VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY

UNIVERSITY OF INFORMATION TECHNOLOGY

HIGHER EDUCATION PROGRAM

# REGULAR PROGRAM

# COMPUTER ENGINEERING

**MARCH 07/2022**

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VIETNAM NATIONAL UNIVERSITY HCMC
**UNIVERSITY OF INFORMATION TECHNOLOGY**

**SOCIALIST REPUBLIC OF VIETNAM**
**Independence – Freedom – Happiness**

# HIGHER EDUCATION PROGRAM

**Program Name:** **Bachelor of Computer Engineering**

**Training level:** **Undergraduate**

**Program code:** **7480106**

**Training type:** **Full-time**

**Intake applied:** **2022 intake and onwards**

## 1 GENERAL INTRODUCTION

### 1.1 Objectives of the Educational Program

The full-time bachelor's educational program in Computer Engineering (hereinafter referred to as the CE Program) is built with the goal of training high-quality human resources, reaching regional and international competency levels in the field of embedded systems and robots, the Internet of Things (IoT), IC design, SoC design, and AI application to meet the development needs of the information and communication technology industry and related industries in the country.

### 1.2 Job Opportunities

CE Program's graduates can work in different positions and fields such as:

- Working as analysts, designers, and developers in projects to develop, design, and manufacture hardware devices; working at companies in computer hardware design, digital systems design, embedded systems design.
- Working as application researchers in information technology at institutes, research centers and universities and colleges; teaching subjects related to computer engineering at universities, colleges, vocational schools and high schools.
- Working as a scientific researcher in the fields of system software, digital system design, automatic control and embedded systems at institutes, research centers and agencies of ministries, universities and colleges.
- Working in the information technology department or information technology application department of all units in need (administrative and non-business administration, banking, telecommunications, aviation, construction, etc...).

- Working in domestic and international companies in designing and outsourcing, IC design, electronics, and control.

## 1.3 Educational Perspectives

The CE Program is built on the following main viewpoints:

- The education program is interdisciplinary and highly applicable, in line with the needs of IT human resources of industry and society.
- The education program is articulable to computer engineering programs of advanced universities in the world to serve as a premise for international collaboration and transfer at higher education levels.

## 1.4 Type and duration of training

- Type of training: Full-time program.
- Number of credits: 128 credits.
- Duration: 4 years (8 semesters)

# 2 APPLICANTS

Applicants are recruited according to the annual enrollment regulation of the VNUHCM-University of Information Technology.

# 3 TRAINING STATUTE

The CE Program is implemented in alignment with the applicable statute and regulations of the VNUHCM-University of Information Technology (UIT).

# 4 LEARNING OUTCOME

The CE Program's graduates achieve the following competencies:

**Competencies of awareness (knowledge):**

- LO1: *Apply fundamental knowledge of natural sciences and social sciences (following ABET 3.1).*
- LO2: *Apply fundamental and advanced knowledge in computer engineering applications. (following ABET 3.2 and GAC 2.b).*

**Competencies of skills:**

- LO3: *Survey documents, analyze and propose solutions to problems related to the computer engineering industry; awareness of the need for lifelong learning (following ABET 3.6, ABET 3.7, and GAC 2.a).*
- LO4: *Design and evaluate systems and solutions of the computer engineering industry (ABET 3.2, ABET 3.6, and GAC 2.a).*

- LO5: *Communicate and cooperate effectively with individuals and groups in certain contexts. (ABET 3.5 and GAC 2.c)*
- LO6: *Communicate at work, read and understand documents and present a specialized solution in a foreign language.*
- LO7: *Understand leadership and management (GAC 2.d).*

**About attitude:**

- LO8: *Understand professional responsibilities, comply with the law and ethical values (following ABET 3.4).*

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***The above learning outcomes are specified as follows:***

| Level | Expected Learning Outcome (ELOs) | Evaluation Rate (max) |
|---|---|---|
| **PLO1** | Mastering foundational knowledge in natural sciences and social sciences and understanding how to apply this knowledge to Computer Engineering industry and practical contexts. | **K3** |
| 1.1 | Mastering foundational knowledge in natural sciences and social sciences | |
| 1.2 | Understanding how to apply foundational knowledge in natural sciences and social sciences to Computer Engineering industry and practical problems | |
| **PLO2** | Mastering foundational knowledge and some specialized knowledge in Computer Engineering to solve practical problems effectively. | **K4** |
| 2.1 | Mastering foundational knowledge in the field of Information Technology | |
| 2.2 | Mastering foundational and some specialized knowledge in Computer Engineering to solve practical problems. | |
| **PLO3** | Surveying documents, reasoning, analyzing and proposing creative solutions to practical problems in Computer Engineering industry; Understanding the lifelong learning | **S4** |

| | | |
|---|---|---|
| 3.1 | Interpreting, reasoning, and analyzing practical problems in the Computer Engineering industry. | |
| 3.2 | Proposing creative solutions to practical problems in the Computer Engineering industry. | |
| 3.3 | Understanding the lifelong learning | |
| **PLO4** | Designing, implementing, and evaluating systems and solutions in Computer Engineering industry | **S4** |
| 4.1 | Designing basic systems for practical problems in Computer Engineering industry | |
| 4.2 | Evaluating and enhancing solutions for practical problems in Computer Engineering industry | |
| **PLO5** | Communicating, collaborating, and connecting effectively with individuals and groups in specific professional contexts | **S4** |
| 5.1 | Communicating and cooperating effectively with individuals and groups | |
| 5.2 | Applying skills of communication, discussion and connection effectively with individuals and groups in Computer Engineering industry | |
| **PLO6** | Communicating effectively at work, comprehending technical documents, and presenting specialized solutions in a foreign language | **S4** |
| 6.1 | Communicating at work and comprehending technical documents in a foreign language | |
| 6.2 | Presenting and discussing specialized solutions in Computer Engineering in a foreign language. | |
| **PLO7** | Understanding of leadership and management | **S3** |
| 7.1 | Understanding basic knowledge of leadership and management skills | |
| 7.2 | Applying basic knowledge of leadership and management skills into practical work | |

| | | |
|---|---|---|
| **PLO8** | Understanding professional responsibilities, compliance to the law and ethical values. | **A5** |
| 8.1 | Understanding fundamental legal regulations and ethical values of Vietnam. | |
| 8.2 | Respecting and complying to ethical values and professional responsibilities. | |

# 5 EVALUATION SCALE OF KNOWLEDGE, SKILLS, AND ATTITUDES

| Symbol | Levels | Competency | Describe |
|---|---|---|---|
| **Evaluation scale of "Knowledge"** | | | |
| K1 | 1 | Remember | It is the ability to record and retrieve the knowledge and information received; expressed by being able to recall that knowledge and information. |
| K2 | 2 | Understand | It is the ability to grasp the meaning of spoken messages, written messages or visual messages; expressed by being able to interpret, for example, classify, summarize, reason, compare and explain |
| K3 | 3 | Apply | It is the ability to apply the knowledge learned to certain situations. |
| K4 | 4 | Analyze | It is the ability to divide knowledge and information into small parts; then determine the relationship between these small parts and with the whole or the overall goal. |
| K5 | 5 | Assess | The ability to make judgments based on standards and criteria; expressed through checking and commenting. |
| K6 | 6 | Creative | It is the ability to connect related things together to form a useful product; expressed through planning and creating a product. |
| **Evaluation scale of "Skills"** | | | |
| S1 | 1 | Awareness of action | It is the ability to use one's own sensory signals to guide motor activities (actions). |
| S2 | 2 | Ready for action | It is the ability to be mentally, physically, and emotionally ready to take action. |

| | | | |
|---|---|---|---|
| S3 | 3 | Act as instructed | It is the first stage of the process of learning complex skills; expressed through the ability to solve simple problems and problems by imitation, trial and error. |
| S4 | 4 | Proficient Action | Acting proficient is the intermediate stage of the process of learning complex skills; This is reflected in the fact that the manipulations have become habits and actions are confident and fluent. |
| S5 | 5 | Skillful action | It is the ability to perform complex operations skillfully and effectively, shown by the smooth, fast, accurate coordination operation with the lowest energy consumption. |
| S6 | 6 | Adaptive action | It is the ability to change the mode of operation (method) to meet new requirements. |
| S7 | 7 | Creative action | It is the ability to create new modes of operation (new methods) to suit a specific situation or problem. |
| **Evaluation scale of "Attitude"** | | | |
| A1 | 1 | Receive | It is an attitude of focusing on attention and listening. |
| A2 | 2 | Respond | It is an attitude of active participation in the collective learning process, currently through participation and interaction in learning activities. |
| A3 | 3 | Respect | It is an attitude of acknowledging or appreciating an object, phenomenon, or behavior. |
| A4 | 4 | Organization | It is the ability to arrange values to form one's own value system. |
| A5 | 5 | Character | It is the acquisition of a value system that controls one's own behavior, helping individuals to express their individuality and act with their own identity without affecting the collective. |

# 6 PROGRAM OUTLINE

## 6.1 Program structure

| **Classification** | | **Credit** | |
|---|---|---|---|
| | | **#** | **%** |
| | Courses in politics and law | 13 | 10.15 |

| | | | |
|---|---|---|---|
| General Knowledge | Courses in Mathematics - Informatics - Natural Sciences | 22 | 17.18 |
| | Foreign language | 12 | 9.38 |
| | Physical Education, Military Education[1] | | |
| Professional Education | Fundamental IT Courses | 49 | 38.28 |
| | Major courses | 18 | 14.02 |
| | Others | 2 | 1.56 |
| Graduation | Internship | 2 | 1.56 |
| | Capstone project | 10 | 7.87 |
| Minimum number of credits required for graduation | | **128** | **100** |

## 6.2 General courses

A total of 17 compulsory courses are required for **47 credits** (excluding physical education and military education).

| S/N | Course Code | Course Name | Total credit | Theory credit | Lab credit |
|---|---|---|---|---|---|
| **Political Theory** | | | **13** | | |
| 1. | SS003 | Ho Chi Minh's Ideology | 2 | 2 | 0 |
| 2. | SS006 | Introduction to Vietnamese Law | 2 | 2 | 0 |
| 3. | SS007 | Marxist-Leninist Philosophy | 3 | 3 | 0 |
| 4. | SS008 | Marxist Leninist Political Economy | 2 | 2 | 0 |
| 5. | SS009 | Scientific Socialism | 2 | 2 | 0 |
| 6. | SS010 | History of Vietnamese Communist Party | 2 | 2 | 0 |
| **Mathematics – Informatics – Natural Sciences** | | | **22** | | |
| 7. | MA006 | Mathematical Analysis | 4 | 4 | 0 |
| 8. | MA003 | Linear Algebra | 3 | 3 | 0 |

[1] Physical education and military education are excluded in the credit calculation.

| | | | | | |
|---|---|---|---|---|---|
| 9. | MA004 | Discrete Structures | 4 | 4 | 0 |
| 10. | MA005 | Probability Statistics | 3 | 3 | 0 |
| 11. | PH002 | Introduction to Digital Circuits | 4 | 3 | 1 |
| 12. | IT001 | Introduction to Programming | 4 | 3 | 1 |
| **Foreign language** | | | **12** | | |
| 13. | ENG01 | English 1 | 4 | 4 | 0 |
| 14. | ENG02 | English 2 | 4 | 4 | 0 |
| 15. | ENG03 | English 3 | 4 | 4 | 0 |
| **Physical Education – Defense Education** | | | | | |
| 16. | ME001 | National Defense Education | Excluded | | |
| 17. | PE012 | Physical Education | Excluded | | |

## 6.3 Professional education course

### 6.3.1 Fundamental IT courses

A total of 14 compulsory courses for **49 credits** are required.

| S/N | Subject Code | Course Name | TC | LT | TH |
|---|---|---|---|---|---|
| 1. | IT002 | Object Oriented Programming | 4 | 3 | 1 |
| 2. | IT003 | Data Structures and Algorithms | 4 | 3 | 1 |
| 3. | IT004 | Introduction to Database | 4 | 3 | 1 |
| 4. | IT005 | Introduction to Computer Network | 4 | 3 | 1 |
| 5. | IT006 | Computer Architecture | 3 | 3 | 0 |
| 6. | IT007 | Operating Systems | 4 | 3 | 1 |
| 7. | CE005 | Introduction to Computer Engineering | 1 | 1 | 0 |
| 8. | CE103 | Microprocessors and Microcontrollers | 4 | 3 | 1 |
| 9. | CE118 | Digital Logic Design | 4 | 3 | 1 |
| 10. | CE119 | Computer Architecture Laboratory | 1 | 0 | 1 |
| 11. | CE121 | Engineering Circuit Analysis | 4 | 3 | $1^{(1)}$ |
| 12. | CE124 | Electronic Devices and Circuits | 4 | 3 | $1^{(1)}$ |
| 13. | CE213 | Digital System Design with HDL | 4 | 3 | 1 |
| 14. | CE224 | Embedded Systems Design | 4 | 3 | 1 |

### 6.3.2 Group of specialized subjects

A total of **18 credits** at least are required.

| S/N | Subject Code | Course Name | TC | LT | TH/BT |
|---|---|---|---|---|---|
| 1. | CE*** | Major Elective Course 1 (2) | 4 | 3 | 1(1) |
| 2. | CE*** | Major Elective Course 2 (2) | 4 | 3 | 1(1) |
| 3. | XX*** | Free Elective Course 1(3), (4) | 3 | 3 | |
| 4. | XX*** | Major Elective Course 2 (3), (4) | 3 | 3 | |
| 5. | CE201 | Project 1 | 2 | 0 | 2 (1) |
| 6. | CE206 | Project 2 | 2 | 0 | 2 (1) |

### 6.3.3 Other course

| S/N | Subject Code | Course Name | TC | LT | BT/TH(1) |
|---|---|---|---|---|---|
| 1. | SS004 | Professional Skills | 2 | 2 | |

## 6.4 Graduation course

### 6.4.1 Internship

| S/N | Subject Code | Course Name | TC | LT | TH |
|---|---|---|---|---|---|
| 1. | CE502 | Internship | 2 | 0 | 2 |

### 6.4.2 Capstone project

Students who are eligible according to the university's statute and regulations for doing capstone projects can register the course of Capstone Project with 10 credits. Students who are not eligible or eligible but do not want to do a capstone project can register to study alternative graduation courses (see details in 6.4.3).

| S/N | Subject Code | Course Name | TC | LT | TH |
|---|---|---|---|---|---|
| 1. | CE505 | Capstone Project(5) | 10 | | 10 |

### 6.4.3 Alternative courses for capstone project

These groups of courses (including 10 credits) are required for students who are not eligible for the capstone project or who are eligible but do not want to do a capstone project.

| S/N | Subject Code | Course Name | TC | LT | TH/BT |
|---|---|---|---|---|---|
| **Major in IC and Hardware Design** | | | | | |
| 1. | CE410 | Computer System Engineering | 4 | 3 | 1(1) |
| 2. | CE*** | Select one course from the list of major elective courses described in **Section 6.5** | 4 | 3 | 1(1) |
| 3. | CE408 | Major Project in IC and Hardware Design | 2 | | 2 |
| **Major in Embedded Systems and IoT** | | | | | |
| 4. | CE410 | Computer System Engineering | 4 | 3 | 1(1) |
| 5. | CE*** | Select one course from the list of major elective courses described in **Section 6.5** | 4 | 3 | 1(1) |
| 6. | CE412 | Major Projects in Embedded Systems and IoT | 2 | | 2 |
| **Major in Robotics and AI** | | | | | |
| 7. | CE410 | Computer System Engineering | 4 | 3 | 1(1) |
| 8. | CE*** | Select one course from the list of major elective courses described in **Section 6.5** | 4 | 3 | 1(1) |
| 9. | CE413 | Major Project in Robotics and AI | 2 | | 2 |

## 6.5 Note:

(1) Credits can be practicing credits, lab credits, coursework credits, or course project credits.

(2) Students register to study Major Elective Course 1 & 2 from **the list of Major Elective Courses** below depending on the major they wish to specialize in. Major Electives Course 1 & 2 can be implemented in collaboration between the Faculty of Computer

Engineering and companies, institutes, universities, or other educational organizations domestically and internationally. The list of major elective courses can be updated each semester to update the novelty of science, engineering and technology of the Computer Engineering training discipline in the direction of international integration.

**List of Major Elective Courses**

| S/N | Course code | Course Name | Credits | | | Room (**) |
|---|---|---|---|---|---|---|
| | | | Total | Theory | Lab | |
| **Major of Computer Hardware & IC Design** | | | | | | |
| 1. | CE433 | SoC Design | 4 | 3 | 1 | |
| 2. | CE222 | Digital IC Design | 4 | 3 | 1 | |
| 3. | CE334 | Analog IC Design | 4 | 3 | 1 | |
| 4. | CE332 | Mix-signal IC Design | 4 | 3 | 1 | |
| 5. | CE436 | Digital Signal Processing and Applications | 4 | 3 | 1 | |
| 6. | CE410 | Computer System Engineering | 4 | 3 | 1 | |
| 7. | CE434 | Special Topic on IC Design 1(6) | 4 | 3 | 1 | A213 A205 |
| 8. | CE435 | Special Topic on IC Design 2(6) | 4 | 3 | 1 | A213 A205 |
| **Major of Embedded System & IoT** | | | | | | |
| 9. | CE232 | Wireless Embedded System Design | 4 | 3 | 1 | |
| 10. | CE439 | Parallel Programming and Distributed Systems | 4 | 3 | 1 | |
| 11. | CE339 | IoT Technology and Applications | 4 | 3 | 1 | |
| 12. | CE340 | Artificial Intelligence for Embedded Systems | 4 | 3 | 1 | |
| 13. | CE342 | Smart Systems | 4 | 3 | 1 | |

| S/N | Course code | Course Name | Credits | | | Room (**) |
|---|---|---|---|---|---|---|
| | | | Total | Theory | Lab | |
| 14. | CE348 | Sensor Technologies for IoT | 4 | 3 | 1 | |
| 15. | CE437 | Special Topic on Embedded Systems Design 1(6) | 4 | 3 | 1 | A213 A205 |
| 16. | CE438 | Special Topic on Embedded Systems Design 2(6) | 4 | 3 | 1 | A213 A205 |
| **Major of Robotics & AI** | | | | | | |
| 17. | CE212 | Automatic Controls | 4 | 3 | 1 | |
| 18. | CE233 | Robot Principle and Design | 4 | 3 | 1 | |
| 19. | CE347 | Robot Intelligent Control | 4 | 3 | 1 | |
| 20. | CE440 | Indoor-and-Outdoor Localization System with AI Applications | 4 | 3 | 1 | |
| 21. | CE319 | Fuzzy Logic and Applications | 4 | 3 | 1 | |
| 22. | CE406 | Human-Computer Interaction | 4 | 3 | 1 | |
| 23. | CE441 | Special Topic on Robotics and AI 1(6) | 4 | 3 | 1 | A213 A205 |
| 24. | CE442 | Special Topic on Robotics and AI 2(6) | 4 | 3 | 1 | A213 A205 |

(3) For Free Elective Courses, students can participate in the professional education courses in undergraduate or postgraduate training programs from VNUHCM member universities, or courses from the other universities that have collaboration agreements with UIT, or training programs from technological enterprises that have collaboration agreements with UIT **in order to expand interdisciplinary knowledge or update new technologies**. In addition, students can choose general courses of the educational programs outside UIT. Equivalent subjects are only counted once in the total number of accumulated credits.

(4) It can be trained at UIT or at other educational institutions or in collaboration between UIT and other educational institutions.

(5) Students who are eligible according to the university's statute and regulations for doing capstone projects can register the course of Capstone Project with 10 credits. Students who are not eligible or eligible but do not want to do a capstone project can register to study alternative graduation courses (see details in 6.4.3)..

(6) For major courses (CE434, CE435, CE437, CE438, CE441, CE442) in the **list of Major Elective Courses**, students may be considered for credit transfer among majors.

# 7 MAPPING OF THE COURSES AND LEARNING OUTCOMES

## 7.1 General courses

| S/N | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 1. | SS003 | Ho Chi Minh's Ideology | K2 | | | | | | | |
| 2. | SS006 | Introduction to Vietnamese Law | K2 | | | | | | | A3 |
| 3. | SS007 | Marxist-Leninist Philosophy | K2 | | | | | | | |
| 4. | SS008 | Marxist Leninist Political Economy | K2 | | | | | | | |
| 5. | SS009 | Scientific Socialism | K2 | | | | | | | |
| 6. | SS010 | History of Vietnamese Communist Party | K2 | | | | | | | |
| 7. | MA006 | Mathematical Analysis | | K3 | S3 | | | | | |
| 8. | MA003 | Linear Algebra | | K3 | S3 | | | | | |
| 9. | MA004 | Discrete Structures | | K3 | S3 | | | | | |
| 10. | MA005 | Probability Statistics | | K3 | S3 | | | | | |

| S/N | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 11. | PH002 | Introduction to Digital Circuits | K2 | | | | | | | |
| 12. | IT001 | Introduction to Programming | | K3 | S3 | S3 | | | | A2 |
| 13. | ENG01 | English 1 | K3 | | | | S3 | S4 | | A4 |
| 14. | ENG02 | English 2 | K3 | | | | S3 | S4 | | A4 |
| 15. | ENG03 | English 3 | K3 | | | | S3 | S4 | | A4 |
| 16. | ME001 | National Defense Education | K2 | | | | | | | A5 |
| 17. | PE012 | Physical Education | | | S2 | | S4 | | | |

## 7.2 IT Fundamental courses

| No. | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 1. | IT002 | Object Oriented Programming | | K3 | S3 | | | S3 | | |
| 2. | IT003 | Data Structures and Algorithms | | K3 | S3 | S3 | | | | A2 |
| 3. | IT004 | Introduction to Database | | K3 | S3 | | | | | |
| 4. | IT005 | Introduction to Computer Network | | K3 | S2 | | | S2 | | |
| 5. | IT006 | Computer Architecture | | K2 | | | | S3 | | |
| 6. | IT007 | Operating Systems | | K3 | | | S3 | | | |

## 7.3 CE Core courses

| No. | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 1. | CE005 | Introduction to Computer Engineering | | | | | S2 | | S2 | A2 |
| 2. | CE119 | Computer Architecture Laboratory | | K3 | S2 | S2 | | | | |
| 3. | CE103 | Microprocessors and microcontrollers | | K3 | S3 | | | S3 | | |
| 4. | CE118 | Digital Logic Design | | K3 | S3 | | | S3 | | |
| 5. | CE121 | Engineering Circuit Analysis | | K2 | | | | | | |
| 6. | CE124 | Electronic Devices and Circuits | | K2 | | | | | | |
| 7. | CE224 | Embedded Systems Design | | K3 | | S4 | | S4 | | |
| 8. | CE213 | Digital System Design with HDL | | K3 | | S4 | | S4 | | |

## 7.4 Major course

| No. | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 1. | CE*** | Major Elective Course 1 | | K4 | S4 | S4 | | | | |
| 2. | CE*** | Major Elective Course 2 | | K4 | S4 | S4 | | | | |
| 3. | CE201 | Project 1 | | | | S3 | S3 | | S2 | |
| 4. | CE206 | Project 2 | | | | S4 | S4 | | S2 | |

## 7.5 Other course

| No. | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 1. | SS004 | Professional Skills | K2 | | | | S3 | | S2 | A2 |
| 2. | XX*** | Free Elective Course 1 | | | | | S3 | | | A3 |
| 3. | XX*** | Free Elective Course 2 | | | | | S3 | | | A3 |

## 7.6 Graduation courses

| No. | Course Code | Course Name | Learning outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 |
| 2. | CE*** | Major project | | | S4 | S4 | S4 | | | |
| 3. | CE410 | Computer Systems Engineering | | | S4 | S4 | S4 | | | |
| 4. | CE502 | Internship | | K4 | | | | | S3 | A4 |
| 5. | CE505 | Capstone project | | | S4 | S4 | S4 | | S3 | |

# 8 TEACHING PLAN

| Semester | Course code | Course name | Course type | Credits | | |
|---|---|---|---|---|---|---|
| | | | | Total | Theory | Lab |
| 1 | CE005 | Introduction of Computer Engineering | Compulsory | 1 | 1 | 0 |
| | IT001 | Introduction to Programming | Compulsory | 4 | 3 | 1 |
| | MA006 | Mathematical Analysis | Compulsory | 4 | 4 | 0 |
| | MA003 | Linear Algebra | Compulsory | 3 | 3 | 0 |
| | SS007 | Marxist-Leninist Philosophy | Compulsory | 3 | 3 | 0 |
| | ENG01 | English 1 | Compulsory | 4 | 4 | 0 |
| | ME001 | National Defense Education | Compulsory | Excluded | | |

| Semester | Course code | Course name | Course type | Credits | | |
|---|---|---|---|---|---|---|
| | | | | Total | Theory | Lab |
| | PE012 | Physical Education | Compulsory | Excluded | | |
| | **Semester 1's credits in total: 19** | | | | | |
| **2** | IT002 | Object Oriented Programming | Compulsory | 4 | 3 | 1 |
| | PH002 | Introduction to Digital Circuits | Compulsory | 4 | 3 | 1 |
| | MA005 | Probability Statistics | Compulsory | 3 | 3 | 0 |
| | MA004 | Discrete Structures | Compulsory | 4 | 4 | 0 |
| | ENG02 | English 2 | Compulsory | 4 | 4 | 0 |
| | **Semester 2's credits in total: 19** | | | | | |
| **3** | IT003 | Data Structures and Algorithms | Compulsory | 4 | 3 | 1 |
| | IT005 | Introduction to Computer Network | Compulsory | 4 | 3 | 1 |
| | IT006 | Computer Architecture | Compulsory | 3 | 3 | 0 |
| | CE119 | Computer Architecture Lab | Compulsory | 1 | 0 | 1 |
| | SS003 | Ho Chi Minh's Ideology | Compulsory | 2 | 2 | 0 |
| | ENG03 | English 3 | Compulsory | 4 | 4 | 0 |
| | **Semester 3's credits in total: 18** | | | | | |
| **4** | CE103 | Microprocessors and microcontrollers | Compulsory | 4 | 3 | 1 |
| | IT007 | Operating System | Compulsory | 4 | 3 | 1 |
| | CE121 | Engineering Circuit Analysis | Compulsory | 4 | 3 | 1 |
| | SS009 | Scientific Socialism | Compulsory | 2 | 2 | 0 |
| | SS010 | History of Vietnamese Communist Party | Compulsory | 2 | 2 | 0 |
| | **Semester 4's credits in total: 16** | | | | | |
| **5** | IT004 | Introduction to Database | Compulsory | 4 | 3 | 1 |
| | CE124 | Electronic Devices and Circuits | Compulsory | 4 | 3 | 1 |
| | CE224 | Embedded Systems Design | Compulsory | 4 | 3 | 1 |
| | CE118 | Digital Logic Design | Compulsory | 4 | 3 | 1 |
| | **Semester 5's credits in total: 16** | | | | | |
| **6** | CE213 | Digital System Design with HDL | Compulsory | 4 | 3 | 1 |
| | SS004 | Professional Skills | Compulsory | 2 | 2 | 0 |
| | CE*** | Major Elective Course 1 | Elective | 4 | 3 | 1 |

| Semester | Course code | Course name | Course type | Credits | | |
|---|---|---|---|---|---|---|
| | | | | Total | Theory | Lab |
| | XX*** | Free Elective Course 1 | Elective | 3 | | |
| | CE201 | Project 1 | Compulsory | 2 | 0 | 2 |
| | **Semester 6's credits in total: 15** | | | | | |
| 7 | CE*** | Major Elective Course 2 | Elective | 4 | 3 | 1 |
| | XX*** | Free Elective Course 2 | Elective | 3 | | |
| | CE206 | Project 2 | Compulsory | 2 | 0 | 2 |
| | SS008 | Marxist Leninist Political Economy | Compulsory | 2 | 2 | 0 |
| | SS006 | Introduction to Vietnamese Law | Compulsory | 2 | 2 | 0 |
| | **Semester 7's credits in total: 15** | | | | | |
| 8 | CE505 | Capstone Project | Elective | 10 | 0 | 10 |
| | **Semester 8's credits in total: 10** | | | | | |
| | **CE Program's credits in total: 128** | | | | | |

# 9 BRIEF DESCRIPTION OF COURSES

## 9.1 General courses

### 9.1.1 Ho Chi Minh's Ideology

The course supplies for students basic knowledge about Ho Chi Minh's Ideology and the application of Ho Chi Minh's Ideology of our Party and State in the renovation period and in the revolution of Vietnam. The course consists of 6 sections:

- The concept, original and process of forming Ho Chi Minh's ideology.
- Ho Chi Minh's ideology about national issues and the revolution of Nation liberation.
- Ho Chi Minh's ideology about socialism and the transitional road to socialism in Vietnam.
- Ho Chi Minh's ideology about great national unity: combining national strength with the power of the times.
- Ho Chi Minh's ideology about the Communist Party of Vietnam.
- Ho Chi Minh's ideology on morality, humanity and culture.

### 9.1.2 Marxist-Leninist philosophy

Follow the current regulations of the Ministry of Education and Training.

### 9.1.3 Marxist-Leninist Political Economy

Follow the current regulations of the Ministry of Education and Training.

### 9.1.4 Scientific Socialism

Follow the current regulations of the Ministry of Education and Training.

### 9.1.5 History of Vietnamese communist party

The course provides basic knowledge about revolution directions of the Communist Party of Vietnam, especially in the renovation period. The course consists of 8 sections:

- The establishment of Communist Party of Vietnam and the first political platform of the Party.
- Rise to power (1930-1945)
- War for independence (1945 – 1975)
- Industrialize direction.
- Socialist-oriented market economy.
- The way to build political, culture and foreign Policy systems.

### 9.1.6 Introduction to Vietnamese Law

Follow the current regulations of the Ministry of Education and Training

### 9.1.7 Mathematical Analysis

The course provides introductory knowledge to calculus. Contents include:

- Complex number.
- Integral calculation of multivariate functions: double integral, multiple integral, line integral, face integral.
- The differential calculation of a multivariate function, Taylor's formula, derivatives in the direction.
- The application of multivariate functions in extreme problems, in geometry.
- Integral calculation of a one-variable function.
- Number series, function series.
- Differential equation one, differential equation two, differential equation system.

### 9.1.8 Linear Algebra

Some of the main contents of the course are:

- Matrices, definitions, linear systems of equations. Solving linear equations using the Cramer method, Gaussian method.
- Linear space, dependence, linear independence.
- Cross-matrix and what it means.
- Linear, global mapping; bring the holistic form to the official form.

### 9.1.9 Discrete structures

This course provides students with the basics of

- Discrete math: Logical basis; Counting methods; Relations; Bool algebra.
- Graph Theory: The basic concepts of graph theory; Graphs and trees.
- Graphs and trees and some basic concepts of graph theory.

### 9.1.10 Probability Statistics

This course provides students with the basics of

- Probability: the basic concepts of probability, one-dimensional random quantities, multidimensional random quantities, some probability distributions.
- Statistics: sample theory, estimation, statistical hypothesis testing, correlation and regression.

### 9.1.11 Introduction to Digital Circuits

This course provides students the following contents:

- Basic theories of logical algebra
- Number counting and coding system
- Combinatorial Circuit Design and Analysis
- Design basic digital circuits
- Sequential Circuit Design and Analysis
- Design counters.

### 9.1.12 Introduction to Programming

This course provides students the following contents:

- Basic concepts such as algorithms, flowcharts, pseudocode, programming languages, programs, translators, executable programs, computer software.
- Basic data types, operations, and basic control structures of a particular programming language (NNLT).
- Write programs that install algorithms using NNLT C, translate, test, catch errors, and fix programs that have already been written.
- Apply functions (or procedures, subprograms) to organize programs into units that can be reused many times in software projects.
- Apply a few basic techniques (iteration processing, retrieval calculation, array browsing, using banners, etc.) to build algorithms and install programs to solve some common and not too complicated problems.

- ASCII text files can be used to store program data.

## 9.2 IT Fundamental Courses

### 9.2.1 Introduction to Computer Engineering Programs

The course provides knowledge about the IT industry in general and Computer Engineering in particular. In which, it provides students with what they will study and what they will do after graduating, where to do it.

### 9.2.2 Professional Skills

The course provides the skills to support professional and professional competencies in the IT field that are necessary for students at the University of Information Technology. Based on a methodology approaching the system, the subject content directs students to actively carry out the process of studying and self-studying at university and graduate with good moral qualities, professional knowledge and skills to meet the working requirements of society. The knowledge provided includes:

- Reading, listening, and note-taking skills
- Conversation skills
- Self-study skills
- Teamwork skills
- Observing, identifying, and problem-solving skills
- Presentation and meeting control skills
- Work organization skills
- Practical skills
- Writing and reporting skills

### 9.2.3 Object-oriented programming

This course covers object-oriented programming with the C++ language. The subject program consists of 2 basic parts divided into 9 chapters. Part 1 consists of the first 4 chapters that introduce basic C++ programming such as: Data Types, Control Flows, Functions, Parameters, Function Stacks, Arrays, Cursors, and Dynamic Arrays. Part 2 consists of the next 5 chapters on object-oriented programming such as: structure, class, constructor, destructor, overload, friend, reference, inheritance, multifunction, virtual function.

### 9.2.4 Data structure and algorithm

This course presents data structures and algorithms, designing algorithms, which is a necessary foundation course for information technology students in general and in the

direction of programming in particular. Chapter 1 presents an overview of algorithms and data structures. Chapter 2 provides a brief introduction to search and sorting algorithms. Chapter 3 presents dynamic data structures such as cursors and link lists. Chapter 4 presents tree structures, types of binary trees.

### 9.2.5 Introduction to Database

This course provides knowledge about databases such as: basic concepts of relational databases; Relational algebraic operations; SQL Language; New word language, Integrity constraints on a database; Governance inside the database, guest/host environment

### 9.2.6 Introduction to computer networking

This course provides an overview of computer networks, including OSI, TCP/IP reference models and network standards; basic concepts and principles of signal transmission and transmission. Students will gain an in-depth understanding of the TCP/IP model such as protocols in layers, especially the network layer and the transport layer. In addition, students are also familiar with basic network services, wireless network techniques and network security.

### 9.2.7 Computer Architecture

This course presents the basic knowledge of computer architecture including the history of the development of computers, the basic components of a computer, the basic concepts related to the numerical systems used in computers, the concept of computer architecture, etc instruction sets, computer architecture types, positioning types used in architecture, distinguishing between CISC (Complex Instruction Set Computer) and RISC (Reduced Instruction Set Computer) architectures, the structure of the central processor and the execution of a machine code instruction, memory knowledge, etc. about transmission lines and communication between parts of the computer.

### 9.2.8 Operating System

This course introduces concepts in order from simple to complex, the course consists of 9 chapters corresponding to computer structures from simple to complex. The first six chapters introduce the basic concepts of an operating system. The next three chapters are high-performance.

## 9.3 CE Core Courses and Major Courses

### 9.3.1 Microprocessors and microcontrollers

- The course will provide knowledge of the concept, architecture and operating principles of a microprocessor, knowledge of x86 processors and methods of controlling data in and out of the microprocessor. At the same time, it introduces modern processors.
- The course also provides knowledge of a microcontroller in which the X51 microcontroller will be studied in terms of communication with devices and programming

### 9.3.2 Digital Logic Design

This course presents the next knowledge of the Introduction to Digital Circuits, including the content that goes deeper and has not been studied in the previous course. The main contents include the following 4 chapters:

+ Chapter I: Sequential Circuit
+ Chapter II: Storage Components
+ Chapter III: Register transfer design
+ Chapter IV: Processor design

### 9.3.3 Computer Architecture Laboratory

This course provides practical exercises for Computer Architecture including

- Build a computer system on an FPGA based on Nios II soft processing cores, DE2 kits, and Quartus software powered by Altera.
- Based on the computer system that can be built, the basic problems of computer architecture such as: assembly language programming, input/export engineering, bus structure... put into practice.

### 9.3.4 Engineering Circuit Analysis

- This course presents the basic concepts of electrical circuits; electrical circuits and equivalent transformations; correlation between voltage currents on circuit elements;
- The course also introduces methods of analysis and decoding in the frequency and time domains.
- Specifically, it will include the following contents:
    - Electrical Circuit Basics
    - Analyze the circuit in the conditioning establishment mode

- Circuit Analysis Methods
- Time Domain Circuit Analysis
- Frequency Domain Circuit Analysis
- Practice analyzing some basic electrical circuits

### 9.3.5 Electronic Devices and Circuits

- This course presents the basic concepts of electronic circuits; amplifiers, filters, comparative circuits, oscillators and circuit equivalence transformations;
- The course also introduces the characteristics of each type of component, the effects of each molecule in DC and AC modes.
- For practice, this subject:
  - Introduces how to assemble electronic components together to form basic electronic circuits and applied electronic circuits.
  - Practice of designing and simulating electronic circuits
  - Practice PCB Design and Printed Circuit Making
  - Learn about electrical and electronic support tools such as VOM, DMM, Oscilloscope

### 9.3.6 Digital System Design with HDL

This course introduces the overview concepts of logical circuit design, front-end IC design methods, and the hardware description language of VHDL & Verilog

### 9.3.7 Embedded Systems Design

This course provides the following contents:

- Introduction to general concepts of embedded, memory, and peripheral systems.
- Introduces integrated methods of software (major) and hardware (small) development for embedded systems built on a family of microcontrollers and microprocessors.
- Provides knowledge to analyze and design a simple embedded system that provides the C/C++ programming language for embedded systems.
- Students can practice and design a simple application embedded system in practice

### 9.3.8 Project 1

This course provides basic electrical-electronic circuits or IC design skills for students as well as skills in developing embedded software, IC development software on circuits designed by students.

### 9.3.9 Project 2

This course provides skills in embedded system design, IoT device design or SoC system design, and design the next IC in Project 1 for students. This course provides embedded programming, system programming, HDL programming skills to develop embedded software, and develop microchips according to a function that students need to design.

### 9.3.10 Free Elective Course 1 & 2

The course allows students to choose knowledge from other disciplines or technological expertise to gain an understanding of new social, technological and technical needs. The content of the subject directs students to actively carry out the process of self-study with good moral qualities, have professional knowledge and skills to meet the working requirements of society.

### 9.3.11 Major Elective Course 1 & 2

The course allows students to choose specialized knowledge in Computer Engineering that is up to date with technology and new techniques. Students need to grasp new knowledge, update new technologies and techniques to meet business needs. The content of the course can be combined with businesses to teach and provide students with the ability to solve practical problems and have a professional working attitude with professional skills to meet the working requirements of the industry.

### 9.3.12 Major Project on Embedded System and IoT Design

This course is for students studying a graduation topic. This project provides skills in embedded system design and IoT. Students who complete this course grasp

- General or specialized knowledge of embedded systems and IoT.
- Skills to learn, research and solve problems in the embedded systems industry, Computer Engineering and skills in presentations, communication and teamwork.
- Positive working attitude in the embedded systems industry

### 9.3.13 Major Project on IC and Computer Hardware Design

This course is for students studying a graduation topic. This project provides skills in IC and computer hardware design, Computer Engineering. Students who complete this course grasp

- General knowledge of IC and hardware design, computer engineering.
- Skills to learn, research and solve problems of the IC design industry, the CE industry and the skills of presentation, communication and teamwork.
- Positive working attitude in the environmental protection industry

### 9.3.14 Major Project on Robotics and AI

This course is for students studying a graduation topic. This project provides design skills in integrating AI technology into the processors/controllers on Robots. Students who complete this course grasp

- General knowledge of AI and Robotics, computer engineering.
- Skills to learn, research and solve problems in AI and Robotics, STEM and skills in presentation, communication and teamwork.
- Positive working attitude in the environmental protection industry

### 9.3.15 VLSI Design

This course provides students with the basics of IC design. Provides in-depth knowledge of CMOS technology, the dominant technology in today's IC design. In addition, functional analysis, timing, modeling, and design optimization methods will also be equipped for students.

### 9.3.16 Mixed-Signal Integrated Circuit Design

This course includes the following contents:

- Present the basics of hybrid IC design:
    - The basic structure of a mixed microchip system.
    - Basic components of the system: Op-amps, D/A converters, S/H circuits, Analog Switches, Comparator, PLL, ...
- Methods/methods for analyzing, designing, simulating, and laying out components or mixed circuits at the CMOS level.
- The exercises follow the theoretical content to help students better understand the theory and have a practical view of hybrid IC design.

### 9.3.17 Analog IC Design

This course includes the following contents

- Present the basics of analog IC design.
- Methods for analyzing, designing, simulating, and laying out components or similar circuits at the CMOS level.
- The exercises follow the theoretical content to help students better understand the theory and have a practical view of similar IC design.

### 9.3.18 SoC Design

This course introduces SoC design methods. Provides students with the SoC design process and basic knowledge of SoC

### 9.3.19 Digital Signal Processing and Applications

English name: Digital Signal Processing and Applications

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The Digital Signal Processing course aims to provide modern signal processing concepts and techniques, system foundations from highly specialized military to consumer electronics industry applications. The course will guide students to learn more about
    - Discrete signals and systems over time, system representations using differential equations, and system analysis using the Fourier transform and Z transform.
    - Continuous signal sampling theory over time, analysis of invariant linear systems over time.
    - The Discrete Fourier Transform (DFT) and the FFT algorithm for fast DFT calculation will be explored along with methods of analyzing the discrete signal spectrum over time.
    - The main methods for designing FIR and IIR filters.
    - Application to design signal processing circuits, design signal processing algorithms on SoC systems, embedded systems, or Matlab simulation systems. Students can do applied subject projects depending on their desired major, such as: IC design or embedded system design.

### 9.3.20 IC Design Seminar 1

English name: Topics on IC and hardware design 1

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description:
    - Introduces the entire stages of designing an IP core or a processor chip in the direction of an FPGA or ASIC.
    - Give a specific design example, showing how to proceed with each design stage.
    - Using specialized software to realize the above design in each of the above stages

helps students have a realistic view of the design process in a company.

### 9.3.21 IC Design Topic 2

English name: Topics on IC and hardware design 2

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Description of the course content: The objective of this course is to combine with enterprises in training new technologies to meet the requirements of the labor market. Therefore, the detailed content of the subject will be issued specifically depending on each training semester. However, the main content is expected to include:
    - Introducing and updating epochal IC technologies.
    - Introducing the technology of designing, realizing, and testing an IP core or a VLSI-oriented IC.
    - Students need to implement an IP core, or an IC that applies new technology to grasp the design, realization and test process of design IC as in the enterprise.

### 9.3.22 Wireless embedded system design

English name: Wireless Embedded Systems Design

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description:
    - Introduction of peripheral integrated embedded system architecture. It introduces the architecture of an end node in the Internet of Things system.
    - Hardware and software integration model on peripheral integrated embedded systems: bootloader, kernel, OS, driver...
    - Introduction to peripheral integrated embedded system design methods.
    - Provides knowledge in analyzing and designing a complex embedded system with integrated memory, peripheral modules, and network communication modules/wireless communication modules.
    - Students know how to practice and design their own application embedded system in an Internet of Things solution.

### 9.3.23 Human-machine interaction

English name: Human-Computer Interaction

- Number of credits: 3.1

- Prerequisites/Previous Course:
- Course description:

Students will learn how to design technologies/applications that bring excitement and convenience to users. Students will approach a number of rapid modelling techniques and evaluate communication options. At the same time, students will learn how to use the models they have created to get feedback from relevant people, from teammates, customers, users, etc. Throughout the semester, students will work on a project in groups of 3 to 4 students. The topic focuses on analyzing user habits, needs and building interfaces for mobile applications. The course focuses on the development of a number of necessary skills, such as ideation, evaluation, communication, development of testing and evaluation models. From there, it helps students gain principles and methods to create convenient ways of communicating with different technologies.

### 9.3.24 IoT Technology and Applications

English name: IoT Technology and Application

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description:

This course content provides students with IoT concepts which focus on platforms (hardware and software platforms that can be applied in IoT), M2M protocols (communication protocols that can be applied in IoT: Zigbee, Bluetooth, IEEE 802.15.4, IEEE 802.15.6, IEEE 802.15.11) and data and information processing mechanisms.

### 9.3.25 Artificial Intelligence for Embedded Systems

English name: AI for embedded system

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description:

Students are provided with concepts and principles of artificial intelligence on embedded systems. This course consists of 9 chapters with the following knowledge blocks: overview of artificial intelligence, basic machine learning algorithms, deep learning models, techniques for designing, realizing, executing and optimizing artificial intelligence applications on embedded systems. Accompanying the above knowledge blocks are practical exercises to provide more practical perspectives on the content that has been introduced.

### 9.3.26 Intelligent System

English Name: Smart Systems

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description:

In the era of Internet of Things (IoTs) and Industrial Revolution 4.0 (IR4.0), intelligent systems have become popular and become an important part of life and scientific research. The course is designed to provide students with the basic knowledge of designing and optimizing intelligent systems. The course consists of 8 chapters with the following knowledge blocks: an overview of smart systems in the context of the development of IoTs and IR4.0, platform technologies in smart systems, smart system design and optimization, and typical examples of smart systems such as smart homes, smart grid. The course also equips students with basic practical skills with projects on smart system design.

### 9.3.27 Embedded System Design Seminar 1

English name: Topics on Embedded systems 1

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The detailed content of this subject will be issued specifically according to the needs of the labor market, but the main content may include
    - Introduce all stages to design and implement an embedded system both in terms of hardware and software.
    - Give a specific design example, showing how to proceed with each design stage
    - Use specialized tools or software to realize the above design in each of the above stages  help students have a realistic view of how the process of designing, installing and realizing an embedded system in a company.

### 9.3.28 Embedded System Design Topic 2

English name: Topics on Embedded systems 2

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Description of the course content: The objective of this course is to combine with enterprises in training new technologies to meet the requirements of the labor market. Therefore, the detailed content of the subject will be issued specifically depending on each training semester. However, the main content is expected to include:
    - Introduce new technology in design, realize, and test an embedded system from

hardware to software.

- Provide knowledge about the design process or practical methods, performance evaluation methods for new, up-to-date embedded systems
- Students need to realize a practical application to grasp the process of designing, installing, and implementing an embedded system for enterprise applications.

### 9.3.29 Automatic Control

English name: Automatic Controls

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The course introduces students to physical models, equips students with knowledge of kinetic properties and practical guidance on the process of analysis, design, and consideration of the stability properties of the basic automatic control system according to specific requirements

### 9.3.30 Robotics Engineering

English name: Robot principle and design

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The course provides basic knowledge of robotics engineering, in which students are equipped with robotic computing techniques, design principles, selection of hardware parts and robot software. Students are also equipped with some knowledge of servo motors, accuracy, controllers, and sensors equipped in robots. Robots include many types corresponding to different fields: industrial robots, humanoid robots, wheeled platforms, unmanned aerial vehicles (UAV/drone). The robotic arm is equipped with knowledge of robot kinematics, stitching coordinate system setup, reverse kinematics, Jacobian matrix, control and programming system for the robotic arm. The mobile robotics section equips the knowledge and algorithms to develop a mobile robot capable of driving itself in a complex environment; equip them with knowledge of how to move, kinematics, cognitive ability, mapping, and tracking the movement trajectory of mobile robots. The drone robot equipment section provides knowledge about aircraft modeling, state estimation, control, and motion trajectory

### 9.3.31 Intelligent Control for Robots

English name: Robot Intelligent Control

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course description: The subject creates a foundation for learners to learn about intelligent systems for robots. The course presents knowledge of methods for analyzing and designing robots and intelligent systems. Methods for modeling systems kinematics, measuring and controlling robots, and making decisions for robots. Numerical methods for evaluation as well as neural networks for classifying and controlling robots.

### 9.3.32 Positioning system with AI application

English Name: Indoor-and-Outdoor Localization System with AI Applications

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The location of people or objects (including Robots) for mobile, autonomous, safe and secure applications. Therefore, this issue has become important due to the increasing need as a part of daily life.

  For outdoor applications, where satellite waves are strong enough to be received, positioning relies mainly on waves from at least four satellites (GPS) with a maximum accuracy of a few meters and a sharp decline in accuracy in places where satellite waves are weak or not strong enough (indoor). Therefore, indoor location applications cannot be based on GPS positioning. Techniques that have been used for indoor positioning include RFID, Fingerprint, ultrawideband (UWB), RSSI/DOA, IMU, vision, etc..... and the combination of techniques together or in combination with GPS.

  This course provides general knowledge about Navigation Systems as above, especially focusing on indoor navigation systems because robots are often used in places where satellite waves are weak or there are no satellite waves. This course also describes common difficulties encountered by indoor navigation systems (e.g. line-of-sight, LOS) and provides solutions to overcome them. Finally, the subject helps learners experience practical indoor positioning systems from design to implementation with AI tools.

### 9.3.33 System Programming

English name: System programming

- Number of credits: 3.1

- Prerequisites/Previous Course:
- Course description:
    - This course presents the basic concepts of the Java language such as data types, control iterative structures, object-oriented concepts such as objects, representations, classes, inheritance, interfaces, polymorphisms. Concepts of interface programming such as applets, swing GUI. System programming concepts such as client-server model, socket, TCP, UDP.
    - Learn and practice basic programming, object-oriented programming, interface programming, and system programming through specific math problems.

**9.3.34 Robotics and AI 1**

English name: Special topics on Robotics and AI 1

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: The detailed content of this subject will be issued specifically according to the needs of the labor market, but the main content may include
    - Introducing technology to design and realize a Robotics application with integrated new control algorithms, artificial intelligence algorithms.
    - Give a specific design example, showing how to proceed with each stage of Robotics application design.

**9.3.35 Robotics and AI 2**

English name: Special topics on Robotics and AI 2

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Description of the course content: The objective of this course is to combine with enterprises in training new technologies to meet the requirements of the labor market. Therefore, the detailed content of the subject will be issued specifically depending on each training semester. However, the main content is expected to include:
    - Introducing new technologies in design, realization and testing of a Robotics system with integrated artificial intelligence algorithms.
    - Provide knowledge about the design process or practical methods, performance evaluation methods for Robotics systems that are new and up-to-date.
    - Students need to realize a practical application to grasp the process of designing,

installing and realizing a smart Robotics application for businesses.

### 9.3.36 Sensor Technology

English name: Sensor Technologies

- Number of credits: 3.1
- Prerequisites/Previous Course: Embedded System Design
- Course description:

Sensors are an important component in the design architecture of embedded systems. In particular, in the development orientation of IoT solutions, sensors have become even more important. The course is designed to equip students with the knowledge and skills to use a variety of sensors for the development of IoT solutions.

In addition to providing knowledge about the principle of operation and techniques for using sensors, the subject updates techniques for using new sensors such as Lidar, Ultrasonic sensor, etc. for modern and accurate solutions.

## 9.4 Graduation Knowledge Block

### 9.4.1 Career Skills

English name: Profession Skills

- Number of credits: 2.0
- Prerequisites/Previous Course:
- Course Description: The course provides the skills to support professional and career competencies in the IT field necessary for students of the University of Information Technology. On the basis of a methodology approaching the system, the subject content directs students to actively carry out the process of studying and self-studying at university and graduate with good moral qualities, professional knowledge and skills to meet the working requirements of society. The knowledge provided includes:
    - Reading, listening, and note-taking skills
    - Conversation skills
    - Self-study skills
    - Teamwork skills
    - Observing, identifying, and problem-solving skills
    - Presentation and meeting control skills
    - Work organization skills
    - Practical skills

- Writing and reporting skills

### 9.4.2 Business Internship

English Name: Internship

- Number of credits: 0.2
- Prerequisites/Previous Course:
- Course description: Provide students with skills to solve practical problems or participate in research, design or implement specific applications from businesses to develop communication skills, teamwork, and presentations in real environments at businesses. In addition, this subject helps students have a positive attitude in Computer Engineering and orient their professional development in the future. The internship period for the bachelor's program is determined to be at least 10 weeks (2.5 months) at the enterprise.

### 9.4.3 Computer Systems Engineering

English name: Computer System Engineering

- Number of credits: 3.1
- Prerequisites/Previous Course:
- Course Description: Introduces general concepts of Computer Systems and the life cycle of developing a computer system in practice. The chapters in the course will present the steps in the system development process in turn, each chapter will have small exercises for students to practice. The subject will have a big assignment.

### 9.4.4 Graduation thesis

English Name: Capstone Project

- Number of credits: 0.10
- Prerequisites/Previous Course:
- Course Description: This course is for students doing the Graduation Thesis. This thesis provides skills in embedded systems design and IoT or IC and computer hardware design. Students who complete this course grasp
    - General knowledge either of the embedded systems and IoT specialization or the hardware and IC design specialization.
    - Skills to learn, research and solve problems of the STEM industry and skills in presentation, communication and teamwork.
    - Positive working attitude in the CE industry and the ability to self-study for life.

# REFERENCES


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ii. Circular No. 17/2021/TT-BGDDT dated June 22, 2021 of the Ministry of Education and Training on regulations on training program standards; developing, appraising and promulgating training programs of higher education levels.

iii. Decree No. 99/2019/ND-CP dated 30/12/2019 of the Prime Minister on detailing and guiding the implementation of a number of articles of the Law amending and supplementing a number of articles of the Law on Higher Education (Decree 99)

iv. Decision No. 1982/QD-TTg of the Prime Minister dated 18/10/2016 approving the Vietnam National Qualification Framework

v. Official Letter No. 85/ĐHQG-ĐH dated 15/01/2020 on reviewing and updating the training program of specialized training disciplines specific to the university level at VNU-HCM in 2020.

vi. Decision No. 1685/QD-ĐHQG dated 24/12/2020 on the pilot approval of the set of qualities and competencies of VNU-HCM graduates.

vii. Decision No. 546/QD-ĐHCNTT dated 30/8/2019, of the University of Information Technology promulgating the Regulation on training under the credit system for the regular university system of the University of Information Technology.

viii. Decision No. 185/QD-ĐHCNTT dated 30/3/2018, of the University of Information Technology promulgating the process of evaluating and updating the training program at the Undergraduate/Postgraduate level of the University of Information Technology.

**Domestic training programs:**

ix. Engineer training program in Computer Engineering, University of Science and Technology - VNU Ho Chi Minh City (139 TC, 8 HK). Source: http://www.cse.hcmut.edu.vn/site/vi/Page?item=82

x. Engineer training program in Computer Engineering, Hanoi University of Science and Technology (including Bachelor's training (4 years), Bachelor's – Engineer integration (5 years), Bachelor's – Master's integration (5.5 years). Source: https://soict.hust.edu.vn/content/uploads/2019/07/IT2-KỸ-THUẬT-MÁY-TÍNH-2019.pdf

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xii. Training program in Computer Engineering Technology at the University of Technical Education (132 TC, 8 HK). Source: https://hcmute.edu.vn/ArticleId/155624e7-1680-4961-b825-c6c72ba2ce4c/cong-nghe-ky-thuat-may-tinh

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