

THAI NGUYEN UNIVERSITY
UNIVERSITY OF INFORMATION
AND COMMUNICATION TECHNOLOGY

PROGRAMME SPECIFICATION
MAJOR: AUTOMATION AND CONTROL ENGINEERING TECHNOLOGY
SPECIALIZATION: AUTOMATION UNDERGRADUATE PROGRAM
CODE: 7510303

*(Issued under Decision No. 566/QĐ-ĐHCNT&TT dated on 30/8/2021
By Rector of the University of Information and Communication Technology)*

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TABLE OF ABBREVIATIONS

CNTT&TT	Information and Communication Technology
TĐNL	Learning Taxonomy
GDTC + GDQP	Physical education + National defense education
CNTĐH	Automation Technology
KHCB	Basic Science
TQ/HT/SH	Pre-requisite/ Previous / Parallel
CNĐT&TT	Electronics and Communications Technology
TC	Credits

1. GENERAL INFORMATION

1.1. Introduction

A training curriculum is a system of modules expressing training objectives, defining standards of knowledge, skills, ethical qualities, scope and structure of training content, methods and forms of training, methods of evaluating training outcomes.

The training program in Automation and Control Engineering Technology (ACET) is designed towards CDIO approach to train students comprehensively in terms of professional knowledge, skills and ethical qualities; which emphasizes practical capacity and sense of social responsibility; ensure students have active learning and practical experience. Graduates meet the requirements of knowledge, professional qualifications of employers and society.

The training curriculum of ACET programme is designed on the basis of compliance with regulations and guidelines of the Ministry of Education and Training, Thai Nguyen University, University of Information and Communication Technology; in accordance with the development orientation of the control and automation technology industry, with the demands of human resource, the locality and the economic region labor market; refer to national and international quality assurance standards; refer and compare with training programs of other national and international universities.

1.2. General Information

1.2.1. Programme Name

+ In Vietnamese: Công nghệ kỹ thuật điều khiển và tự động hóa

+ In English: Automation and Control Engineering Technology

1.2.2 Programme Code: 52510303

1.2.3 Specialization

+ In Vietnamese: Tự động hóa

+ In English: Automation undergraduate program

1.2.4. Programme Type: Full-time

1.2.5. The Degrees

+ Bachelor degree in Automation and Control Engineering Technology (4 years)

+ Engineer degree in Automation and Control Engineering Technology (5 years)

1.2.6. In-charge Training and Granting Degrees Unit

University of Information and Communication Technology – Thai Nguyen University

2. PROGRAMME OBJECTIVES

The objectives of the training program are built in accordance with the Vision - Mission - Educational philosophy of ICTU; which aims to foster people and develop applied scientific research to meet the needs of socio-economic development and international integration.

2.1. Vision - Mission - Educational Philosophy of ICTU

2.1.1 Vision

University of Information and Communication Technology will become Vietnam's leading digital technology based multidisciplinary applied university in the Vietnamese higher education system.

2.1.2 Mission

“Training human resources at graduate and postgraduate levels; short-term fostering; research and technology transfer to meet labor market requirements and in accordance with the National Strategy on the Industrial Revolution 4.0 and the National Digital Transformation Program, to meet the needs of economic, cultural, and social development of the country.”

2.1.3. Educational Philosophy of ICTU

“Establishing comprehensive education in a learner-centered manner; training digital citizen role models; creating the future, nurturing compassion”

2.2. Programme Objectives

2.2.1 General Objectives

Training bachelor's degree in ACET (major in Automation) with good professional ethics; idealistic and responsible; has the ability of systematic thinking and reasoning and solving the problems of science and technology specialized in automation; be able to operate and repair/maintain automation systems; be able to design small automation systems; has capabilities of lifelong learning to adapt to the continuous development of science and technology; With the engineering degree program, students are equipped with more specialized knowledge and skills to meet the capacity to participate in implementing, manufacturing, deploying, and evaluating technical solutions; and adapt well to different jobs in the wide field of ACET.

2.2.2 Specific Objectives: Graduates' Knowledge, Skills and Competencies

- Having fundamental knowledge of basic science modules (political theory, law, physics, mathematics...) to solve related problems in work and life fields.
- Having foreign language and computer skills to meet the needs of working in an interdisciplinary, multicultural, and multinational environment.
- Having basic technical knowledge and professional knowledge in electricity, electronics, measurement, programming, control, and automation; qualified to participate in solving related problems in the field of automation technology.
- Having skills in inspecting, repairing, maintaining, and operating automation systems.
- Having communication and teamwork skills; capable of leading interdisciplinary engineering teams to conceptualize, and participate in system design, implementation and operation.
- Having personal skills and lifelong learning ability to adapt to the continuous development of science and technology.
- Be able to meet job positions in foreign-invested enterprises / in advanced countries (objective for engineers).
- Having the ability to think, analyze, evaluate, upgrade and develop new automation systems (objective for engineers).

3. Expected Learning Outcomes and Contribution of Each Module to the Outcomes

3.1. Expected Learning Outcomes

No.	PLO	PLOs	Level
1		Technical reasoning knowledge	
1.1	L1	<i>Apply fundamental (basic) knowledge of social sciences and natural sciences (such as political theory, mathematics, physics) to solve related problems in professional fields, career and life.</i>	2.5
1.1.1		Apply knowledge of Marxism-Leninism, Ho Chi Minh's thought, and the Party's viewpoints to perceive scientific, technical, and technological issues; build political bravery and develop moral values, responsibility to self, family, and social community.	2.5
1.1.2		Apply fundamental knowledge of mathematics, physics, and logical thinking as the foundation for studying, researching, and solving professional and professional problems.	2.5
1.1.3		Apply knowledge of national defense and security and physical education to realize the responsibility for the cause of national defense and health training to ensure assigned tasks.	2.5
1.2	L2	<i>Achieve a foreign language level 3/6 (B1) according to the 6-level foreign language competency framework for Vietnam or other equivalent international foreign language certificates.</i>	3
1.2.1		Apply basic knowledge of vocabulary and grammar to meet the acquisition of professional knowledge.	3
1.2.2		Synthesize learned knowledge and language skills to listen, speak, read and write on familiar topics in life and work.	4
1.3	L3	<i>Computer skills: Achieve one of the following certificates: IC3, MOS, ICDL, Certificate of Information Technology Application (according to Circular 03/2014/TT-BTTTT of the Ministry of Information and Communications).</i>	3
1.3.1		Have basic knowledge of information technology	2
1.3.2		Have ability to use a computer at a basic level	3
1.3.3		Have ability to use word processing software at a basic level	3
1.3.4		Have ability to use Excel software at a basic level	3
1.3.5		Have ability to use Powerpoint software at a basic level	3
1.3.6		Have ability to use Internet at a basic level	3
1.4	L4	<i>Apply foundational knowledge (shared disciplinary foundational and disciplinary foundational such as electricity, electronics, measurement, control, automation) to describe, and compute and simulate technical systems, processes, and products in the field of Automation.</i>	3
1.4.1		Apply knowledge of occupational safety to ensure production activities are on schedule, ensure the safety of themselves and surrounding workers, and minimize the loss of people and property.	3.0

No.	PLO	PLOs	Level
1.4.2		Understand the structure and principle operation of electrical equipment, electronic components, and basic electrical circuits in automation systems.	2.0
1.4.3		Understand the structure and operating principle of measuring devices; Basic measurement methods applied in checking, monitoring, and collecting information about the operation of automation systems.	2.0
1.4.4		Apply the knowledge of programming to design, operate, repair, replace the operation program of automation systems.	3.0
1.4.5		Apply control and automation knowledge to calculate and simulate automation systems; test system performance; adjust parameters during system operation.	3.0
1.5	L5	<i>Apply intensive knowledge of automation in analyzing, designing, installing, and operating technical systems in the field of Automation.</i>	3.0
1.5.1		Apply knowledge of industrial programming, industrial communication, process control to be able to reason, analyze, design some small automation systems.	3.0
1.5.2		Apply knowledge of electrical equipment, electric drives and control of electric drive systems to design, build, operate, maintain/service and repair electric machine control systems.	3.0
1.5.3		Apply knowledge of industrial robots, and intelligent automation systems in designing, building, operating, maintaining/repairing modern production lines..	3.0
1.6	L6	<i>Apply intensive knowledge and analytical thinking in executing experimenting, testing, analyzing and upgrading technical solutions in the field of Automation.</i>	3.0
1.6.1		Apply advanced PLC programming knowledge, automate the production process to analyze, design, evaluate, upgrade and build automation systems in industry.	3.0
1.6.2		Apply IoT knowledge and computerized monitoring controls to analyze, design and build automation systems in new sectors and areas of social life.	3.0
1.6.3		Apply the knowledge of intelligent control, advanced image processing... to improve existing systems, build modern control systems.	3.0
2		Skills, personal and professional qualities	
2.1	L7	<i>Being proficient in professional skills, and being able to fit for job positions.</i>	4.0
2.1.1		Design and manufacture automation systems proficiently	4.0
2.1.2		Install automation systems proficiently	4.0
2.1.3		Correct operation of automation systems	3.0
2.1.4		Maintain/service automation systems	3.0
2.2	L8	<i>Creative thinking at work</i>	3.0
2.2.1		Have ability of logical thinking	3.0

No.	PLO	PLOs	Level
2.2.2		Be proactive and creative	3.0
2.2.3		Be progressive and lifelong learning	3.0
2.3	L9	<i>Personal attitude, professional ethics and effective contribution in technical practices.</i>	3.0
2.3.1		Have sense of responsibility	3.0
2.3.2		Have sense of discipline and industrial style	3.0
2.3.3		Respect yourself and everyone	3.0
2.3.4		Be honesty and integrity in all activities	3.0
3		Communication and teamwork skills (Soft skills)	
3.1	L10	<i>Having proficient teamwork skills.</i>	4.0
3.1.1		Actively and effectively participate in group activities	4.0
3.1.2		Organize, run and develop the team to accomplish set tasks	3.0
3.2	L11	<i>Being proficient in communication skills through writing, presentation, discussion and effective use of modern tools and media.</i>	4.0
3.2.1		Master the standard of written communication	3.0
3.2.2		Use multimedia communication tools proficiently and effectively	3.0
3.2.3		Be proficiency in reporting and presentation skills	4.0
4		Ideation, design, implementation and operation in the context of business and society (Capacity to apply knowledge in practice)	
4.1	L12	<i>Forming technical ideas and solutions.</i>	5.0
4.1.1		Analyze objectives and technical requirements in the field of Automation	4.0
4.1.2		Propose plans and technical solutions	5.0
4.2	L13	<i>Designing automation products, processes and systems.</i>	5.0
4.2.1		Use specialized software for the system overall design	3.0
4.2.2		Sketch the physical model	3.0
4.2.3		Simulate systems	3.0
4.2.4		Evaluate design models and solutions	5.0
4.3	L14	<i>Operating automation systems precisely.</i>	3.0
4.3.1		Outline the operation process plan	3.0
4.3.2		Apply process of software deployment	3.0
4.3.3		Perform system operation, inspection, and validation	3.0

No.	PLO	PLOs	Level
4.4	L15	<i>Evaluating system performance and proposing alternative technical solutions in the field of Automation.</i>	5.0
4.4.1		Be able to analyze the measurement data and interpret the experimental results with the control of the theory	4.0
4.4.2		Detect experimental errors and correct them	2.0
4.4.3		Be able to evaluate the economic - technical efficiency of the system	5.0
4.4.4		Propose technical alternatives or upgrade the system based on factors combining theory and experiment	5.0
4.4.5		Apply periodic system maintenance procedures	3.0
4.5	L16	<i>Explaining the impact of technical solutions in global economic, environmental and social contexts.</i>	2.0
4.5.1		Identify the global economic, environmental and social context.	2.0
4.5.2		Explain the impact of engineering solutions on economy, environment and society	2.0
4.6	L17	<i>Apply one's knowledge, skills and professional attitude to lead in engineering</i>	3.0
4.6.1		Have capacity of information processing and thinking	3.0
4.6.2		Delegate tasks in accordance with competencies	3.0
4.6.3		Solve problems related to production operation (technical solutions)	3.0
4.7	L18	<i>Start a startup or a business in automation technology on one's own</i>	3.0
4.7.1		Respect corporate culture	3.0
4.7.2		Define the strategy, objectives, and plans of the business in the field of operation	3.0
4.7.3		Have ability of business thinking based on specialized knowledge	3.0

3.2. The Contribution Matrix of Each Module to the ELOs

Courses	PLOs																	
	1						2			3		4						
	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	4.5	4.6	4.7
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18
Semester 1																		
Marxist-Leninist Philosophy	3									3.5	3							
General Informatics			3							3.5	3							
Physics	2.5						3.5											
Advanced Math	2.5							3.5										
English 1		3								3.5	3							
Semester 2																		
English 2		4								3.5	3							
Marxist-Leninist political economy	2.5									3.5	3					3		3
Electronic engineering				2			2	3.5		3.5	3							
Applied mechanics					2		2	3.5		3.5	3							
Technical drawing and AutoCAD					2		2	3			3							
Electrical circuit theory				2			2	2			3							
Semester 3																		
English 3										3.5	3							
Scientific Socialism	2.5							4		3.5	3							
Automatic control theory				3						3.5	3							
Matlab and its application in engineering				3			2	3.5		3.5	3							
Safety and electric devices				3			2	3.5		3.5	3							3
Semester 4		4																
English 4										3.5	3							
History of Vietnamese Communist Party	2.5									3.5	3							
C programming for engineering				3			2	3.5	4	3.5	3							
Measuring and sensing techniques				2			2	3.5	4	3.5	3							
Power electronics				2			2	2		1	3							

Courses	PLOs																	
	1						2			3		4						
	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	4.5	4.6	4.7
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18
Electric machines				2			2	3.5	4	3.5	3							3
Semester 5																		
Ho Chi Minh's Ideology	2.5									3.5	3							
Microprocessor and microcontroller engineering				2				3.5	4	3.5	3.5							3
PLC industrial programming technique				2			3	3			3	3						
Electric drive				3			3	3.5		3.5	3.5							3
Measurement and control techniques by computer					3		3			2	3	4						
Semester 6																		
Hydraulic and pneumatic drives				2			2	3.5	4	3.5	3							
Industrial robotics					3		3	2				3	3					
Application of image processing in industry					3		2	3.5	4	3.5								
Elective 1					3		3	3.5	4	3.5	3.5			3	3		3	
Electrical and electronic equipment for industrial machines					3		3	2			3							
Semester 7																		
Industrial communication and SCADA					3		3	3.5	4	3.5	3.5	3	5	3	3	3		3
Process control					3		2	3.5	4	3.5	3.5	3.5		3				
Elective 2					3		3	3.5	4	3.5	3.5							
Elective 3					3		3	3.5	4	3.5	3.5			3	3		3	
Specialized internship							3	3	3		3	3	3	2				
Semester 8																		
Graduation internship						3	4		3.5	3.5	3.5	3.5	5					
Graduation project							4	3	4	3.5	3.5	3.5	5					
Design of automatic control system						3	4	3			3	3.5	5	3				3
CAD/CAM/CNC in control and automation						3	3	3		3.5	3	3.5	5					3

Courses	PLOs																	
	1						2			3		4						
	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	4.5	4.6	4.7
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18
Semester 9																		
Module 1: Measuring, controlling, and monitoring industrial automation systems						3	4	3	3.5	3.5	3.5	3.5	3	3				3
Module 2: Production process automation						3	2	3	3.5	3.5	3.5	3.5	3	3				3
Module 3: Operation and repair of automation systems in the industry						3	4	2	3.5	3.5	3.5	3.5		3				3
Semester 10																		
Module 4: Design of intelligent control system						3	4	3	3.5	3.5	3.5	3.5	5	3	3			3
Module 5: Enterprise-oriented Module						3	4		3.5	3.5	3.5	3.5	5		3	3	3	3
Graduation internship						3	2									3.5	3	3

4. Learning Taxonomy

(Issued according to the process of developing outcomes standards
and training program towards CDIO approach)

Proficiency scale (PS)		Brief description
$0.0 \leq \text{Level} \leq 1.0$	Basic	Remembering: Students memorize/recognize/recall knowledge by such activities as defining, repeating, listing, identifying, verifying, ...
$1.0 < \text{Level} \leq 2.0$	Working	Understanding: students construct their own knowledge from learning materials from such activities as explaining, classifying, illustrating, deducing ...
$2.0 < \text{Level} \leq 3.0$		Applying: Students apply knowledge in creating such products as models, real products, simulated products, reports ...
$3.0 < \text{Level} \leq 4.0$	Extensive	Analyzing: Students analyze documents/knowledge into details/parts and point out their overall relationship by analyzing, categorizing, comparing and synthesizing...
$4.0 < \text{Level} \leq 5.0$		Evaluating: Students make judgments and predictions about knowledge/information according to established standards, criteria and indicators by commenting, criticizing, submitting, etc.
$5.0 < \text{Level} \leq 6.0$	Expert	Creating: Students create/arrange/organize/design/generalize/details/parts in a different/new way to create new structures/models/products.

5. The Volume of Knowledge of Whole Programme

- For engineer degree program: 150 credits

- For bachelor degree program: 120 credits

(excluding physical education, national defense education and extra-curricular subjects).

6. Allocation of Knowledge Blocks

Knowledge blocks	Credits		
	Total	Compulsory	Elective
General education	32	32	0
Social Sciences and Humanities	11	11	0
Natural Sciences	6	6	0
Informatics	3	3	0
Foreign Language	12	12	0
Professional education	88	79	9
Basic courses for programme groups	30	30	0
Basic courses for the programme	15	15	0
Specialized courses	31	22	9
Graduation internship, Graduation project/Alternative module for graduation project	12	12	0
In-depth education for engineer's degrees	30	30	0
Modular courses	25	25	0
Internships	5	5	0
Physical education + National defense	Not accumulating credits		

Knowledge blocks	Credits		
	Total	Compulsory	Elective
education			
Physical education 1	1	1	0
Physical education 2	1	1	0
Physical education 3	1	1	0
National defense Education	165	165	0
Extracurricular education	Not accumulating credits		

7. Admission Criteria

According to the general regulations of the Ministry of Education and Training, TNU and ICTU.

8. Training Process, Graduation Conditions

8.1. Training Methods

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

8.2. Class Organization

According to the current credit training regulations of the Ministry of Education and Training, TNU, and ICTU.

8.3. Graduation Conditions

Applying the undergraduate training regulations according to the credit system of the Ministry of Education and Training, TNU, and ICTU.

9. Scoring Scale

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

10. Career prospects

Students who graduate from Automation and Control Engineering Technology - majoring in Automation can meet the following job positions:

- Software engineer/designer for automatic system control; testing, operating, inspecting, and accepting projects on automatic control lines at companies and factories;
- Maintenance staff of machines, equipment, and automation systems of production lines in companies, factories, and enterprises.
- Warranty staff working at companies, manufacturers, or commercial centers...
- Research and teaching in research institutes, in training institutions (colleges and universities), vocational training related to automation solutions;
- Working in production and technical management in foreign joint-venture companies, facilities with modern production lines with high-level automation and control systems;
- Working as an expert at metrology sub-departments, measurement and inspection centers of provinces such as the Department of Science and Technology; Provincial Metrology Sub-Department; the metering, measuring, and testing rooms of the Electricity Company; automatic measurement workshops of factories;
- Engineers, managers, operators at consulting companies, designing production lines, and automation systems; factories have automatic system applications in production....

- Engineers, technical managers at thermal and hydroelectric power plants, consulting and construction companies; electricity transmission and distribution companies;
- Continue to study and research in-depth majors at the graduate level such as Automation, production management, and administration.
- Sales staff, sales of electrical, electronic, refrigeration and automatic products at stores, supermarkets, trade centers... can also set up their own business companies in the field of automation.

11. Teaching, Learning and Assessment Methods

Lecturers participating in the training program are regularly trained to approach new teaching methods; cooperate with businesses in specialized fields to enhance the reality for lecturers and students. The assessment method is carried out on the basis of the requirements in the learning outcomes of the training program and each module, according to the accreditation standards issued by the Ministry of Education and Training, towards regional and national standards such as AUN-QA.

12. Program Content (Name and Volume of Compulsory Modules)

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
General education knowledge block (Total credits: 32 credits / 12 courses)																
1	English 1	3		1	3											
2	English 2	3		2		3									English 1 (2)	
3	English 3	3		3			3								English 2 (2)	
4	English 4	3		4				3							English 3 (2)	
5	Scientific Socialism	2		3			2								Marxist-Leninist political economy (2)	
6	Marxist-Leninist political economy	2		2		2									Marxist-Leninist Philosophy (2)	
7	History of Vietnamese Communist Party	2		4				2							Scientific Socialism (2)	
8	Marxist-Leninist Philosophy	3		1	3											
9	Ho Chi Minh's Ideology	2		5					2						History of Vietnamese Communist Party (2)	
10	General Informatics	3	1	1	3											
11	Physics	2		1	2											
12	Advanced math	4		1	4											
Basic knowledge block for programme groups (Total credits: 30 credits/10 courses)																

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
13	Electronic engineering	3	1	2		3									Physics (2)	
14	Applied mechanics	3	0	4				3							Physics (2)	
15	Microprocessor and microcontroller engineering	3	1	5					3						Electronic engineering (2) C programming for engineering (2)	
16	C programming for engineering	3	1	2		3									General Informatics (2) Advanced Mathematics (2)	
17	Technical drawing và AutoCAD	3	1	2		3									General Informatics (2)	
18	Measuring and sensing techniques	3	1	3			3								Electronic engineering (2)	
19	Electrical circuit theory	3	1	2		3									Physics (2)	
20	Automatic control theory	3	0	3			3								Advanced Mathematics (2) Electrical circuit theory (2)	
21	Power electronics	3	1	4				3							Electronic engineering (2)	*
22	Matlab and its application in engineering	3	1	3			3								Automatic control theory (1) Advanced Mathematics (2) Measuring and sensing techniques (1)	

**Basic knowledge block for the programme
(Total credits: 15 credits / 5courses)**

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
23	Hydraulic and pneumatic drives	3	1	6						3					Applied mechanics (2) Electric machines (2) Electric drive (2)	
24	Electric machines	3	1	4				3							Electrical circuit theory (2)	
25	PLC industrial programming technique	3	1	5					3						Matlab and its application in engineering (2) Electric machines (2) Safety and electric devices (2)	*
26	Electric drive	3	1	5					3						Electric machines (2) Safety and electric devices (2) Power electronics (2)	
27	Safety and electric devices	3	1	4				3							Electrical circuit theory (2)	
Specialized knowledge block (Total credits: 31 credits / 10 modules, Compulsory: 22 credits, Elective: 9 credits)																
28	Measurement and control techniques by computer	3	1	6						3					Microprocessor and microcontroller engineering (0)	*
29	Industrial communication and SCADA	3	1	7							3				PLC industrial programming technique (2) Hydraulic and pneumatic drives (2)	*

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
30	Industrial robotics	3	1	5					3						Electrical circuit theory (2) Technical drawing và AutoCAD (2) Applied mechanics (2)	
31	Application of image processing in industry	3	1	6						3					Microprocessor and microcontroller engineering (2)	
32	Elective 1	3	1	6						3						
33	Electrical and electronic equipment for industrial machines	3	1	6						3					Electric machines (2) Safety and electric devices (2)	*
34	Process control	3	1	7							3				PLC industrial programming technique (2) Industrial communication and SCADA (2)	
35	Elective 2	3	1	7							3					
36	Elective 3	3	1	7							3					
37	Specialized internship	4	0	7							4				Measurement and control techniques by computer (2) Industrial communication and SCADA (1) Application of image processing in industry (2) Electrical and electronic equipment for industrial machines (2) Process control (1)	

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
List of elective courses (9 credits)																
	Elective 1: Control field	3	1													
38	AC motor inverter control	3	1												Electric machines (2) Safety and electric devices (2)	
39	Numerical control for electric drive	3	1												Safety and electric devices (2)	
40	Numerical control of machine tools	3	1												Measuring and sensing techniques (2)	
	Elective 2: Programming and monitoring field	3	1													
41	Advanced PLC programming	3	1												PLC industrial programming technique (2)	
42	Building Management System	3	1												Measurement and control techniques by computer (2)	
43	Distributed control system	3	1												PLC industrial programming technique (2)	
	Elective 3: Device field	3	1													
44	Sensors in automatic control	3	1												Measuring and sensing techniques (2)	
45	Building apps on FPGA	3	1												Microprocessor and microcontroller engineering (2)	

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
46	Magnetic strip card, RFID code and barcode in application	3	1												Microprocessor and microcontroller engineering (2)	
Internship, graduation project for bachelors (12 credits)																
47	Graduation internship	5	0	8								5			Specialized internship (2)	
48	Graduation project	7	0	8								7			Graduation internship (2)	
List of courses equivalent to graduation project for bachelor degree (7 credits)																
49	CAD/CAM/CNC in control and automation	3	1	8											Application of image processing in industry (2)	
50	Design of automatic control system	4	0	8											Industrial communication and SCADA (2) Process control (2) Measurement and control techniques by computer (2)	
Total accumulated credits for bachelor degree		120														
List of in-depth courses for engineer degree (30 credits)																
51	Module 1: Measuring, controlling, and monitoring industrial automation systems	5	2	9										5	Industrial communication and SCADA (2) Process control (2) Application of image processing in industry (2)	

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
52	Module 2: Production process automation	5	0	9									5		Industrial communication and SCADA (2) Process control (2) Application of image processing in industry (2)	
53	Module 3: Operation and repair of automation systems in the industry	5	2	9									5		Industrial communication and SCADA (2) Electric machines (2) Electrical and electronic equipment for industrial machines (2)	
54	Module 4: Design of intelligent control system	5	2	10									5		Measurement and control techniques by computer (2) Industrial communication and SCADA (2) Application of image processing in industry (2)	
55	Module 5: Automation topic	5	2	10									5		Measurement and control techniques by computer (2) Process control (2) Industrial communication and SCADA (2) Application of image processing in industry (2)	

No.	Courses	Credits	Practical credits	Sem.	1	2	3	4	5	6	7	8	9	10	Prerequisite/Preparation/Concurrent Courses (0)/(2)/(1)	Corequisite courses (*)
					15	17	14	17	14	15	16	12	15	15		
56	Graduation internship	5	0	10										5	Module 1 (2) Module 2 (2) Module 3 (2)	
Total accumulated credits for engineer degree		150														

Note:

- Physical education 1 is placed in semester 1, Physical education 2 is placed in semester 2.
- National defense Education is scheduled by TNU.
- For the Japan oriented training program, the English courses are replaced by Japanese ones.

13. Description of Content and Allocation of Courses

13.1. General Curriculum

1. English 1. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* No

- *Parallel subject:* No

- *Course description:* The module equips students with basic grammar knowledge such as how to use to be, singular nouns, plural nouns., adverbs of frequency, present simple, and provide vocabulary related to topics such as personal information, family, everyday objects, colors, how to say hours, leisure time, In addition, students are trained to evenly develop four skills of listening, speaking, reading and writing, especially basic communication skills. At the same time, it is asymptotic to the standard exam format B1.

2. English 2. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* English 1

- *Parallel subject:* No

- *Course description:* The subject equips students with basic grammar knowledge such as countable nouns, uncountable nouns, simple past tense, present continuous tense, comparative levels of adjectives. In addition, the course equips students with vocabulary related to the topics of Food, Money, Journeys and Appearance. Students are trained to develop the four skills of listening, speaking, reading, and writing evenly and at the same time approaching the standard test format B1.

3. English 3. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* English 2

- *Parallel subject:* No

- *Course description:* The module equips students with basic grammar knowledge such as how to use the near future tense, present perfect tense, should/shouldn't, have to/don't have to, can/can't, will/won't and the course also provides vocabulary related to the topics of Film and the Arts, Science, Tourism and the Earth. In addition, the subject continues to help students become familiar with and competently approach diverse communication situations and evenly develop intermediate-level listening, speaking, reading and writing skills. In addition, students have access to exercise formats according to the standard test format of foreign language ability equivalent to level 3.

4. English 4. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* English3

- *Parallel subject:* No

- *Course description:* The subject equips with grammar knowledge at A2+ level and approaching B1 level (Level 3) such as type 1 conditional sentences, past continuous, passive sentences.... At the same time, it provides a vocabulary system related to the topics of means of transport, health, tourism, technology... Besides, the subject continues to help students familiarize themselves with and approach competently with other topics. diverse communication situations and uniform development of skills in listening, speaking, reading and writing at the pre-intermediate level (B1). In addition, students are reviewed with exercises in the format of a standardized test of foreign language ability equivalent to level 3 (B1).

5. Scientific Socialism. Number of credits: 02

- *Allocation of study time:* 2(2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* Marxist-Leninist political economy

- *Parallel subject:* No

- *Course description:* The course provides learners with basic knowledge of the theory of scientific socialism, including: The socialist regime that our Party has chosen; on the path, measures and methods of building the socialist regime. On that basis, the course equips students with a solid political system, a solid ideology and right actions in accordance with ethical standards. Students have faith in the leadership of the Party and management of the State.

6. Marxist-Leninist Political Economy. Number of credits: 02

- *Allocation of study time:* 2(2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* Marxist-Leninist philosophy

- *Parallel subject:* No

- *Course description:* Marxist-Leninist political economy is an economic science that equips students with basic and core knowledge of political economy in the development context of the country and the world today. On that basis, it helps students to form thinking, analytical skills, assessment and identification of the nature of economic relations in the country's socio-economic development. The subject contributes to building social responsibility for students suitable for job positions and life after graduation. Thereby, students will form the school, Marxist-Leninist ideology.

7. History of Vietnam Communist Party. Number of credits: 02

- *Allocation of study time:* 2 (2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* Scientific socialism

- *Parallel subject:* No

- *Course description:* The course provides systematic and basic knowledge about the birth of the Communist Party of Vietnam (1920-1930); the leadership of the Communist Party of Vietnam for the Vietnamese revolution during the period of struggle for power (1930-1945); in two resistance wars against the French colonialists and the American imperialists (1945-1975); in the cause of national construction and defense during the period of the country's transition to socialism, conducting the doi moi (1975-2018). Thereby, the subject equips with scientific thinking methods on history; skills in selecting research and study materials; the ability to apply historical awareness to practical work. The module serves as a basis for criticizing misconceptions about the Party's history and helps students build a sense of respect for objective truths, improve pride and belief in the Party's ideals.

8. Marxist-Leninist Philosophy. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* No

- *Parallel subject:* No

- *Course description:* The subject provides learners with an understanding of the most common principles and laws of nature, society, and thought. On the basis of that knowledge, learners have a correct perception of practical issues from the worldview and methodological stance of Dialectical Materialism and Historical Materialism. The course also helps students develop self-directed thinking and teamwork, critical thinking and self-responsibility skills.

9. Ho Chi Minh's Ideology. Number of credits: 02

- *Allocation of study time:* 2(2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* Scientific socialism

- *Parallel subject:* No

- *Course description:* The course helps students understand the basic knowledge about the origin, process of formation and development of Ho Chi Minh's ideology; the basic contents of Ho Chi Minh's thought on the issues of the Vietnamese revolution in the people's democratic national revolution and in the socialist revolution. Since then, the course helps students consolidate their ideals, beliefs and determination to take action to build and defend the Fatherland.

10. General Informatics. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course equips students with knowledge about the structure of computers; how to process information on electronic computers; familiar with Windows operating system and basic operations on windows operating system; exploiting utilities and resources on the network; learn about PASCAL programming language; Advanced programming and installation of some applied problems.

11. Physics. Number of credits: 02

- *Allocation of study time:* 2(2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* No

- *Parallel subject:* No

- *Course description:* The course consists of two main parts: Electricity and Magnetism. The General Physics module provides basic knowledge about: Electric currents; Ohm's law with electrical circuits; magnetic field caused by a constant current; Electromagnetic induction; electromagnetic fields and electromagnetic materials. These are the basic knowledge of physics, helping students to continue studying the modules in the basic and specialized fields.

12. Advanced Mathematics. Number of credits: 04

- *Allocation of study time:* 4(4/0/8)

- *Pre-requisite subject:* No

- *Previous subject:* No

- *Parallel subject:* No

- *Course description:* The course provides students with basic knowledge about sets; mapping; complex numbers; matrix; determinant; system of linear equations; vector space; linear and quadratic mapping. These are the basic knowledge of Advanced Mathematics, which serves as the foundation for students to continue studying in the basic and specialized modules.

13.2 Basic industry knowledge

1. Electronic Engineering. Number of credits: 03

- *Allocation of study time:* 3(3,0,6)

- *Pre-requisite subject:* No

- *Previous subject:* Physics

- *Parallel subject:* No

- *Course description:* The course consists of two parts: The analog electronics section provides students with the knowledge of electronic components and related basic electronic circuits. These include: passive electronic components; semiconductor electronic components such as diodes, bipolar transistors, field transistors and algorithmic amplifiers; electronic circuits; small signal amplifier circuit; harmonic oscillator circuit; some circuits use amplification algorithms; inverting, non-inverting amplifier circuit; integrator circuit; differential circuit and amplifier circuit. These basic knowledge is the foundation for students to be able to analyze and design

electronic circuits, small and medium electronic systems. The Digital Electronics Engineering section equips students with basic knowledge of the mathematical and logical foundations of electronic computers; Basic logic elements; operations with logical algebra. From there, students can apply it to analyze and design digital logic circuits (combination circuits, sequence circuits).

2. Applied Mechanics. Number of credits: 02

- *Allocation of study time:* 2(2,0,4)

- *Pre-requisite subject:* No

- *Previous subject:* Physics (PHY231)

- *Parallel subject:* No

- *Course description:* Applied Mechanics provides students with basic knowledge of kinematics and statics and helps students solve problems on deformed solid mechanics. The content of the module includes: Basic knowledge about mechanics of machine, laws of statics, problems in plane force system and space force system. In addition, the knowledge about 4 basic types of deformation, including Tension (compression), bending, twisting and the combination of deformation forms are also presented to students in this module. From there, students apply this knowledge to solving problems of analyzing and synthesizing structures, calculating and designing basic machine parts and structures in engineering.

3. Microprocessor and Microcontroller. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Pre-requisite subject:* No

- *Previous subjects:* Electronic Engineering (ELE131), C Programming for Engineering (PGC232)

- *Parallel subject:* No

- *Course description:* The subject provides students with knowledge about microprocessors and microprocessor systems such as: Sorting input and output data in microprocessor systems; Interrupts and interrupt handling; Some of the advanced microcontroller families; Application programming techniques with the 8051 family of microcontrollers; Microcontroller PIC16F877A. With these knowledge, students have the skills to build practical electronic products.

4. C Programming for Engineering. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Pre-requisite subject:* No

- *Previous subjects:* General Informatics (GIS121), Advanced Mathematics (MAT140).

- *Parallel subject:* No

- *Course description:* The subject belongs to the basic knowledge block, it provides students with basic knowledge about programming, the C programming language; application of C programming language in electronic engineering, automation engineering, computer engineering.

Thereby, students are able to solve basic computer problems and technical problems using C programming language. In addition, students also have basic knowledge about programming in embedded systems, Programming with microcontrollers and microprocessors.

5. Technical Drawing and AutoCAD. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Pre-requisite subject:* No

- *Previous subject:* General Informatics (GIS121)

- *Parallel subject:* No

- *Course description:* The course introduces the basic knowledge in how to present, read and understand a technical drawing. Thereby students understand the structure of a technical drawing, know how to draw (by hand) and represent objects in the form of projections. In addition, students have the ability to draw technical drawings in the electrical industry and use AutoCAD software to represent drawings on computers.

6. Measuring and Sensing Techniques. Number of credits: 04

- *Allocation of study time:* 4(3/1/8)

- *Previous subject:* Electronic Engineering (ELE131)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* This course introduces students to basic metrology and electrical measurement. The subject also helps students understand the operating principle and structure of the indicator mechanisms, meters of electrical parameters and know the methods of measuring electrical parameters such as current, voltage, resistance, capacitance, inductance, frequency, phase angle, types of power, electricity. In addition, students know how to analyze and evaluate measurement errors, understand the principles and operation of electrical measurement systems in industry. At the same time, students also gain knowledge about sensors and their applications in industry such as light sensors; thermal sensors; motion sensors; velocity sensors; acceleration sensors; force sensors; flow sensors and level sensors, etc.

7. Electrical Circuit Theory. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Physics (PHY231), Electronic Engineering (ELE131).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course helps students understand the basic concepts of circuit theory, methods of solving circuit theory problems in linear steady state and transient mode; Knowledge of 4-pole linear and 3-phase circuit theory. These are the basic, important and indispensable knowledge of students before delving into specialized knowledge.

8. Automatic Control Theory. Number of credits: 03

- *Allocation of study time:* 3(3/0/6)
- *Previous subjects:* Advanced Mathematics (MAT140), Circuit Theory (ETC221)
- *Pre-requisite subject:* No
- *Parallel subject:* No
- *Course description:* The subject belongs to the basic knowledge of the industry, it provides knowledge about the components of an automatic control system, the methods of building mathematical models of the automatic control system. These include: transfer functions, signal graphs and equations of state, controllable and observable problems, methods of investigating the stability of automatic control systems, methods of investigating the quality of control system such as accuracy, time domain, frequency domain and automatic control system design methods so that the system is stable and achieves the set quality criteria.

9. Power Electronics. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)
- *Previous subject:* Electronic Engineering (ELE131)
- *Pre-requisite subject:* No
- *Parallel subject:* No
- *Course description:* The subject belongs to the basic knowledge of the industry, it provides students with the concepts, structures, and operating principles of common power semiconductor devices and power converters. In addition, it helps students know how to read and analyze power electronic circuits, design power electronic circuits and apply power converters in practice. Therefore, this subject creates the foundation knowledge for subjects such as Electrical Drives, Initial Vocational Internship, Basic Internship, Simulation and System Design, etc.

10. Matlab and Its Application in Engineering. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)
- *Previous subjects:* Advanced Mathematics (MAT140), Measurement and Sensory Engineering (EME241).
- *Pre-requisite:* Automatic control theory (TAC221)
- *Parallel subject:* No
- *Course description:* The subject helps students have the ability to: Analyze and model dynamical systems in control systems; Use system modeling languages; System design and testing; Process simulation. It helps students know how to design and build a control system, including: how to analyze problems, choose control methods, model the system, build simulation models, and use fluent languages. simulation language. In addition, the module is the basis for Analysis and design of automatic control electric drive system and system testing, system calibration to build a complete system.

13.3 Basic Knowledge of the Industry

1. Hydraulic and Pneumatic Drives. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Measuring and sensors (EME241), Automatic Control Theory Motion (TAC221), Circuit Theory (ECT221), Electrical Machines (EMA231), Electric Drive (TDP321).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The subject provides students with basic knowledge including: Mechanical properties of liquids and compressed gases; flow modes; mathematical foundations of fluids. They form the basis for the design of devices that work with liquids and compressed gases in different modes. The course also presents machines and equipment in hydraulic-pneumatic transmission systems; analysis and design of hydraulic and pneumatic drive systems; electro-hydraulic, electric-pneumatic. Its knowledgeable module covers two major branches of automation, providing students with a fuller view of automation systems in practice.

2. Electric Machines. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Circuit theory (ETC221)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Subject content:* The subject belongs to the basic block of the industry, in order to provide students with knowledge about the structure, operating principles, parameters, equations, methods of opening machines, working modes of DC motor and AC motor.

3. PLC Industrial Programming Technique. Number of credits: 0325

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* C Programming for Engineering (PGC233), Matlab and its applications in engineering (MAA221), Electronic engineering (ELE131), Measurement and sensing engineering (EME241), Machine Electrical (EMA231), Safety and electric devices (SPT131)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course equips learners with the following contents: hardware structure, function and operating principle of PLC; PLC communication with industrial network system; how to define the input/output and the method of connecting the PLC to the peripheral; Basic script and part advanced script. These contents enable students to tackle basic industrial programming problems.

4. Electric Drive. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Electrical machines (EMA231), Safety and electrical tools (SPT131), Industrial electronics capacity (DTS332).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* Students have the ability to calculate to build mechanical and electromechanical characteristics of electric drive systems, methods of speed regulation of DC and AC machines. The course provides an important foundation for specialized and specialized subjects.

5. Safety and Electric Devices. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Circuit theory (ETC221)

- *Pre requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course consists of 2 basic contents: The content of electric tools equips learners with the basic contents of structure and working principle of electric tools; Calculation method of quantities and technical parameters of electric tools. The electrical safety content provides learners with basic concepts of labor protection and occupational hygiene; Harm of electric current to the human body; safety analysis when people are exposed to direct and indirect electric shock; Analysis and calculation of earthing diagrams to protect people's safety, protection measures against high voltage to low voltage ingress; protective measures when working in environments under the influence of high frequencies; Necessary tools and means for electrical safety and first aid when people are electrocuted.

13.4. Specialized Knowledge

1. Measurement and Control Techniques by Computer. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Microprocessor and Microcontroller Engineering (MAN131)

- *Pre-requisite:* No

- *Parallel subject:* No

- *Course description:* The course provides students with knowledge of hardware and software to help students analyze and design measurement and control systems using computers. The main contents include: methods of data input and output with computers through interfaces; techniques for connecting computers with external modules, with microprocessors, with other computers; data storage on the computer; computer control programming; Computer applications in measurement and control.

2. Industrial Communication and SCADA. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* PLC industrial programming technique (PLC343)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* This course provides learners with the content of data transmission techniques; network structure; the most basic and commonly used industrial networking protocols (PROFIBUS, PROFINET...); components of the Scada system in the automation system; System of actuators; Remote I/O devices RTUs (Remota Terminal Units) or Programmable Logic Controllers (PLCs); Central monitoring control station; Communication system; Human-Machine Interface (HMI); How to integrate hardware and software to build a SCADA system in practice.

3. Industrial Robotics. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Physics (PHY231), Circuit theory (ECT221), Technical drawing and AutoCAD (DRT231), Applied Mechanics (APM221).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The module provides learners with basic knowledge about kinematics, robot dynamics; Robotic sensors and actuators; Motion control method of Industrial robotics. These contents help students master some types of robots applied in industry today.

4. Application of Image Processing in Industry. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Computer control and measurement techniques (CMN101).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides learners with the skills to apply image processing in industry. It helps them to understand the technology of CNN cell neural network, CNN-UM parallel processing computer and apply these techniques in image processing at the speed of tens of thousands of images per second.

5. Elective 1. Number of credits: 03

5.1. AC Motor Inverter Control. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Electrical machines (EMA231), Electric drive (TDP321)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides learners with knowledge about some common types of inverters in industry today; Method of pairing the inverter with the AC motor; Method of controlling and stabilizing AC motor speed; how to use inverters in some typical applications.

5.2. Numerical Control for Electric Drive. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Electrical machines (EMA231), Electric drive (TDP321)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides students with knowledge of skills in calculating, designing, tuning and analyzing a three-phase asynchronous motor controller using field-oriented control (FOC) method. In addition, the knowledge of numerical control of electromechanical systems will help students to design, install or operate well the inverter-based electric drive systems that are commonly used in industry.

5.3. Numerical Control of Machine Tools. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Electrical machines (EMA231), Electric drive (TDP321)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides knowledge about numerical control applications in machine tools; help students have the ability to analyze, design, install or operate well-known machine tool control systems.

6. Electrical and Electronic Equipment for Industrial Machines. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Electrical machines (EMA231), Electric drive (TDP321), Safety and gas power tool (SPT131).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides learners with basic knowledge about the use; main movements; Loudspeakerd determination method; power of the motor driving the machine; characteristics and requirements of electrical and electronic systems in industrial machines. The course also introduces the typical control stages and some control diagrams of industrial machines in practice such as lathes, milling machines, drills, planers and transport lifting machines such as elevators, cranes, conveyors.

7. Process Control. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subjects:* Industrial programming techniques (PLC343), Industrial Communication and SCADA (ICS131).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course introduces technological process control systems used in practice; Methods of modeling technological processes; control principles in process control systems as well as feedback control systems. The final part of the course will provide students with microprocessor-based controllers and distributed control.

8. Elective 2. Number of credits: 03

8.1. Advanced PLC Programming. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Industrial programming techniques (PLC343).

- *Pre-requisite subject:* None

- *Parallel subject:* None

- *Course description:* The course provides learners with knowledge and skills in programming some advanced PLC problems: HSC, PID, PTO/PWM, Read Real Time, etc. This is an indispensable knowledge for automation engineers working with control systems using PLCs.

8.2. Building Management System. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Automatic Control Theory (TAC221), Safety and electrical appliances (SPT131), Computer control and measurement engineering (CMN101).

- *Pre-requisite subject:* None

- *Parallel subject:* None

- *Course description:* The subject provides students with content knowledge about smart building management systems such as: analysis methods, design of BMS system; control and monitor the electromechanical system; lighting, ventilation, water supply and drainage systems... in the building; Create man-machine interface for operators; automatically detect problems and give warnings; Reduce energy costs...

8.3. Distributed Control System. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Industrial Communication and SCADA (ICS131), Process Control program (DKQ333).

- *Pre-requisite subject:* None

- *Parallel subject:* None

- *Course description:* The course provides learners with an important part of knowledge about distributed structured control systems; Devices and methods of pairing devices; Data collection methods; control and monitoring in a distributed control system.

9. Elective 3. Number of credits: 03

9.1. Sensors in Automatic Control. TC number: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Measurement and sensor engineering (EME241).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The subject provides learners with basic knowledge about the concept, classification, structure, operating principle of various types of sensors; then apply sensors in

automatic control systems.

9.2. Building Apps on FPGA. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Microprocessor and Microcontroller Engineering (MAN131), Measurement Engineering and controlled by computer (CMN101).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides learners with knowledge of the basic and advanced design processes of industrial electronic circuits. Help students grasp programming technologies such as PLA, CPLD, FPGA. Students understand VHDL (Very High Speed Integrated Circuit Hardware Description Language) for high speed integrated circuits. From there, learners acquire the skills to analyze and design digital electronic circuits correctly and effectively.

9.3. Magnetic Strip Card, RFID Code and Barcode in Application. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Microprocessor and Microcontroller Engineering (MAN131)

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The course provides students with knowledge about identification technologies via magnetic cards, barcodes, radio frequency identification (RFID) and applications for automatic product management in industry.

13.5. Internship

1. Specialized Internship. Number of credits: 04

- *Allocation of study time:* 4(4/0/8)

- *Previous subject:* Computer control and measurement engineering (CMN101), Industrial communication and SCADA (ICS131), Industrial robotics (ITR321), Industrial image processing applications (IPI321), Electrical and electronic equipment industrial (EIM332).

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* The subject synthesizes and provides students with the knowledge they have learned in the specialized block, from which students know how to apply it to specific objects.

2. Graduation Internship (for Bachelor Degree). Number of credits: 05

- *Allocation of study time:* 5(5/0/10)

- *Previous subjects:* Specialized kNowledge modules

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* In this subject, learners perform the tasks assigned to the bachelor's

apprentice majoring in Automation at companies, factories, factories, and production facilities.

3. Graduation Internship (for Engineer Degree)

- *Allocation of study time:* 5(5/0/10)

- *Previous subjects:* Intensive kNowledge modules

- *Pre-requisite subject:* No

- *Parallel subject:* No

- *Course description:* In this subject, learners perform the tasks assigned to apprentice engineers specializing in Automation at companies, factories, enterprises, and production facilities.

13.6. Graduate

1. Graduation Project. Number of credits: 07

- *Allocation of study time:* 7(0/0/14)

- *Previous subjects:* specialized knowledge modules

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course equips students to perform the assigned tasks of an electrical engineer such as surveying, analyzing, and designing an automation system, production line, electric transmission, etc at companies, factories, enterprises, production facilities.

2. Alternative Modules for Graduation Project. Number of credits: 07

2.1. CAD/CAM/CNC in Control and Automation. Number of credits: 03

- *Allocation of study time:* 3(2/1/6)

- *Previous subject:* Computer control and measurement techniques (CMN101), Robot industrial (ITR321)

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course provides students with content related to numerical control systems; structure, operating principle of numerical control machine; programming language and software for machining on numerical control machines; skills in operating and controlling machining machines.

2.2. Design of Automatic Control System. Number of credits: 04

- *Allocation of study time:* 4(3/1/8)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321)

- *Pre requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course provides students with knowledge about technological processes, operating principles, analysis and design of automation systems associated with actual

production processes. Such processes include flexible manufacturing FMS, integrated manufacturing CIM, etc.

13.7. In-depth Knowledge

1. Measuring, Controlling and Monitoring Industrial Automation Systems. Number of credits: 05

- *Allocation of study time:* 5(3/2/10)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321)

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The subject provides students with knowledge about: Automatic measurement, control and monitoring systems in industry; system design process. From there students are able to implement a complete system from measurement; collect signals about the controller; calculate, analyze; Design, simulation and hardware construction of an industrial automation system.

2. Production Process Automation. Number of credits: 05

- *Allocation of study time:* 5(5/0/10)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321)

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course provides students with specific knowledge about technological processes (technology diagrams, process functional block diagrams, input/output impact factors, process noise, requirements for finished products, etc) of production processes in many different fields in reality (mechanical processing, machine building, production processes in the fields of power industry, light industry, mining, processing, etc.) production of consumer goods, services, etc.). In addition, the course also provides students with knowledge of methods of analysis, calculation, design, simulation, system building and operating automatic production processes.

3. Operation and Repair of Automation Systems in the Industry. Number of credits: 05

- *Allocation of study time:* 5(5/0/10)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321)

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course provides students with general knowledge about the operating process of industrial automation systems; operating and maintaining electrical machines, electrical tools, distribution cabinets, electric drive systems, electrical equipment, hydraulic-pneumatic transmission. At the same time, the module introduces how to find errors that arise during system operation, including hardware and software failures; Analyze problems, propose solutions to adjust, replace, and upgrade the system.

4. Design of Intelligent Control System. Number of credits: 05

- *Allocation of study time:* 5(5/0/10)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321), Applications industrial image processing.

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The course provides students with the necessary knowledge about intelligent control systems that automatically make decisions on behalf of people in the process of controlling automation systems. The module also introduces sequences; method of intelligent control system design using modern control methods such as neural networks, hedging algebra, artificial intelligence and methods of combining classical control with modern.

5. Automation Topic. Number of credits: 05

- *Allocation of study time:* 5(5/0/10)

- *Previous subject:* Industrial programming engineering (PLC343), Industrial communication and SCADA (ICS131), Process control (DKQ333), Computer control and measurement engineering (CMN101), Industrial robotics (ITR321)

- *Pre-requisite subjects:* No

- *Parallel subject:* No

- *Course description:* The subject provides students with the necessary knowledge required by 1 or a group of businesses using automation in production. Depending on the development of technology and human resource needs each year, the subject content may change to suit the new orientation. The course is conducted by automation experts at enterprises. The main contents include: General knowledge about automation systems in enterprises; the process of exploiting, operating, repairing, maintaining and upgrading an automation system in general; and other knowledge related to the field of business activities.

14. Facilities for Learning

14.1. Workshops, Laboratories and Important Laboratory Equipment Systems

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
1	Lecture hall 49-100 seats	39	11260 m ²	Projector và các thiết bị hỗ trợ khác (Loudspeaker, micro,..)	1	Lecture hall 49-100 seats
2	Experimental machine room	9	620 m ²	Computer	2	Experimental machine room
3	Data Science Lab	1	52 m ²	Meeting table	3	Data Science Lab
				Desktop table	14	
				Writing table	1	
				Air conditioner		
				Project font	1	
				Chair Stands On Two Legs	15	
				Lenovo ThinkCenter M920t Computer	10	
4	Samsung Lab ICTU	1	120 m ²	Laptop, projectors, TV,...	4	Samsung Lab ICTU
5	Library	1	1.000 m ²	Reference books	451	Courses in the training program
6	Room C6-501 (Embedded System)	1	50 m ²	System of practical modules for measurement, control, and supervision	1	Microprocessor engineering and applications; Measuring and sensing engineering;
				The computer installs the camera pairing processing card	2	Image processing, Advanced image processing
				Practical module on the Arduino platform	1	Microprocessor engineering and applications
				Student desk	6	Serving learning and practice
				Schoolboard	1	Learning service
				Practice table	4	Serving learning and practice
				Industrial sensor systems	1	Measuring and sensing engineering
				Traffic light model table	1	Electronic Engineering
				Long line module	1	Circuit Theory
7	Room C6-502	1	50 m ²	Control model of 4-storey elevator	1	Electric machines and Electric

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
	PLC programming in industry			LF - 794		drive; Industrial programming techniques
				Module Inverter SMI 07	1	Electric machines and Electric drive;
				Ozon inverter module OMI - 15	1	Electric machines and Electric drive;
				Model of temperature controller TC - 700A	1	Electric machines and Electric drive
				PLC practice module	4	
				Chair	10	Learning service
				Table	2	Learning service
				Schoolboard	1	Learning service
				Practice table	8	Learning service
				Simulation model of liquid level and flow measurement sensor KM - 872	1	Electric machines and Electric drive; Measuring and sensing engineering
8	Room C6-503 (Electrical machines and electrical equipment)	1	50 m2	Power electronics practice module	2	Power electronics
				Schoolboard	1	Learning service
				Module of power tools, electrical equipment, electric machines	6	Electric machines and Electric drive
				Practice table	10	Learning service
				Chair	15	Learning service
	Room C6-506 (Robotic and CNC)	1	60 m2	CNC Machine	1	Image processing, Advanced image processing
				3D Printer	1	Image processing, Advanced image processing
				Schoolboard	1	Learning service
				Robot arm	1	Image processing, Advanced image processing, Trí tuệ nhân tạo

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
				Student desk	5	Learning service
				Practice table	3	Learning service
				Folding chair	10	Learning service
				Realistic Model System Industrial Scada 4.0/ALS.EDU4.0	01	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Local monitoring and control area		Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Extended actuator device		Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Scada PLC controller board S7-1516-3PN/DP/70280	02	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Connection interface expansion board-70285	02	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Control inverter Siemens S120/55411	01	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Control inverter Siemens G120/55321	01	Industrial programming techniques, Industrial Communication Engineering,

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
						Advanced PLC programming.
				Module ET200 PROFINERT 8DI/8DO	02	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Module ET200 PROFIBUS 8DI/8DO	02	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
				Control inverter Siemens S120/55411	01	Industrial programming techniques, Industrial Communication Engineering, Advanced PLC programming.
10	Room C6-507 (Production process automation)	1	90 m2	Crane system module	1	Electric machines and Electric drive; Power electronics
				Schoolboard	1	Learning service
				Weighing Module	1	Electric machines and Electric drive; Power electronics
				Flexible production line module FMS 600	1	Electric machines and Electric drive; Power electronics
				Student desk	5	Learning service
				Practice table	3	Learning service
				CNC Machine	01	
				3D Printer		
12	Digital Electronics lab and workshop (introduction to electronics)-C6.401	1	60m2	Device name 1: Module AE 101 Diode internship	01	Serving for all subjects: Analog Electronic Engineering, Digital Electronic Engineering, Automotive embedded system programming
				Module AE 102 Transistor internship	01	
				Module AE 103 Transistor internship	01	

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
				Module AE 104 Vibration practice	01	
				Module AE105 Oscilloscope Practice	01	
				Module DE 201 Logic Gate Practice	01	
				Module DE 202 Logic Gate Practice	01	
				Module DE 203 Practice on logic gate application	01	
				Module DE 204 Decoder and encoder internship	01	
				Module DE 205 Practice on numerical comparators and counting diagrams	01	
				Module AE 107 Practice on the KTTT	01	
				Module AE 108 Practice on the KTTT	01	
				AE 111 Stabilizer practice	01	
				Module AE 112 Analog switch practice	01	
				Module DE 206 Practice on multiplexing and demultiplexing switches	01	
				Module DE 208 Practice on trigger and recorder diagrams	01	
				Module DE 209 Practice on trigger and recorder diagrams	01	
				Module DE 210 Trigger and logger diagrams	01	

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
12	Microprocessor and Microcontroller Lab: C6.402	1	60 m2	Device name 1: LMD . microcontroller practice module		Serving for all subjects: Analog Electronic Engineering, Digital Electronic Engineering, Automotive embedded system programming
				Module for practicing different types of sensors		
				Module to practice measuring diode's V/A characteristic		
				Computer communication practice module-8255		
				PIC practice module		
				LAN practice equipment.		
				CPLD and FPGA practice module.		
13	Embedded systems practice room: C6. 407	01	60 m2	Hệ thống thực hành thí nghiệm trên vi điều khiển-ARM STM32. System of exercises to practice peripheral communication with microcontrollers - MSP430	01	Serving for all subjects: Analog Electronic Engineering, Digital Electronic Engineering, Automotive embedded system programming
14	Lab on Embedded Systems and IOT	1	25m2	Embedded IoT Training System/ IoT-1000	1	
				Embedded IoT Training System/ GT-IoT900	1	
				Embedded Router/ Router 310	1	
				AI (Artificial Intelligence) Training System/ GT-19	1	
				PLC with IoT training system/ PLC 2000	1	
				Dell vostro desktop/ Vostro 3671 Mini Tower	13	

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching							
				Device name							
				Bao Lam computer desk Length 1800 x Width 900 x Height 750(mm)	6						
				Bao Lam Computer Desk 1200 x Width 600 x Height 750(mm)	1						
				Hoa Phat staff chair/ SG550	20						
				Projector Viewsonic/ PA503SP	1						
				Wall-mounted projection screen - Dalite/ P84WS	1						
				Daikin air conditioner/ FTC50NV1V/ RC50NV1V	2						
				Switch Cisco/ SG350-20-K9-EU 20-port Gigabit Managed	1						
				Cat 5E Commscope Network Cable	2						
				Jack RJ 45 COMMSCOPE	30						
				Power cord 2 x 1.5	50m						
				Double power socket - SINO	15						
				Tien Phong plastic pipe 20 x 40	30m						
				Tien Phong plastic pipe 28 x 10	30m						
				Iron cabinet with 4 doors	1						
				15	Computer room C4.101	1		90 m2	Computer	37	General and specialized subjects, online exam service
									Air conditioner	2	Learning service
								Projector	1	Learning service	
				Teacher's desk and chair	1	Learning service					
				Student desk	18	Learning service					
				Switch network device	1	Learning service					
				Camera	2	Monitoring					

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
				Micro	1	Learning service
				Computer	37	General and specialized subjects, online exam service
16	Computer room C4.102	1	90 m2	Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
				Micro	1	Learning service
				17	Computer room C4.103	1
Air conditioner	2	Learning service				
Projector	1	Learning service				
Teacher's desk and chair	1	Learning service				
Student desk	18	Learning service				
Switch network device	1	Learning service				
Camera	2	Monitoring				
Wireless router	1	Learning service				
Loudspeaker	4	Learning service				
Amplifier	1	Learning service				
Micro	1	Learning service				
18	Computer room C4.201	1	90 m2	Computer	37	General and specialized

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
						subjects, online exam service
				Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
				Micro	1	Learning service
19	Computer room C4.202	1	90 m2	Computer	37	General and specialized subjects, online exam service
				Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
				Micro	1	Learning service
20	Computer room C4.203	1	90 m2	Computer	37	General and specialized subjects, online exam service
				Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
				Micro	1	Learning service
				21	Computer room C4.301	1
Air conditioner	2	Learning service				
Projector	1	Learning service				
Teacher's desk and chair	1	Learning service				
Student desk	18	Learning service				
Switch network device	1	Learning service				
Camera	2	Monitoring				
Wireless router	1	Learning service				
Loudspeaker	4	Learning service				
Amplifier	1	Learning service				
Micro	1	Learning service				
22	Computer room C4.302	1	90 m2	Computer	37	General and specialized subjects, online exam service
				Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service

NO	Type of classroom	Quantities	Area (m ²)	List of main equipment to support teaching		
				Device name		
23	Computer room C4.303	1	90 m2	Micro	1	Learning service
				Computer	37	General and specialized subjects, online exam service
				Air conditioner	2	Learning service
				Projector	1	Learning service
				Teacher's desk and chair	1	Learning service
				Student desk	18	Learning service
				Switch network device	1	Learning service
				Camera	2	Monitoring
				Wireless router	1	Learning service
				Loudspeaker	4	Learning service
				Amplifier	1	Learning service
Micro	1	Learning service				

14.2. Library, Website

No	Library	Website	Note
1	Library of printed materials of ICTU	http://elib.ictu.edu.vn/	
2	Digital resources of ICTU	http://tailieu.ictu.edu.vn/	
3	ICTU Learning Resource Center	http://lrc.tnu.edu.vn/	

15. Instructions for Implementing the Program

15.1 Implement Training Program

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

The conversion time is calculated as follows:

- 1 credit = 15 hours of theory instruction or class discussion
- = 30 hours of experimentation or practice
- = 45 hours of self-study

= 45 ÷ 90 hours of internship at the facility.

= 45 ÷ 60 hours of project implementation, graduation thesis.

The number of hours of the course is a multiple of 15.

15.2 Foreign Language Output Standards

Achieve a foreign language level 3/6 (B1) according to the 6-level foreign language competency framework for Vietnam or obtain other equivalent international foreign language certificates.

15.3 Informatics Output Standard

Obtain one of the following certificates: IC3, MOS, ICDL, Certificate of Information Technology Application (according to Circular 03/2014/TT-BTTTT of the Ministry of Information and Communications).

16. Release Date

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

VICE DEAN



PhD. Nguyen Von Dim