve the efficiency of algorithms looking for solutions to solve problems. The course also equips students with basic knowledge, skills, and methods to represent and process knowledge; skills in using logical programming languages to represent simple knowledge with predicate logic, reason, and finding solutions to specific problems are also presented. In addition, the course also helps students have research skills, synthesizing documents, presenting reports and presentations, and teamwork skills.

[20CT3212] – Image processing

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

Image Processing is a compulsory course of the major knowledge block that equips students with knowledge of the terms used in image processing and introduces digital image processing methods and techniques such as image editing, object bounding, image enhancement, and image transformation on the frequency domain. The course also aims to help students enhance their ability to work in groups, search for materials, and report results.

[20CT4111] – Data Mining

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

Data Mining is a compulsory course in the major knowledge block that provides students with knowledge about data warehousing and OLAP; preparing data and discovering knowledge from data; concepts and applications of data mining. The course also teaches students about data pre-processing, data mining tasks, and common data mining techniques to extract useful knowledge from data warehouses. The topics include the role of data mining in the context of big data, data mining tasks (predicting or describing data), data mining techniques such as common sets, associative law, layering and clustering, etc. issues that need attention to solve in the field of data mining. In addition, the course also

helps students research, synthesize documents, present reports, and presentations, and develop teamwork skills.

[20CT4112] – Big Data

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: None.

The course is compulsory in the major knowledge block that provides students with knowledge and techniques to process big data in the cloud using Apache Hadoop and Google MapReduce technology.

[20CT3213] – Parallel Programming

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Data Structures and Algorithms, Operating System.

Parallel programming is an elective course of major knowledge block that provides basic concepts and principles in the parallel computing environment, introduces the method, and designs basic parallel algorithms. Build programs in parallel using Pthread, MPI, and OpenMP libraries. In addition, the course also equips students with skills to search and synthesize documents, present and work in a team.

[20CT3214] – Advanced Machine Learning

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Methods of Machine Learning.

Advanced Machine Learning is an elective course of major knowledge block that imparts knowledge of Deep Learning - a method of Machine Learning. The course allows us to train an AI to predict outputs based on a set of inputs. Both supervised and unsupervised methods can be used for training. The course includes an introduction to neural networks, some deep learning methods, and using some deep learning libraries to solve problems in image processing and natural language.

[20CT3215] – Data Pre-processing and Analysis

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of object-oriented programming, Database.

Data Pre-processing and Analysis is an elective course of specialized knowledge block that equips students to know the terms used in data collection, pre-processing, and analysis. This course also introduces popular pre-processing techniques, including missing data processing, encoding categorical variables, standardizing data, scaling data, etc. The course also aims to help students enhance their ability to work in groups, search for materials, and report results.

[20CT3216] – Advanced Python Programming

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Python Programming.

Advanced Python Programming is an elective course that provides students with advanced knowledge related to libraries developed in the Python language and used in data science, such as NumPy, Pandas, and matplotlib. In addition, the subject also helps students have skills in researching, synthesizing documents, presenting reports and presentations, and teamwork skills.

[20CT4113] – Computer Vision

Number of credits: 2 (Theory: 2 – Practice: 2)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Principles of object-oriented programming, Image Processing.

Computer Vision is an elective course in the major knowledge block that provides students with basic knowledge of image processing for recognition. The course provides basic knowledge in computer vision, such as image preprocessing, feature extraction, and object recognition models. The course also introduces machine learning models on images that students can use in the future. The course also equips students with skills to work in teams, design and deploy simple recognition applications, and improve skills in reading and searching for English documents.

[20CT4114] – Natural Language Processing

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Methods of Machine Learning.

Natural Language Processing is an elective course in the major knowledge block that provides basic natural language processing techniques. In addition, the course introduces some tools and application areas of natural language processing, such as information search, text classification, and machine translation. In addition, the course also provides students with skills in document lookup, group management, and a sense of career when participating in natural language processing.

[20CT4115] – Neural Network

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Advanced Mathematics B1, Artificial Intelligence, Machine Learning Methods.

Neural Network is an elective course in the major knowledge block that provides students with understanding and building neural network models for machine learning problems. Besides, students grasp the critical computations underlying deep learning and use them to build and train deep neural networks.

In addition, the subject also helps students have skills in researching, synthesizing documents, presenting reports and presentations, and teamwork skills.

[20CT4116] – Cloud Computing

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Computer Networking, Network Design.

Cloud computing is an elective course of major knowledge block that provides students with the knowledge and practical skills on basic topics of cloud computing, applying the features of cloud computing on different cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Business Process as a Service (BPaaS). In addition, students must analyze and select the cloud computing service model that suits the needs of organizations and businesses.

[20CT4118] – R programming for Data Science

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: Probability and Statistics, Machine Learning Methods.

The R Programming for Data Science is an elective course of the major knowledge block that provides students with the background knowledge and necessary skills to perform analysis, statistics, graphical representation, and reporting in R. In addition, the course also equips students with the ability to apply some machine learning algorithms in classifying, predicting, and grouping data. Moreover, the course also helps students to gain skills in report writing, presentation, and collaboration.

[20CT4119] – Semantic Web

Number of credits: 3 (Theory: 2 – Practice: 1)

Course: Compulsorily ☐ Electively ☑

Prerequisite courses: None.

The course provides the following knowledge: theory and foundational technologies of the Semantic Web; evaluate the advantages and limitations of the Semantic Web; apply the Semantic Web, ontology in the context of computer science and the Semantic Web; queries and inferences in Semantic Web systems. In addition, the course also equips skills in teamwork, report writing, presentations, searching for documents, and reading specialized English materials.

4. The common courses in the specialization

[20CT3202] – Major Project

Number of credits: 3 (Theory: 1 – Practice: 2)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: The general knowledge courses.

The major project is a compulsory course of the major knowledge block. The course helps students consolidate and apply all the basic and specialized equipment knowledge of computer networks, programming techniques, or data science to undertake an in-depth level research topic. During the implementation of the project, students are also introduced to making research hypotheses, how to develop research proposals, search for documents, and apply knowledge to determine the scope of the topic, solve problems, and achieve the expected results. Finally, students must synthesize all research knowledge and create products with specialized applied knowledge.

[20CT3204] – Career Visiting

Number of credits: 1 (Theory: 0 – Practice: 1)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: The general knowledge courses.

Career visiting is a compulsory course of major knowledge block for IT students that helps students acquire more knowledge from reality and how to apply the knowledge and skills learned in the natural working environment at facilities, enterprises, and companies in the field of Information Technology. At the same time, gain a basic understanding of a company or enterprise's organizational structure and operating model in the Information Technology industry.

[20CT4201] – Internship

Number of credits: 8 (Theory: 0 – Practice: 8)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: The general and professional knowledge courses.

Internship is a compulsory course of major knowledge block. The course helps students have experience in applying the knowledge they have learned in the natural working environment of organizations or businesses; equip knowledge about the organization and operation of enterprises; corporate context, goals, and culture; In addition, the subject helps students with soft skills such as communication, writing and presenting reports, teamwork.

[20CT4202] – Thesis

Number of credits: 10 (Theory: 0 – Practice: 10)

Course: Compulsorily ☑ Electively ☐

Prerequisite courses: The general and professional knowledge courses.

The thesis is a compulsory course in the major knowledge block of the Information Technology training program.

Purpose: This course adds in-depth knowledge about a narrow research direction in a major or intersection between other majors and disciplines. This course helps students to practice professional, personal, and soft skills in the field of study and contribute to intensive career orientation for learners.

The main content of the course:

- Form research ideas, find places with conditions for implementation, instructors.
- Formulate research proposal
- Conduct research, record results
- Analyze results, synthesize, and write Graduation Project reports
- Presentation of research findings.

ĐẠI HỌC ĐÀ LẠT