

**THAI NGUYEN UNIVERSITY
THAI NGUYEN UNIVERSITY OF TECHNOLOGY**



**THE PROGRAMME
SPECIFICATION
ELECTRICAL ENGINEERING
UNDERGRADUATE PROGRAMME**

THAI NGUYEN 2024

THAI NGUYEN UNIVERSITY
THAI NGUYEN UNIVERSITY OF TECHNOLOGY



**THE PROGRAMME
SPECIFICATION
ELECTRICAL ENGINEERING
UNDERGRADUATE PROGRAMME**

This advanced electrical engineering undergraduate programme has been approved and accepted by University's Science and Education Council

**SCIENCE AND EDUCATION COUNCIL CHAIR
RECTOR**

Assoc. Prof. Dr. Đỗ Trung Hải

THAI NGUYEN 2024

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ADVANCED ELECTRICAL ENGINEERING UNDERGRADUATE PROGRAMME

PART I GENERAL INFORMATION

I. GENERAL INFORMATION ABOUT PROGRAMME

1. Training Program: Advanced Program in Electrical engineering (CTTT)

Training major code: 7905228

2. Training level: Undergraduate

3. Training duration: 4.5 years - 5 years.

4. Diploma: Engineer in Electrical Engineering

5. Certificated by: Thai Nguyen University of Technology – Thai Nguyen University

II. GENERAL INFORMATION ABOUT CERTIFICATE OF QUALITY ASSURANCE FOR EDUCATIONAL INSTITUTIONS OF THAI NGUYEN UNIVERSITY OF TECHNOLOGY - THAI NGUYEN UNIVERSITY

The Certificate of Quality Assurance for Educational Institutions of Thai Nguyen University of Technology - Thai Nguyen University complies with the Education Quality Standards as specified in Decision No. 116/QĐ-KĐCLGD dated December 11, 2017, issued by the Quality Assurance Center for Education - Association of Universities and Colleges of Vietnam.

III. LEARNING OUTCOMES AND TRAINING PROGRAM

3.1. Objectives of the Electrical Engineering programme

3.1.1 General objectives

Training engineers in the field of Electrical Engineering program with a solid foundation in social sciences, politics, and law, as well as fundamental knowledge in technical and specialized areas; fostering critical thinking, analytical skills, synthesis, and professional practice; cultivating self-learning capabilities, communication skills, and the ability to work independently and collaboratively in both evolving work environments and international settings.

3.1.2 Specific Objectives

The Electrical Engineering program provides learners with:

Objective 1. Fundamental knowledge of social sciences, politics, and law; solid foundational knowledge in technical and specialized areas;

Objective 2. Critical thinking, analysis, synthesis, and evaluation skills in the field of electrical engineering, including data and information

Objective 3. Personal integrity and professional responsibility; the ability to work independently, collaboratively, and engage in lifelong learning; utilizing English and multimedia communication to adapt to diverse interdisciplinary, international work environments.

Objective 4. Capability to generate ideas, participate in design, and operate within the realm of electrical and electronic engineering.

3.2. Program Learning Outcomes

3.2.1. Learning outcomes of the training program (Level 2 learning outcomes – disclose to community)

Table 1. Learning outcomes of the programme

Number of PLO	Program Learning Outcome
1	Knowledge and Reasoning in the Field
1.1	Apply foundational knowledge in mathematics, natural sciences, and social sciences to describe, calculate, and simulate systems, processes, and technical equipment.
1.2	Apply fundamental knowledge in electrical engineering, technology, measurement, control, communication, and automation in the field of electrical engineering.
1.3	Design and evaluate solutions, production processes, and technical products in the field of electrical-electronic engineering.
2	Possess professional skills and personal qualities
2.1	Reason and solve technical problems.
2.2	Experiment and test hypotheses related to the field of electrical engineering.
2.3	Demonstrate systematic thinking and critical thinking.
2.4	Show creative thinking and lifelong learning abilities.
2.5	Exhibit honesty and professional responsibility.

Number of PLO	Program Learning Outcome
3	Social skills necessary for effective collaboration in interdisciplinary teams and international environments.
3.1	Work independently and collaboratively in a multi-industry work environment.
3.2	Communicate through written text, presentations, and discussions, utilizing electronic media and communication tools.
3.3	Use English for communication and professional activities.
4	Capability to apply knowledge in practice within social and environmental contexts (CDIO)
4.1	Recognition of the relationship between technical solutions and economic, social, and environmental factors.
4.2	Identification of the cultural, strategic, and organizational aspects of enterprise production and business.
4.3	Identification of problems and formulation of technical solution ideas, participation in project development.
4.4	Participation in the design of systems, processes, and products, proposing technical solutions in the field of electrical engineering.
4.5	Involvement in the manufacturing of products, implementation of systems, and deployment of technical solutions related to electrical engineering.
4.6	Operation and management of systems, processes, and products related to electrical engineering.

3.2.2. The program is to show that the expected learning outcomes consist of both generic outcomes (related to written and oral communication, problem-solving, information technology, teambuilding skills, etc.) and subject specific outcomes (related to knowledge and skills of the study discipline).

The learning outcome of training program on Electrical Engineering include 17 learning outcomes structured into 3 groups of knowledge, skills, autonomy and responsibility according to the Vietnam National Qualifications Framework. as well as the Training Program Standards of the Ministry of Education and Training. The correlation between the learning outcome of the training program and the requirements of the Vietnam National Qualifications Framework is shown in Table 1.2:

Table 2. Classification of output standards in terms of knowledge, skills, autonomy and responsibility.

Output standard	Code of output standard	Knowledge		Skills		Autonomy and responsibility
		Common	Major	Common	Major	
PLO1	1.1	x				
PLO2	1.2		x			
PLO3	1.3		x			
PLO4	2.1				x	
PLO5	2.2				x	
PLO6	2.3				x	
PLO7	2.4					x
PLO8	2.5					x
PLO9	3.1			x		
PLO10	3.2			x		
PLO11	3.3			x		
PLO12	4.1			x		
PLO13	4.2				x	
PLO14	4.3				x	
PLO15	4.4				x	
PLO16	4.5				x	
PLO17	4.6				x	

3.3. Career options after graduation

After graduating from Electrical Engineering, students can work in many different areas, including but not limited to:

- Design and manufacture electrical products such as electronic circuits, PLC controllers, transformers, power converters, etc.
- Install and maintain electrical systems for factories, buildings, industrial parks, and other construction projects.
- Analyze, design, implement, maintain, and evaluate the performance of automatic control systems.
- Design, test, and evaluate electrical circuits, devices, and instrumentations.
- Design, test, and evaluate electrical circuits, devices, and instrumentations.
- Design, implement, manufacture, and maintain automatic control systems for robots.
- Design, test, and evaluate the performance of mobile and communication systems.
- Build and deploy machine vision and artificial intelligence engineering.
- Consulting, manufacturing, management, and marketing in electrical engineering.

3.4. Postgraduate study opportunities

After graduation, students may pursue further education at higher levels, such as master's or doctoral degrees, at technical training institutions both domestically and internationally

3.5. Description of the programme structure

3.5.1. Duration of Training and Knowledge Volume

Major: Electrical Engineering

Duration of training: 4.5 years

Total credit hours for the program: 151 credits (excluding the Physical Education, National Defense Education, additional English language courses, and extracurricular activities)

3.5.2. Allocation of Knowledge Blocks

Table 3. Allocation of Knowledge Blocks

Name	Credit		
	Total	Compulsory	Elective
General Education Knowledge Block	59	56	3
+ Political Theory and Law	13	13	
+ Mathematics and Natural Sciences	30	30	
+ Science, Society, and Environment	3	3	3
+ Foreign Languages	7	7	
+ Computer Science	3	3	
Professional Knowledge Block	95	92	3
+ Fundamental Group and Branch Basis	49	46	3
+ Specialization	31	31	
+ Interdisciplinary	19	19	
+ Workshop Practice and Internship	3	3	
+ Internship and Final Project/Thesis	12	12	
+ Economics, Management	3	3	
Physical Education and National Defense Education Knowledge Block	Excluded		
+ Mandatory Physical Education	1		
+ Basic Elective Physical Education	1		
+ Advanced Elective Physical Education	1		
+ National Defense Education	5		
Extracurricular Activities	Excluded		

3.5.3. Duration of Training and Knowledge Volume

No	Code	Course	Credits	Class hour		Prerequisite			Implementing Faculty
				Teaching hour	Practice/ Experiment	Prerequisite	Learn before	Parallel	
A. General Knowledge block (59 credits)									
I	Compulsory Courses								
1	BAS123	Philosophy of marxism and Leninism	3	45					Faculty of Basic and Applied Sciences Faculty of International Training (Foreigner only)
	MAE060	Ethics in Engineering (Foreigner only)	3	45					
2	BAS215	Political economics of marxism and leninism	2	30					
	GMA002	Introduction to engineering drawing and CAD (Foreigner only)	3	45					
3	BAS305	Scientific socialism	2	30					
	GMA004	Introduction to MAE Practice (Foreigner only)	3	45					
4	BAS217	History of Vietnamese communist party	2	30					
	GEE015	Minor Project of Independent study (Foreigner only)	1	15					
5	BAS110	Ho Chi Minh's ideology	2	30					
	MAE014	Instrumentation and computer (Foreigner only)	3	45					
6	PHY001	General Physics 1	4	60					
7	PHY002	General Physics 2	3	45					
8	PHY003	Physic laboratory	1		30				
9	FIM207	Introduction to Law	2	30					Faculty of Industrial Economics

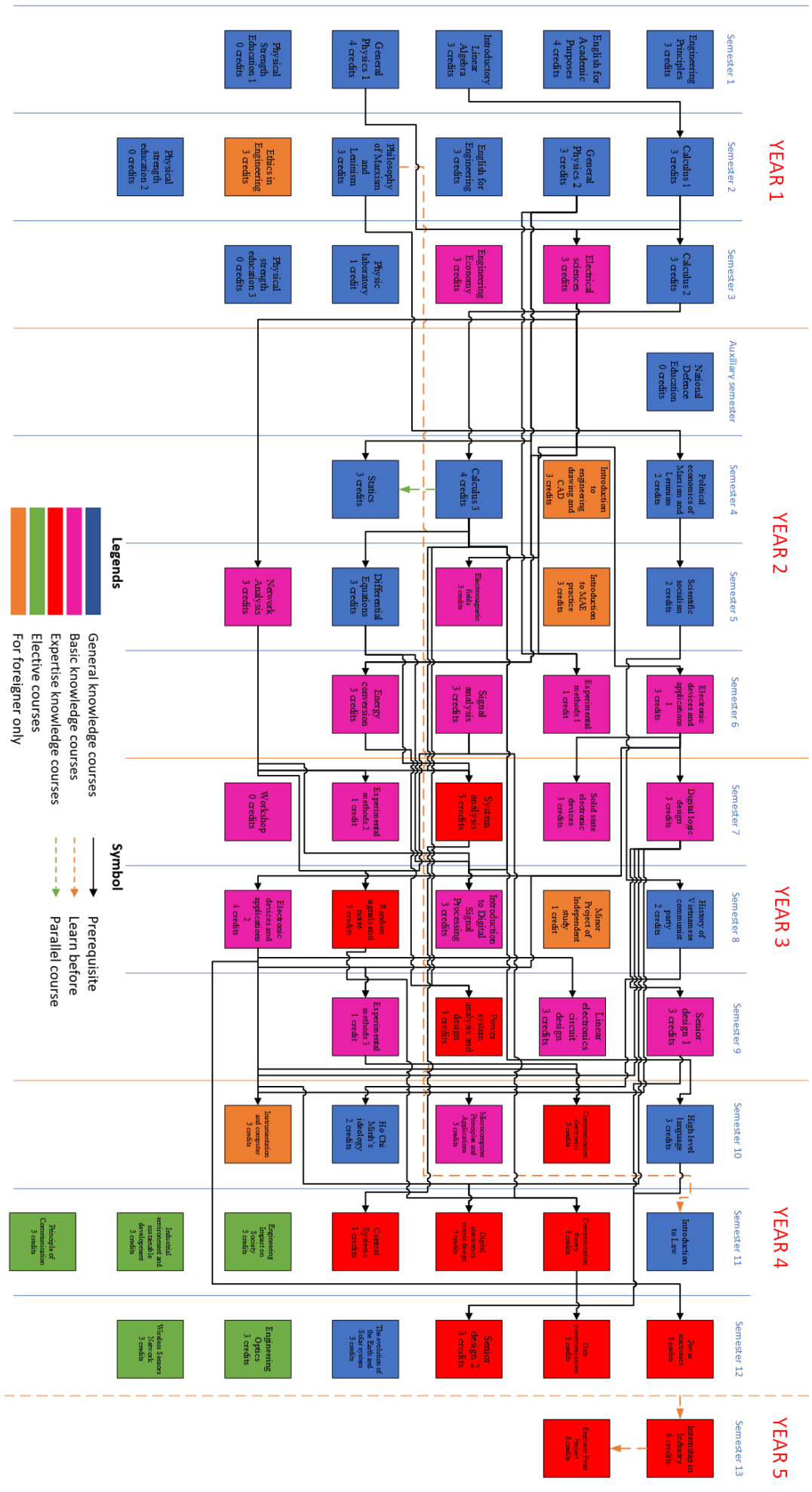
No	Code	Course	Credits	Class hour		Prerequisite			Implementing Faculty
				Teaching hour	Practice/ Experiment	Prerequisite	Learn before	Parallel	
10	GMA001	Engineering Principles	3	45					Faculty of International Training
11	MAT002	Calculus 1	3	45					
12	ENG104	English for Academic Purposes	4	60					
13	MAT003	Calculus 2	3	45					
14	ENG106	English for Engineering	3	45					
15	MAT004	Calculus 3	4	60					
16	MAT005	Differential Equations	3	45					
17	MAT001	Introductory Linear Algebra	3	45					
18	MAE001	Statics (Tĩnh học)	3	45					
19	GMA006	High level language	3	45					
20	GMA005	The evolution of the Earth and Solar system	3	45					
II.1	<i>Elective Physical Strength Education</i>		0						
21.1	TCV101	<i>Physical strength education 1</i>	(1)						Faculty of Basic and Applied Sciences
21.2	TCV102	<i>Physical strength education 2</i>	(1)						
21.3	TCV103	<i>Physical strength education 3</i>	(1)						
21.4	TCV104	National defence education	(5)						Thai Nguyen National Defense Education Center
II.2	<i>Elective subjects of Experiential learning, Economics-Culture-Social-Invirnement</i>		3						
22.1	GMA002	<i>Experiential Internships</i>	(3)						Faculty of International Training
22.2	GMA003	<i>Engineering Impact on Society</i>	(3)						

No	Code	Course	Credits	Class hour		Prerequisite			Implementing Faculty
				Teaching hour	Practice/ Experiment	Prerequisite	Learn before	Parallel	
22.3	GMA006	<i>Industrial environment and sustainable development</i>	(3)						
22.4	GMA007	<i>Principle of communication</i>	(3)						
B	Base group knowledge, expertise knowledge and interdisciplinary knowledge block								
I	Base group knowledge and interdisciplinary knowledge block								
1.1	Interdisciplinary knowledge block (19 credits)								
23	MAE060	Ethics in Engineering	3	45					Faculty of International Training
24	GMA002	Introduction to engineering drawing and CAD	3	45					
25	GMA004	Introduction to MAE Practice	3	45					
26	GEE015	Minor Project of Independent study	1	15					
27	MAE014	Instrumentation and computer	3	45					
28	MAE001	Statics (Tĩnh học)	3	45					
29	GMA005	The evolution of the Earth and Solar system	3	45					
1.2	Base group knowledge block (49 credits)								
1.2.1	Compulsory Courses								
1	GEE001	Electrical sciences	3	45					Faculty of International Training
2	GEE003	Electromagnetic fields	3	45					

No	Code	Course	Credits	Class hour		Prerequisite			Implementing Faculty	
				Teaching hour	Practice/ Experiment	Prerequisite	Learn before	Parallel		
3	EEC007	Network analysis	3	45						
4	EE0003	Solid state electronic devices	3	45						
5	GEE004	Experimental methods 1	1		30					
6	EE0008	Signal analysis	3	45						
7	GEE011	Energy conversion	3	45						
8	GEE005	Experimental methods 2	1		30					
9	EE0006	Digital logic design	3	45						
10	EE0001	Electronic devices and applications 1	3	45						
11	EE0005	Linear electronics circuit design	3	45						
12	TTV101	Workshop	0							TNUT Experiment Center
13	EE0017	Introduction to Digital Signal Processing	3	45						Faculty of International Training
14	EE0004	Electronic devices and applications 2	4	60						
15	EE0009	Senior design 1	3		90					
16	GEE006	Experimental methods 3	1		30					
17	GEE002	Engineering Economy	3	45						
18	EE0002	Microcomputer Principles and Applications	3	45						
1.3.2	<i>Elective courses</i>									
19.1	MAE014	Instrumentation and computer	3	45					Faculty of International Training	
19.2	EE0011	Engineering Optics	3	45						

No	Code	Course	Credits	Class hour		Prerequisite			Implementing Faculty
				Teaching hour	Practice/ Experiment	Prerequisite	Learn before	Parallel	
II	Expertise knowledge block (31 credits)								
	<i>Compulsory Courses</i>								
1	GEE007	Random signals and noise	3	45					Faculty of International Training
2	EEC010	Systems analysis	4	45					
3	EE0015	Power system analysis and design	3	45					
4	EE0013	Communication electronics	3	45					
5	GEE008	Communication theory	3	45					
7	EE0014	Digital electronics circuit design	3	45					
8	EE0020	Control Systems	3	45					
9	EE0012	Power electronics	3	45					
10	GEE009	Data communications	3	45					
11	EE0016	Senior design 2	3		90				
III	Internship and Graduated Thesis (12 credits)								
1	TTV002	Internship in Industry	6		180				
2	EE0019	Engineering Final Project	6		180				
	TỔNG CỘNG		151						
Total credits: 151 (Compulsory: 145, Elective: 6)									

3.5.4. Correlation diagram of the modules in the curriculum



3.5.5. Full course training plan

SEMESTER 1					
No.	Code	Course	Credit	Pr./Ex.	Note
1	GMA001	Engineering Principles	3		
2	ENG104	English for Academic Purposes	4		
3	MAT001	Introductory Linear Algebra	3		
4	PHY001	General Physics 1	4		
5	TCV001	Physical Strength Education 1	0		
		Total	14		
SEMESTER 2					
No.	Code	Course	Credit	Pr./Ex.	Note
1	MAT002	Calculus 1	3		
2	PHY002	General Physics 2	3		
3	ENG106	English for Engineering	3		
4	BAS123	Philosophy of marxism and Leninism	3		<i>Vietnamese</i>
	MAE060	Ethics in Engineering	3		<i>Foreigner</i>
5	TCV002	Physical strength education 2	0		
		Total	14		
SEMESTER 3					
No.	Code	Course	Credit	Pr./Ex.	Note
1	MAT003	Calculus 2	3		
2	GEE001	Electrical sciences	3		
3	MAE001	Statics	3		
4	PHY003	Physic laboratory	1	15	
5	TCV003	Physical Strength Education 3	0		
		Total	10		
AUXILIARY SEMESTER					
No.	Code	Course	Credit	Pr./Ex.	Note
1	TCV004	National defence education	0		<i>Vietnamese</i>
SEMESTER 4					

No.	Code	Course	Credit	Pr./Ex.	Note
1	BAS215	Political economics of marxism and leninism	2		<i>Vietnamese</i>
	GMA002	Introduction to engineering drawing and CAD	3		<i>Foreigner</i>
2	MAT004	Calculus 3	4		
3	GEE002	Engineering Economy	3		
		Total	9(10)		<i>(Foreigner)</i>
SEMESTER 5					
No.	Code	Course	Credit	Pr./Ex.	Note
1	BAS305	Scientific socialism	2		<i>Vietnamese</i>
	GMA004	Introduction to MAE practice	3		<i>Foreigner</i>
2	GEE003	Electromagnetic fields	3		
3	MAT005	Differential Equations	3		
4	EEC007	Network analysis	3		
		Total	11(12)		<i>(Foreigner)</i>
SEMESTER 6					
No.	Code	Course	Credit	Pr./Ex.	Note
1	EE0001	Electronic devices and applications 1	3		
2	GEE004	Experimental methods 1	1	15	
3	EE0008	Signal analysis	3		
4	GEE011	Energy conversion	3		
		Total	10		
SEMESTER 7					
No.	Code	Course	Credit	Pr./Ex.	Note
1	EE0006	Digital logic design	3		
2	EE0003	Solid state electronic devices	3		
3	EEC010	Systems analysis	3		
4	GEE005	Experimental methods 2	1	15	
5	TTV101	Workshop	0		
		Total	10		
SEMESTER 8					
No.	Code	Course	Credit	Pr./Ex.	Note

1	BAS217	History of Vietnamese communist party	2		<i>Vietnamese</i>
	GEE015	Minor Project of Independent study	1		<i>Foreigner</i>
2	EE0017	Introduction to Digital Signal Processing	3		
3	GEE007	Random signals and noise	3		
4	EE0004	Electronic devices and applications 2	4		
		Total	12(11)		(Foreigner)
SEMESTER 9					
No.	Code	Course	Credit	Pr./Ex.	Note
1	EE0009	Senior design 1	3		
2	EE0005	Linear electronics circuit design	3		
3	EE0015	Power system analysis and design	3		
4	GEE006	Experimental methods 3	1		
		Total	10		
SEMESTER 10					
No.	Code	Course	Credit	Pr./Ex.	Note
1	GMA006	High level language	3		
2	EE0013	Communication electronics	3		
3	EE0002	Microcomputer Principles and Applications	3		
4	BAS110	Ho Chi Minh's ideology	2		<i>Vietnamese</i>
	MAE014	Instrumentation and computer	3		<i>Foreigner</i>
		Total	11(12)		(Foreigner)
SEMESTER 11					
No.	Code	Course	Credit	Pr./Ex.	Note
1	FIM207	Introduction to Law	2		
2	GEE008	Communication theory	3		
3	EE0014	Digital electronics circuit design	3		
4	EE0020	Control Systems	3		
Elective subjects of Economics-Culture-Social-Invironment			3		Select 1 in 3
5	GMA003	<i>Engineering Impact on Society</i>	(3)		
6	GMA006	<i>Industrial environment and sustainable development</i>	(3)		
7	GMA007	<i>Principle of Communication</i>	(3)		
		Total	14		
SEMESTER 12					
No.	Code	Course	Credit	Pr./Ex.	Note

1	EE0012	Power electronics	3		
2	GEE009	Data communications	3		
3	EE0016	Senior design 2	3		
4	GMA005	The evolution of the Earth and Solar system	3		
Elective courses			3		Select 1 in 2
5	EE0011	<i>Engineering Optics</i>	(3)		
6	EE0018	<i>Wireless Sensors Network</i>	(3)		
		Total	15		
SEMESTER 13					
No.	Code	Course	Credit	Pr./Ex.	Note
1	TTV002	Internship in Industry	6		
2	EE0019	Engineer Final Design Project	6		
		Total	12		

3.6. Correlation Matrix

Table 4. This correlation matrix demonstrates the development of knowledge, skills, and personal qualities. In this table, the outcomes standards of the courses will be referenced here and it forms the basis for the preceding and succeeding tables in this appendix.

No.	CODE	COURSE	PROGRAM LEARNING OUTCOME															
			1			2					3			4				
			1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5
General Knowledge block																		
1	BAS123	Philosophy of marxism and Leninism	3					3	3	3								
2	BAS215	Political economics of marxism and leninism	3					3	3	3								
3	BAS305	Scientific socialism	3					3	3	3								
4	BAS217	History of Vietnamese communist party	3					3	3	3								
5	BAS110	Ho Chi Minh's ideology	3					3	3	3								
6	PHY001	General Physics 1	3															
7	PHY002	General Physics 2	3															
8	PHY003	Physic laboratory	3								3	3						
9	FIM207	Introduction to Law						3		4		3						
10	GMA001	Engineering Principles				3		3	3	3								
11	MAT002	Calculus 1	3						3									
12	ENG104	English for Academic Purposes									3	3	3					
13	MAT003	Calculus 2	3						3									
14	ENG106	English for Engineering									3	3	3					
15	MAT004	Calculus 3	3						3									

No.	CODE	COURSE	PROGRAM LEARNING OUTCOME															
			1			2					3			4				
			1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5
16	MAT005	Differential Equations	3					3										
17	MAT001	Introductory Linear Algebra	3					3										
<i>Elective course</i>																		
18	GMA002	<i>Experiential Internships</i>								4	4	4	3					
19	GMA003	<i>Engineering Impact on Society</i>									3	3	4	4				
20	GMA006	<i>Industrial environment and sustainable development</i>						3	3				3					
21	GMA007	<i>Principle of communication</i>				3		3	3		4	4						
Base group knowledge and interdisciplinary knowledge block																		
Interdisciplinary knowledge block																		
1	MAE060	Ethics in Engineering						3		5								
2	GMA002	Introduction to engineering drawing and CAD							3	3								
3	GMA004	Introduction to MAE Practice				3			3	3								
4	MAE001	Statics	3															
5	GMA005	The evolution of the Earth and Solar system	3										3					
6	GEE015	Minor Project of Independent study				3			3		3	3						
7	GMA006	High level language				3	3	3										

No.	CODE	COURSE	PROGRAM LEARNING OUTCOME															
			1			2					3			4				
			1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5
Base group knowledge block																		
1	GEE001	Electrical sciences	3	3		3						3						
2	GEE003	Electromagnetic fields	3	3		3												
3	EEC007	Network analysis		3		3						3						
4	EE0003	Solid state electronic devices	3	3														
5	GEE004	Experimental methods 1		3			4				3							
6	EE0008	Signal analysis	3	3		3												
7	GEE011	Energy conversion	3	3		3												
8	GEE005	Experimental methods 2		3			4				3							
9	EE0006	Digital logic design		4	3		3				3		3					
10	EE0001	Electronic devices and applications 1	3	3														
11	EE0005	Linear electronics circuit design		4	3		3											
12	TTV101	Workshop		3	3	3	3				3							
13	EE0017	Introduction to Digital Signal Processing	3	3		3	3				3	3	3					
14	EE0004	Electronic devices and applications 2	3	4														
15	EE0009	Senior design 1		4	3	4	3					4	3					
16	GEE006	Experimental methods 3		3		4				3	3							
17	GEE002	Engineering Economy								3				3	4			

No.	CODE	COURSE	PROGRAM LEARNING OUTCOME																
			1			2					3			4					
			1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5	4.6
18	EE0002	Microcomputer Principles and Applications	3	3		3	3				3	3	3						
Elective course																			
1	MAE014	Instrumentation and computer	3	3			3				3	3							
2	EE0011	Engineering Optics	3	3															
Expertise knowledge block																			
1	GEE007	Random signals and noise		4	4														
2	EE0010	Systems analysis		4	3	4					3	3	3				4		
3	EE0015	Power system analysis and design			4	4	4							3					
4	EE0013	Communication electronics			3	3													
5	GEE008	Communication theory			3	3													
6	EE0014	Digital electronics circuit design			4		4				3	3							
7	EE0020	Control Systems			4	3	4				3	3	3						
8	EE0012	Power electronics			4	3					3	3							
9	GEE009	Data communications			4	3													
10	EE0016	Senior design 2			5	5	5				5	5	3			3			
Internship and Graduated Thesis																			
1	TTV002	Internship in Industry				4					5	5		5	5	4	4		4
2	EE0019	Engineering Final Project				5					5	5				4	5	5	5

PART II TRAINING PROGRAM COURSE DESCRIPTION

I. General Knowledge block

1.1. Compulsory Courses

1. Philosophy of marxism and Leninism (BAS123)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Học phần Triết học Mác - Lênin là học phần đầu tiên, bắt buộc trong hệ thống các môn học lý luận chính trị trong chương trình đào tạo. Nội dung của môn học bao gồm 03 chương, nghiên cứu những quy luật vận động, phát triển chung nhất của tự nhiên, xã hội và tư duy; xây dựng thế giới quan, phương pháp luận khoa học, cách mạng, vận dụng vào hoạt động nhận thức khoa học và thực tiễn cách mạng.

2. Political economics of marxism and leninism (BAS215)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Nội dung học phần trình bày về lý luận của kinh tế chính trị Mác – Lênin và một số vấn đề kinh tế của Việt Nam như: Kinh tế thị trường định hướng xã hội chủ nghĩa và công nghiệp hóa hiện, đại hóa và hội nhập kinh tế quốc tế của Việt Nam hiện nay.

3. Scientific socialism (BAS305)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Môn học trình bày những nội dung cơ bản của Chủ nghĩa xã hội khoa học như: Sứ mệnh lịch sử của giai cấp công nhân; Chủ nghĩa xã hội và thời kỳ quá độ lên chủ nghĩa xã hội; Dân chủ xã hội chủ nghĩa và nhà nước xã hội chủ nghĩa; Cơ cấu xã hội - giai cấp và liên minh giai cấp, tầng lớp trong thời kỳ quá độ lên chủ nghĩa xã hội; Vấn đề dân tộc, tôn giáo, gia đình trong thời kỳ quá độ lên chủ nghĩa xã hội.

4. History of the Communist Party of Vietnam (BAS217)

- *Prerequisites: BAS123, BAS215, BAS305*

- *Corequisites: None*

- *Course description:* Học phần Lịch sử Đảng Cộng sản Việt Nam cung cấp cho sinh viên kiến thức về sự ra đời của Đảng Cộng sản Việt Nam, quá trình lãnh đạo của Đảng qua các thời kỳ cách mạng từ năm 1930 đến nay. Qua đó khẳng định những thành công, tổng kết những kinh nghiệm về sự lãnh đạo cách mạng của Đảng để giúp người học nâng cao nhận thức, niềm tin đối với Đảng, vận dụng kiến thức đã học vào thực tiễn công tác, góp phần xây dựng và bảo vệ Tổ quốc Việt Nam.

5. Ho Chi Minh ideology (BAS110)

- *Prerequisites:* BAS123, BAS215, BAS305, BAS217

- *Corequisites:* None

- *Course description:* Tư tưởng Hồ Chí Minh là học phần bắt buộc giảng dạy trong chương trình đào tạo cho sinh viên đại học, cao đẳng khối không chuyên ngành Mác - Lênin, tư tưởng Hồ Chí Minh. Học phần nhằm trang bị cho sinh viên hệ thống quan điểm của Hồ Chí Minh về những vấn đề cơ bản của cách mạng Việt Nam.

6. Introduction to laws (FIM207)

- *Prerequisites:* BAS123

- *Corequisites:* None

- *Course description:* Pháp luật đại cương là học phần bắt buộc thuộc phần kiến thức đại cương về khái quát chung về nhà nước và pháp luật; hệ thống pháp luật; luật hiến pháp; luật hành chính; luật dân sự; luật hình sự; luật hôn nhân và gia đình; luật phòng, chống tham nhũng, giúp sinh viên nắm được kiến thức cơ bản về pháp luật Việt Nam, áp dụng vào thực tiễn, nâng cao ý thức pháp luật, đánh giá và định hướng hành vi xử sự của mình và người khác theo chuẩn mực pháp lý, tôn trọng và thực hiện pháp luật.

7. Engineering Principles (GMA001 - 3TC)

- *Prerequisites:* None

- *Corequisites:* None

- *Course description:* This course is the first-level course intended to introduce students to various aspects of Engineering and the fundamental principles used in engineering analysis and design. It also introduces students to the engineering professions and aspects of professionalism including ethics and etiquette. Moreover, it presents engineering problem solving methods and several common engineering models.

8. Calculus 1 (MAT002)

- *Prerequisites:* MAT001

- *Corequisites:* None

- *Course description:* Calculus I is concerned with change and motion, it deals with quantities that approach other quantities. This is the first part of a three-semester sequence in calculus for students of mathematics, natural sciences, and engineering. Topics covered include functions and models; limits and derivatives; differentiation rules; and application of differentiation

9. English for Academic Purposes (ENG104)

- *Prerequisites:* None

- *Corequisites:* None

- *Course description:* English for Academic Purposes is the course in which learners are trained with reading skills and writing skills through a various types of tasks

relating to common everyday life topics at level B1. Moreover, learners have chances to reinforce their vocabulary and grammar as well as improve their competences in communication.

10. General Physics 1 (PHY001)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* This is a first course in general physics for engineering, mathematics and computer science majors. Topics covered include the calculus-based study of vectors, particle kinematics, Newton's laws, friction, work, conservation of energy and momentum, gravitation and rotation. Emphasis is placed on problem solving and applications to laboratory experience.

11. Calculus 2 (MAT003)

- *Prerequisites: MAT002*

- *Corequisites: None*

- *Course description:* Calculus II is the second part of a three-semester sequence in calculus intended for technology, biology, computer science, economics for students of mathematics, natural sciences, and engineering. Topics covered include integration techniques, applications of Integrations, Parametric Equations and Polar Coordinates, and Infinite Sequences and Series.

12. English for Engineering (ENG106)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* English for Engineering is the course in which learners are provided with common technical knowledge of Electrical and Mechanical Engineering. Moreover, they can train to realize their knowledge and skills as well as improve their competences in communicating.

13. Calculus 3 (MAT004)

- *Prerequisites: MAT001, MAT003*

- *Corequisites: None*

- *Course description:* The course is the most important pattern in the block of general education of the curriculum. The subjects in the course covered a large part of the training program which seem to appear in almost all applied science fields and in physics. Two fundamental calculations of calculus including the differentiation and the integration are constructed as the heart of the classic multivariate calculus. They are developed with the intensive presence of the vector fields, the oriented objects in spatial time.

14. Differential equations (MAT005)

- *Prerequisites:* MAT004

- *Corequisites:* None

- *Course description:* Ordinary differential equations (ODE) are a fundamental part of the mathematical vocabulary used to describe natural phenomena. The course emphasizes classical methods for finding exact solution formulas. The course covers a rich number of subjects relating to an ODE, especially the case of the initial value problems (IVPs). The basic concepts of the solutions including the exact solution, the integral curve, and the vector field of the DE are introduced as the foundation of the theory of ODE. The analytic setting of the IVP for the existence and uniqueness of the solution, the superposition principle are the crucial knowledge needed to be equipped for students whose majors are natural sciences and engineering. Following these foundations, the various types of basic ODE are presented with analytic methods in solving their exact solution under the consideration of its existence and uniqueness. In bridging the fields of engineering and calculus, Laplace Transforms also presented as the important part of the analytic methods for finding the solution of an IVP. The population of this tool in studying other scientific courses of the curriculum provides a fertile material for learners to present the creation in their engineering or scientific fields.

15. Physics 2 (PHY002)

- *Prerequisites:* PHY001

- *Corequisites:* None

- *Course description:* To provide students a calculus-based introductory course primarily for chemistry, engineering, and physics majors. Covers the electric field, Gauss' law, electric potential, capacitance, DC circuits, RC circuits, magnetic field, Faraday's law, inductance, LR circuits, AC circuits, and Maxwell's equations.

16. Physic laboratory (PHY003)

- *Prerequisites:* PHY001, PHY002

- *Corequisites:* None

- *Course description:* To provide students a calculus-based introductory course primarily for chemistry, engineering, and physics majors. Covers the electric field, Gauss' law, electric potential, capacitance, DC circuits, RC circuits, magnetic field, Faraday's law, inductance, LR circuits, AC circuits, and Maxwell's equations.

17. Introductory Linear Algebra (MAT001)

- *Prerequisites:* None

- *Corequisites:* None

- *Course description:* Introductory Linear Algebra is an introduction to the theory and applications of systems of linear equations and linear operations, focusing on these on finite dimension spaces. Applying widely of this theory, especially in the

engineering, is very useful for the developing of the model technology. Topics covered include matrices, determinants, linear systems, vector spaces, linear transformation, eigenvalues and diagonalization of matrices:

18. Physical strength education 1 (TCV101)

18.1. Physical strength education 1 (TCV101)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Giáo dục thể chất tự chọn (Bóng chuyền 1) là môn học tự chọn đối với sinh viên hệ chính quy trong toàn trường. Học phần trang bị cho sinh viên những kiến thức, kỹ năng, kỹ thuật cơ bản trong môn Bóng chuyền. Qua đó sinh viên vận dụng vào trong tập luyện và thi đấu để nâng cao sức khỏe và phát triển các tố chất thể lực; hình thành nhân cách và lối sống lành mạnh;.... đáp ứng nhu cầu phát triển toàn diện cho sinh viên

18.2. Physical strength education 2 (TCV102)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Học phần Bóng đá 1 là học phần tự chọn. Học phần này cung cấp cho sinh viên kiến thức, kỹ thuật động tác cơ bản trong môn Bóng đá. Qua đó sinh viên vận dụng vào trong tập luyện và thi đấu để nâng cao sức khỏe và phát triển các tố chất thể lực; hình thành nhân cách và lối sống lành mạnh;.... đáp ứng nhu cầu phát triển toàn diện cho sinh viên

18.3. Physical strength education 3 (TCV103)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Giáo dục thể chất tự chọn (Bóng rổ 1) là môn học tự chọn đối với sinh viên hệ chính quy trong toàn trường. Học phần trang bị cho sinh viên những kiến thức, kỹ năng, kỹ thuật cơ bản trong môn Bóng rổ. Qua đó sinh viên vận dụng vào trong tập luyện và thi đấu để nâng cao sức khỏe và phát triển các tố chất thể lực; hình thành nhân cách và lối sống lành mạnh;.... đáp ứng nhu cầu phát triển toàn diện cho sinh viên

18.4. Physical strength education 4

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Giáo dục thể chất tự chọn (Cầu lông 1) là môn học tự chọn đối với sinh viên hệ chính quy trong toàn trường. Học phần trang bị cho sinh viên những kiến thức, kỹ năng, kỹ thuật cơ bản trong môn Cầu lông. Qua đó sinh viên vận dụng vào trong tập luyện và thi đấu để nâng cao sức khỏe và phát triển các tố chất thể lực; hình

thành nhân cách và lối sống lành mạnh;.... đáp ứng nhu cầu phát triển toàn diện cho sinh viên.

18.5. Physical strength education 5

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Học phần này cung cấp cho sinh viên kiến thức, kỹ thuật động tác cơ bản trong môn Thể dục và Điền kinh (chạy 100m). Qua đó sinh viên vận dụng vào trong tập luyện và thi đấu để nâng cao sức khỏe và phát triển các tố chất thể lực; hình thành nhân cách và lối sống lành mạnh;.... đáp ứng nhu cầu phát triển toàn diện cho sinh viên.

1.2. Elective courses (Experiential learning, Economics-Culture-Social-Environment)

19. Experiential Internships (GMA002)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Experiential Internships is the course which enables learner to earn credit through qualifying internships/job experiences in the area of Electrical Engineering.

20. Engineering Impact on Society (GMA003)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* This course, a one-credit freshman seminar course, aims at broadening students' vision of engineering problem solving, and elucidating how engineers can make a difference in meeting key societal needs. The course focus is the National Academy of Engineering's 'Grand Challenges' for the future. It includes a series of interactive presentations by engineering faculties who are experts in these areas, offering an understanding of both problems and engineering approaches to solving them. Students also explore a self-selected area of personal interest as a step toward identifying possible niches for their own career path.

21. Industrial environment and sustainable development (GMA006)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Industrial environment and sustainable development is an elective course in the general education knowledge block for engineering students. This module provides students with basic knowledge about the environment and systems, the relationship between humans and natural resources, environmental pollution in general, pollution in industries today. On that basis, this course helps students to have the ability

to analyze the role of the environment existence, existence and natural resources in human and development; be able to analyze the causes and consequences of resource degradation and environmental pollution; have the ability to take action to contribute to environmental protection. In addition, students can work in groups and present problems, improving presentation skills.

22. Principle of communication (GMA007)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Principles of communication" is a course designed to develop the communication skills for engineering students in the context of creativity, negotiation, interpersonal and problem solving environment. The course introduces and experiences students with reading academic documents, writing technical definitions, descriptions, instructions and engineering reports. The whole attitudinal framework that enables effective and purposeful exchange of information for learning and working in engineering environment is also provided.

23. Higher Level Language (GMA006)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* C++ (pronounced cee plus plus) is a general purpose programming language. It has imperative, object-oriented and generic programming features, while also providing the facilities for low level memory manipulation.

II. Base group knowledge, expertise knowledge and interdisciplinary knowledge block

2.1. Interdisciplinary knowledge block

24. Ethics in Engineering (MAE060)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Engineers and computer scientists can impact thousands of lives and are often put in difficult situations, such as those involving internal pressures and constraints surrounding deadlines and budgets. This is why it's essential for them to develop a habit of considering the ethical implications of their choices, as even seemingly small, everyday decisions can have unintended consequences. This course will introduce students to engineering and computing ethics by teaching them to identify ethical issues in engineering and computer science practice and acquire ways to think about them. Students will become familiar with ethical theories, professional ethics, and

the ethical codes of their particular field. Through analyzing and discussing case studies, they will develop skills in critical thinking, communication, and reflection.

25. Introduction to engineering drawing and CAD (GMA002)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Engineering drawing is a basic course for all undergraduate Engineering program. This course is introduced to provide the basic understanding of the fundamentals of engineering drawings, mainly visualization, graphics theory, standards and conventions of drawing, the tools of drawing including computer software (AutoCAD) and the use of drawings in engineering applications.

26. Introduction to MAE Practice (GMA004)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* This course is an overview of engineering in industry that introduces engineering design concepts, some common engineering components and tools, and fundamentals of traditional and advanced manufacturing processes.

27. Instrumentation and Computer (MAE014)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* This course introduces data acquisition using A/D converters. Theory of A/D and D/A converters, fundamentals and examples of transducers used for mechanical measurements, static and dynamic response, amplifiers, theory of A/D and D/A converters, error analysis, elementary statistics.

28. Statics (MAE001)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* This course is designed to give you an introduction to engineering mechanics in static systems. Statics deals with two- and three-dimensional systems of particles and rigid bodies in static equilibrium. Additional topics include concentrated and distributed forces, centers of gravity and centroids, and moments of inertia. Special attention is devoted to forces in frames, structures, beams, and cables. For many of you, this will be your first engineering course. In fields such as mechanical or civil engineering, statics is indispensable in the design and analysis of structures that must hold their shape while bearing a load or performing a task where dynamic forces (forces arising from acceleration of the system) are absent or negligible.

29. The evolution of the earth and Solar system (GMA005)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* Evolution of the Earth and Solar System is scientific course studying origin, formation and evolution of the Earth and Solar system.

2.2. Base group knowledge block

30. Electrical science (GEE001)

- *Prerequisites:* MAT002, PHY001

- *Corequisites:* None

- *Course description:* The Electrical Science introduces the basic concepts and methodologies that are widely used in theoretical and applied electric circuits. Basic laws such as Ohm's and Kirchhoff's laws, methods of analysis like nodal and mesh analysis, and circuit theory, e.g., Thevenin's and Norton's theorems will be included. The circuit theory and technique applied to AC circuits will be covered.

31. Electromagnetic fields (GEE003)

- *Prerequisites:* MAT004

- *Corequisites:* None

- *Course description:* Electromagnetic Fields is the course focusing on time-harmonic and transient response of transmission lines. Maxwell's equations and their applications to engineering problems in electrostatics, magnetostatics, time-harmonic fields and plane wave propagation.

32. Network analysis (EEC007)

- *Prerequisites:* GEE001

- *Corequisites:* None

- *Course description:* Analysing electrical AC circuits; the phenomenon of electrical AC circuits, waveforms, values, power; frequency response and resonance; magnetic circuits, filters and transmission line; three phase circuits and systems.

33. Solid state electronic devices (EE0003)

- *Prerequisites:* EE0001

- *Corequisites:* None

- *Course description:* Solid state physics basis of modern electronic devices. Introductory quantum mechanics. Energy bands in solids. Electronic properties of semiconductors. Junction diodes. Bipolar transistors. Field effect transistor.

34. Experimental methods 1 (GEE004)

- *Prerequisites:* PHY102, GEE001

- *Corequisites:* None

- *Course description:* Basic electrical measurements and instrumentation techniques and devices. Use of voltmeters, ammeters, oscilloscopes, impedance bridges to study resistive, inductive and capacitive circuit elements in steady state and transient operation. Reinforces GEE001 and introduces design of instrumentation networks. Serves as introduction for nonmajors.

35. Signal Analysis (EE0008)

- *Prerequisites: None*

- *Corequisites: None*

- *Course description:* The course is to provide the basic concepts, definitions, theories of signals and systems, as well as related examples and practical problems. It also helps students using Matlab to simulate and check results. This course also includes: Deterministic signals; Fourier series and Fourier transforms; Impulse response, convolution and correlation; Sampling theorem; Analog modulation techniques.

36. Energy conversion (GEE011)

- *Prerequisites: GEE001, PHY002*

- *Corequisites: None*

- *Course description:* Solid state physics basis of modern electronic devices. Introductory quantum mechanics. Energy bands in solids. Electronic properties of semiconductors. Junction diodes. Bipolar transistors. Field effect transistor.

37. Experimental methods 2 (GEE005)

- *Prerequisites: EEC007*

- *Corequisites: None*

- *Course description:* Second laboratory in electrical measurements and instrumentation techniques and devices. Frequency response using gain/phase meter. Identification of unknown two-port networks, steady state operation and linear networks. Reinforces EEC007 and continues with the design of networks.

38. Digital logic design (EE0006)

- *Prerequisites: EE0001*

- *Corequisites: None*

- *Course description:* Boolean algebra, optimization of logic networks. Design using SSI, and MSI, LSI components. ROM and PLA applications. Analysis and design of clock sequential logic networks. Flip-flops, counters, registers. A synchronous circuit design and analysis. Laboratory experience in implementing combinational and sequential logic devices.

39. Electronic Devices and Applications 1 (EE0001)

- *Prerequisites: EEC007*

- *Corequisites: None*

- *Course description:* Semiconductor electronic components including DIODEs, and OpAmps. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises.

40. Linear electronics circuit design (EE0005)

- *Prerequisites: EE0004*

- *Corequisites: None*

- *Course description:* Study of the circuit building blocks utilized in CMOS and BJT integrated circuits; differential and multistage amplifiers and output stages. Topics related to amplifier circuits; such as bias, small-signal operation, frequency response, stability, and feedback are covered. Emphasis is on preparation for the practice of electronics design and for more advanced courses on analog integrated circuit design.

41. Introduction to Digital Signal Processing (EE0017)

- *Prerequisites: MAT004, EEC007, MAT005*

- *Corequisites: None*

- *Course description:* Introduction to discrete signals and linear systems using difference equations, z transforms, and discrete Fourier transforms. Design of digital filters. Sampling theorems. Multirate DSP techniques. Applications of DSP in theory and practice. MATLAB programming of DSP applications.

42. Electronic devices and applications 2 (EE0004)

- *Prerequisites: EE0001*

- *Corequisites: None*

- *Course description:* Semiconductor electronic components including MOSFETs, BJTs. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises.

43. Senior design 1 (EE0009)

- *Prerequisites: EEC007, EE0001, EE0006*

- *Corequisites: None*

- *Course description:* Senior design 1 is the course that complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.

44. Experimental methods 3 (GEE006)

- *Prerequisites: EE0001, EE0004*

- *Corequisites: None*

- *Course description:* Third laboratory in electrical measurements and instrumentation techniques and devices. Become familiar with the use of transistor curve tracers, transistor operating points and application related models. This includes the behavior of simple BJT and FET amplifiers circuits, operational amplifiers and feedback circuits. The lab reinforces EE0001, continuing the design experience in the context of electronics, continuing the design experience in the context of electronics.

45. Engineering economy (GEE002)

- *Prerequisites: ENG106*

- *Corequisites: None*

- *Course description:* Engineering Economy is an introductory course that introduces the basic models of microeconomic theory, and mathematical reasoning that is widely used in theoretical and applied microeconomics. Consumer decision theory, demand curves for goods, producer decision theory, production process and associated cost function, cost-minimizing and profit-maximizing behavior of firms, and introductory-level deregulated electricity market will be covered.

46. Microcomputer principles and applications (EE0002)

- *Prerequisites: EE0004, EE0006*

- *Corequisites: None*

- *Course description:* Introductory microcomputers. Digital logic elements and number systems, memory components and organization. Microprocessor and microcomputer system architecture, assembly language programming, software development, interfacing techniques.

47. Engineering Optics (EE0011)

- *Prerequisites: ENG106*

- *Corequisites: None*

- *Course description:* Optics engineering' is the field of study that focuses on applications of optics. Optics is the branch of physics which involves the behaviour and properties of light, including its interactions with matter and the construction of instruments that use or detect it. Optical engineers design components of optical instruments such as lenses, microscopes, telescopes, and other equipment that utilizes the properties of light. Other devices include optical sensors and measurement systems, lasers, fiber optic communication systems, optical disc systems.

2.3. Expertise knowledge block

48. Random Signals and Noise (GEE007)

- *Prerequisites: EE0008, EE0007*

- *Corequisites: None*

- *Course description:* Elementary concepts of probability, random variables. Random distributions and density functions. Operations on random variables such as expectation, variance and moments. Pairs of random variables. Introduction to random process. Applications on probability theory to practical problems and analysis of electrical systems using elementary concepts of probability.

49. System analysis (EEC010)

- *Prerequisites: MAT004, MAT005, EEC007*

- *Corequisites: None*

- *Course description:* Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first-and second-order systems. Laplace transform

techniques for solving differential equations, transfer functions, frequency response and resonance.

50. Power system analysis and design (EE0015)

- *Prerequisites: EE0007*

- *Corequisites: None*

- *Course description:* Power system component models from circuit theory. Formulation and design of the load flow model and the optimum economic generator allocation problem utilizing computer methods.

51. Communication Electronics (EE0013)

- *Prerequisites: EE0004, EE0006*

- *Corequisites: None*

- *Course description:* Introduction to radio-frequency (RF) communication systems with a primary focus on transistor- and circuit-level analysis. Investigations of RF system properties (noise, linearity, and matching) modulation schemes, and transceiver architectures. Operation principles and basic design of low-noise amplifiers, mixers, power amplifiers, and oscillators.

52. Communication Theory (GEEC008)

- *Prerequisites: EE0008, GEE007*

- *Corequisites: None*

- *Course description:* This course provides the fundamental theory of the basic building blocks that exist in all communication systems.

53. Digital electronics circuit design (EE0014)

- *Prerequisites: GEE006, EE0004*

- *Corequisites: None*

- *Course description:* Digital electronics circuit design is the course learning about Theory of digital and electronics circuits. Digital logic families TTL, IIL, ECL, NMOS, CMOS, GaAs. Large signal models for transistors. Implementation at RAM and ROM.

54. Control systems (EE0020)

- *Prerequisites: EEC010*

- *Corequisites: None*

- *Course description:* Control system optimization and compensation techniques, digital control theory, computer simulation studies.

55. Power electronics (EE0012)

- *Prerequisites: GEE001, EE0004, EE0010*

- *Corequisites: None*

- *Course description:* Power Electronics is the course learning about Power electronic devices, components and their characteristics; DC to AC conversion; fundamentals of inverters and waveshaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverter and power conditioning topologies.

56. Data communications (GEE009)

- *Prerequisites: EE0013*

- *Corequisites: None*

- *Course description:* This course teaches the design and implementation techniques essential for engineering robust networks. Topics include networking principles, Transmission Control Protocol/Internet Protocol, naming and addressing (Domain Name System), data encoding/decoding techniques, link layer protocols, routing protocols, transport layer services, congestion control, quality of service, network services, Software Defined Networks (SDNs), programmable routers and overlay networks, wireless and mobile networking, security in computer networks, multimedia networking, and network management.

57. Senior design 2 (EE0016)

- *Prerequisites: EE0009*

- *Corequisites: None*

- *Course description:* Senior design 1 is the course that complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.

58. Internship in Industry (TTV002)

- *Prerequisites: Students who have obtained 140 credits are eligible for "Internship in Industry" course*

- *Corequisites: None*

- *Course description:* The course is practical working of solving engineering problems in the real industry.

As an integral part of engineering education, the course "Internship in industry" provides students with an opportunity to gain work experience that will enhance and complement their academic learning; Enables correlation of class room learning with its application in industry; Broadens understanding of the types of employment available in the field; Helps students discover their individual interests; Builds resume credentials for the students; and develops relationships between TNUT and industrial firms..

59. Engineering Final Project (EE0019)

- *Prerequisites: All courses in syllabus*

- *Corequisites: None*

- *Course description:* Final design project is the course that student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility considerations, detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact.

PART III QUALITY ASSURANCE

I. HUMAN RESOURCES, INFRASTRUCTURE FOR ELECTRICAL ENGINEERING TRAINING

1.1. Teaching staff

Table 5. List of lecturers participating in teaching the theoretical part of the Base group knowledge, expertise knowledge of the Advanced Electrical Engineering program.

No.	Qualification	Number of lectures		
		Core lecture	Part-time lecture	Guest lecture
1	Prof., Assoc. Prof.	02	03	-
2	Dr.	19	-	02
3	Msc	26	-	02
4	B.S.	02	-	-

Table 6. List of technical staff, full-time employees teaching experiments, and practice

No.	Full name, Dob	Prof., Assoc. Prof., year of recognition	Degree, country, year of recognition	Field	Year of Training Participation	Scientific achievements
1	Tran Que Son, 1986		Msc, Việt Nam, 2015	Electronic Engineering	2011	
2	Nguyen Duc Mui, 1990		Msc, Việt Nam, 2018	Electronic Engineering	2021	

Table 7. List of management staff in charge of the training program

No.	Full name, year of birth, current position	Degree, year of recognition	Field	Note
1	Dao Huy Du, 1979 Head of the Training Department	Dr., 2013 Assoc. Prof., 2018	Electronics and Automation	
2	Nguyen Tien Duy, 1977 Deputy Head of Training Department	Dr., 2018	Computer Engineering	

3	Vu Lai Hoang, 1978 Deputy Head of Training Department	Dr., 2013	Metallurgy	
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1.2. Teaching facilities

1.2.1. Classrooms, laboratories, training equipment

Currently, TNUT is well-equipped with classrooms, research rooms, seminar rooms, and self-study rooms for undergraduated and postgraduated students. The classrooms are built according to technical standards, ensuring space, light, and equipped with various teaching aids such as multimedia classrooms, computer rooms (24/24 network connection), ensuring the highest effectiveness for teaching and learning for both faculty and students throughout the university.

Table 8. Statistics of the total number of main equipment of TNUT

No.	Room/classroom/lab	Quantity	Floor area (m2)	Usage form		
				Own	connective	Rent
1	Internship Workshop	02	3.529	x		
2	Multi-purpose sports building	01	450	x		
3	Halls	01	612	x		
4	Classroom	74	15.217	x		
5	Multimedia classroom... (foreign language classroom)	01	72	x		
6	Library	02	3.470	x		
7	Learning Resource Center	01	4.500		x	
8	Other function rooms	01	11.466	x		

To effectively support both training and research aligned with practical needs, the university has 18 laboratories covering a constructed floor area of 5,850m², equipped with 1,224 specialized devices. These laboratories, along with their basic equipment, meet the requirements of the training program. Specifically, for the Advanced Electrical Engineering program, TNUT provides laboratories with basic equipment to meet training requirements, and a system of laboratories that serve all training programs within the university (details in Table 9).

Table 9. Laboratory facilities and equipment

List of Practical and experimental rooms for the Electrical Engineering program

No.	Room/classroom/lab	Quantity	List of main equipment	Usage form		
				Own	Connective	Rent
1	Workshop for Electrical Practice - Experimental Center	1	Variable Frequency Drive - Electric Motor (01 unit) PLC Training		x	
2	Hydrodynamics Engineering Laboratory	1	Hydraulic research table for fluid mechanics			
3	Thermal Engineering Laboratory	1	Concurrent flow heat exchange system, radiation, and heat transfer		x	
4	Industrial Systems Laboratory	1	Spring experiment set (demonstrating Hooke's Law) Experiment set to test the sustainability of a bar (under the influence of bending force and torsional force)		x	
5	Electrical Engineering Laboratory	1	Labvolt experimental system		x	
6	Electrical Equipment Laboratory	2			x	
7	Industrial Automation Laboratory	9	- SMC Automation Laboratory - Mitsubishi Electric Automation Laboratory - Siemens Industrial Automation Laboratory - Industrial Robotics		x	

No.	Room/classroom/lab	Quantity	List of main equipment	Usage form		
				Own	Connective	Rent
			Automation Laboratory - Electrical Drives and Process Control Laboratory - Power Electronics Laboratory - PLC and AC Motor Frequency Control Laboratory - Industrial Communication Systems Laboratory - Digital Control and Drive Systems Laboratory			
8	Power Systems Laboratory	1	Measurement, Protection, and Power Supply System		x	
9	Electronic Engineering Laboratory	3	Electronic Circuits for Analog & Digital Techniques and Boards		x	
10	Industrial Computer Science Laboratory	2	Supporting boards		x	
11	Measurement and Control Laboratory	2	Measurement and Control System		x	
12	Telecommunications Electronics Laboratory	2	Broadcast Antenna Transmission Set		x	
14	Physics Laboratory	1	Mechanical, Electrical, and Optical Experiment Set		x	

II. Library, information technology systems

2.1. Library

TNUT has a rich collection of learning resources, providing comprehensive textbooks and reference materials for all courses, effectively meeting the educational and research needs of both students and faculty. The university library houses 6,361 titles, comprising textbooks and reference materials, totaling 94,854 volumes, along with over 1,300 theses and dissertations, nearly 2,000 digital documents, and more than 500,000 pages. Annually, the university ensures the library is equipped with the latest materials to support the research and learning activities of faculty and students. The effective utilization of TNUT's learning resources is evidenced by the considerable number of students visiting the library, the frequency of borrowed materials, and the use of digital resources. Over 90% of students express satisfaction with the library's relevance and the appropriateness of learning resources in facilitating teaching and research activities. On average, the library accommodates around 900,000 visits per year, with over 160,000 borrowings and returns, and more than 4,000,000 accesses to digital materials.

Table 10. Statistics on the number of study materials and documents at TNUT Library

No.	Document List	Quantity
1	Syllabus; Reference books	4482
2	Dissertation, Thesis	1224
3	Article	50

2.2. The information technology systems:

The university's information technology system ensures coverage, stability, smoothness, security, safety, maintenance, warranty, and upgrade according to regulations and is processed according to the system process that is Managing and maintaining the information technology system and the process of maintaining and upgrading the management software system.

With the characteristics of the University is training in the field of science and technology, including Industrial Informatics, the University has an advanced and modern information technology technical infrastructure system, which well meets the requirements of digital transformation of the university at the present time and in the future, including: a system of 11 data storage and processing servers, an internal network system connected to the whole university by optical cables with a length of about 8,000 meters, including more than 70 devices connecting and sharing data in the network system, more than 1,400 fixed network connections, 13 broadband internet lines with a total bandwidth of 1,400 Mbps, the wifi system is installed and covers all working areas, lecture halls, campuses, dormitories and libraries. In recent years, with the strong trend

of digital transformation in education, the University has invested in 59 smart lecture halls integrating face-to-face and online teaching functions. This system is very suitable for international training, the distance system helps to increase interaction between lecturers and students studying online.

Table 11. List of network infrastructure devices

No.	Device name/type	Quantity	Status
1	Network Switch Planet: GSW-2401+ phụ kiện	2	Good
2	Network card Cisco (Modun quang): 3560G 24 Ethernet 10/100 Port and 4 SFP based Giga bit Ethernet Ports	1	Good
3	Cisco Central Switch	2	Good
4	Optical Transceiver Device: Cisco GE, SFP, LC (Optical connection device)	4	Good
5	Cisco 4400 Series WLAN Controller	1	Good
6	Cisco switch catalyst 2960 24 port (WS - C2960 -24 TT-L)	2	Good
7	Cisco GLC - T 1000 BASE-T SFP	2	Good
8	Cisco WS 2960 G - 24TC-S Catalyst 2960-24 Port 10/100 Ethernet Switch	2	Good
9	Switching device: Cisco WS C2960 -24TC-S	5	Good
10	Switching device: Cisco WS 2960-24TC-S	9	Good
11	Modem ADSL: TP Links W8951 ND	1	Good
12	Switch 24 port: TP link TL-SF 1024D	6	Good
13	Wireless router: TP Link TL WR 841 N	3	Good
14	Wireless router: N750 TL -WDR 4300 TP Link	24	Good
15	Switch 8 port: TP Link 10/100	1	Good
16	Switch TP Link 5 port	4	Good
17	Switch TP Link 16 port	14	Good
18	Switch TP link 24 port	1	Good
19	Switch TP link	1	Good
20	Switch surecom 24 port	4	Good
21	Switch surecom 16 port	2	Good

The university is equipped with software used in training and management such as Edusoft software, in 2022 on the basis of practical requirements and to better meet the training management features, the University has upgraded the software to Edusoft.Net version with more than 40 modules/features, integrated management of training activities; student management; human resource management; tuition management; scientific management; management of facilities and assets; dormitory management; association management; outpatient management; extracurricular activities management; alumni management; quality management, etc. From 2020, in the face of the complicated development of the epidemic situation, to meet the requirements of

online training, the University buys Zoom and Meet, etc, accounts to serve online teaching and working, conferences.

In order to support officials, employees, and lecturers to improve their information technology skills in training, scientific research and support services, the University organizes training on using Edusoft software for experts, training on the use of equipment for teaching.

The University’s information technology system is constantly being upgraded, improved, expanded and modernized to catch up with the trend of the 4.0 technology era and digital transformation, supporting the University’s fields of operation. On the basis of the plan, every year the University invests in supplementing and upgrading both hardware and software for the information technology system. In the period from 2018 to now, the University has invested about 10 billion VND for maintenance and repair of infrastructure and upgrading of information technology equipment. In which, about 20% of new computers and information technology equipment were purchased. In addition, the University uses regular funds to maintain and repair computers, intranet systems, and internet connections throughout the university.

The Office for Undergraduate Training and the Office for Administration and Service are responsible for monitoring, supervising and evaluating the investment efficiency of information technology infrastructure and software. Based on the feedback of the user units, survey and assessment of the current state of the equipment, the units in charge report to the Rector for consideration and decision on investment policy and funding. In addition, to ensure the timely management, operation, repair and troubleshooting, as a basis for evaluating the operation of the university-wide information technology system, the University performs regular checks and fully updates the status of the information technology system in the log book of management and maintenance of the intranet system.

III. Teaching and learning strategies

The Advanced Electrical Engineering program is designed based on the PLOs. The sequence and content of teaching approach progressively enhance students' awareness and competency levels, with each experience built upon previous ones while reinforcing them. In addition to acquiring knowledge, students develop skills, autonomy, and responsibility through experimental courses, practical exercises, internships, experiences, integrated courses, and the final thesis throughout the program. Teaching methods are emphasized to help students achieve the expected learning outcomes.

Table 12. List of network infrastructure devices

Strategy	Description	Method
Teaching Strategies		

Direction	Most of the theoretical subjects are taught by the method of presentation and teaching, questioning, prompting questions, giving homework to students and testing students' self-study ability through exercises and discussions, seminars...	<ul style="list-style-type: none"> - Presentation; - Suggested questions, diagnosis; - Demonstration of samples; - Exercising, practice,
Indirection	Some modules are taught indirectly without any explicit intervention of the lecturer, selected subjects in the training program can be conducted by project-based teaching (PBL) or problem-based teaching (PBL), learners are provided with the best environment in terms of funding and other resources for learning activities of these courses. Business internships subjects,, subject project, graduation project,	<ul style="list-style-type: none"> - Request - Problem solving - Research on situation - Constructing ideas
Interaction	Practiced in most subjects of the training program. Students do group exercises, group presentations, group experiments, corporate internships, field trips and graduation projects...	<ul style="list-style-type: none"> - Debate, discuss - Problem solving - Study in group - Interaction, Feedback
Learning strategies		
Experience	The subjects of the training program are designed for experiential learning such as basic sciences, basic industry and majors, students are equipped with practical learning and laboratory experiments. Business internship subjects, professional training, design project, graduation theses...	<ul style="list-style-type: none"> - Simulation - Image focus - Role playing, games - Model - Reality; experiment
Independence	Experimental activities, design in the subjects of graduation thesis, presentation of theses, design projects, homework, writing of experimental reports, presentation of experiments and free learning...	<ul style="list-style-type: none"> - Assign individual work - Research projects, theses, - Instruction for using computer - Reflection

IV. Graduation Requirements

According to Article 23, Chapter 4 of the training regulations for undergraduate level under the credit system of the Industrial University of Technology (Issued together with Decision No. 3561/QD-DHKTCN dated December 12, 2022 by the Rector of the Industrial University of Technology).

Requirements for Graduation Evaluation and Recognition

4.1. Requirements for Graduation Evaluation:

Students must meet the following requirements to be considered for graduation and recognized are stipulated:

- a) No criminal liability or not under disciplinary suspension during the study period.
- b) Accumulate 100% of the credits of the training program within the allowed training period.
- c) Maintain a cumulative GPA of 2.0 or above (on a 4.0 scale) for the entire course.
- d) For Vietnamese students or students from non-English speaking countries: Achieve the foreign language proficiency standard as stipulated by the University; possess a certificate in National Defense and Security education; complete Physical Education courses.
- e) Return books and materials to the library, pay all tuition fees, and other fees as stipulated by the university.

4.2. Graduation Evaluation schedule

The school organizes graduation evaluation after each main semester and after each additional semester.

4.3. Graduation Evaluation implementation

- a) The university announces the graduation evaluation schedule
- b) Students who meet the graduation requirements as stated in clause 1 of this provision register for graduation evaluation online via the website specified in the university's announcement. During the graduation examination period, the university regularly updates the graduation evaluation data on the website for students to monitor and provide timely feedback.
- c) The Graduation Evaluation Council shall decide the student's graduation based on the conditions stipulated in clause 1 of this provision.

The Graduation Evaluation Council, chaired by the Rector or Vice Rector of the University, appointed by the Rector, consists of the Head of the Training Department as the secretary, and members including Heads of academic departments, the Head of Student Affairs Department, the Head of Inspection and Legal Affairs Department, the Head of Quality Management Department, the Head of Financial Planning Department, and relevant units.

d) Based on the proposal of the Graduation Evaluation Council, the Rector signs the decision to officially recognize graduation for students who meet the graduation requirements.

e) After the decision to officially recognize graduation is made, if students request, the Training Department will issue a temporary graduation certificate and transcript for the students. Within a period of 3 months, the University must issue the diploma to the students. Students who have completed the training program but have not yet reached the graduation evaluation period may request a certificate of program completion.

V. EXTRACURRICULAR AND STUDENT SUPPORT ACTIVITIES

5.1. Student Counseling and Support Activities:

Counseling is a form of student support through communication and empathy between counselors and students, aimed at helping students clarify concerns, provide information, and assist them in developing their potential to find solutions and become more confident in their chosen actions. The university has established a Counseling and Student Support Center under the Department of Student Affairs.

The center has the following functions:

- Information provision: Providing students in need of counseling with accurate, clear information to change any misconceptions or incorrect perceptions they may have.
- Showing support: Since most students live far from their families, they have to be independent. Therefore, counseling is a process of demonstrating support, helping with psychological and emotional aspects, understanding, and comforting students.
- Conflict resolution: Assisting students in resolving differences and conflicts with others and within themselves.
- Problem-solving: Assisting students in analyzing difficulties, finding action-oriented solutions, and ultimately identifying effective solutions to address the problem.
- Decision-making: Assisting students in identifying options and making specific decisions on how to resolve issues in their daily lives, studies, and work.
- Behavioral change: Equipping students with life skills, academic skills, and appropriate activities so they can decide on changes related to their thoughts, emotions, and behaviors.

Some counseling and student support:

- Counseling, support on emotions: Counseling on friendship, love, adolescent sexual health, youth...
- Counseling, support on studying, scientific research: Counseling on university-level study methods, counseling on exams, choosing research topics, graduation topics, scholarship advice, study abroad advice...

- Counseling, support on career, living conditions: Career guidance, choosing a profession, job counseling, accommodation advice...
- Counseling, support on training, entertainment: Sports training advice, accessing Internet services advice...

Some forms of counseling and student support:

- Direct counseling: This involves counselors directly engaging in conversation with students seeking advice.
- Phone counseling: This involves counselors engaging in conversation with students seeking advice over the phone.
- Community counseling: This involves counselors engaging in conversation with groups of students (clubs, associations, etc.).
- Letter counseling: This involves counselors exchanging information with students seeking advice on a particular issue via letter.
- Counseling through university radio, newsletters, and magazines, as well as student union publications: This involves exchanging information with students through question-and-answer sections.

5.2. Scientific research and entrepreneurship:

In recent years, TNUT has always accompanied students in scientific research and entrepreneurial activities, while creating a learning environment based on the spirit of openness, innovation, and creativity. Scientific research and entrepreneurial activities have always been given special attention by the University. The University has established an Entrepreneurship and Knowledge Transfer Center, which is seen as a lever to enhance the quality of education, integrate scientific research with innovation and entrepreneurship, and closely align with career application. Furthermore, startup funds and scientific research funds for students and faculty are continuously invested and expanded. Research projects of faculty and students are always closely linked to the University's entrepreneurial activities, with the quantity and scale increasing year by year.

5.3. Extracurricular activities and career orientation:

To help students understand their field of study, job opportunities, and career orientation, extracurricular activities and career orientation activities are always prioritized by the University to help students acquire skills, serving as a good stepping stone for better preparation upon graduation, providing opportunities for employment and development in today's highly competitive job market. One of the greatest benefits that extracurricular activities/social projects bring to you is the essential skills they provide for the 'real world'. These skills include goal setting, teamwork, time management, problem-solving, analytical thinking, leadership, and public speaking.

VI. TRAINING PROGRAMME AND PROGRAM LEARNING OUTCOMES BENCHMARKS

6.1. Training programs Benchmark:

Table 13. List of domestic and international training programs used for Benchmarking

N ^o	University/ Institute	Program Name for Benchmarking	Training program Workload	Training Duration	Degree
1	Hanoi University of Science and Technology	Electrical engineering https://drive.google.com/file/d/1ezXSgzhDR5T4pjaxNdoMq8uh883CrZZFi/view	132 credits	4 years	Bachelor
			180 credits	6 years	Master
2	Ton Duc Thang University	Mechanical Engineering Technology https://FITe.tdtu.edu.vn/giao-duc/dai-hoc-tieu-chuan/nganh-ky-thuat-dien-chuong-trinh-tieu-chuan	155 credits	5 years	Engineer
3	Oklahoma State University – OSU	Electrical Engineering, BSEE https://drive.google.com/file/d/1i5GIDhcNstZhxQw8eQJTricU2J-r5VxX/preview	124 credits	4 years	Bachelor
4	University at Buffalo, USA	Electrical Engineering BS https://catalog.buffalo.edu/academicprograms/electrical_engineering_bs_curricular_plan.html	126 credits	4 years	Bachelor

6.2. Results of Matching the program Learning Outcomes of Domestic and International Training programs

Table 14. List of domestic and international training programs used for Matching the PLOs

Note: (1), (2), (3), and (4) represent the order of Program Learning Outcomes for the matched training programs as Table 2.

Code	Electrical Engineering Program Learning Outcomes (FIT)	Compatibility Level with the Program Learning Outcomes of Domestic and International Training programs (%)			
		(1)	(2)	(3)	(4)
1	Disciplinary knowledge and reasoning				
1.1	Apply fundamental knowledge of mathematics, natural sciences, and social	95	90	80	80

Code	Electrical Engineering Program Learning Outcomes (FIT)	Compatibility Level with the Program Learning Outcomes of Domestic and International Training programs (%)			
		(1)	(2)	(3)	(4)
	sciences to describe, calculate, and simulate systems, processes, and technical equipment.				
1.2	Apply basic knowledge of electrical engineering, technology, measurement, control, communication, and automation in the field of electrical engineering.	95	85	60	70
1.3	Design and evaluate solutions, production lines, and technical products in the field of electrical and electronic engineering.	95	80	80	85
2	Professional skills and personal qualities				
2.1	Reason and address technical problems.	95	95	95	95
2.2	Experiment and test hypotheses related to the field of electrical engineering.	95	90	95	95
2.3	Systematic and critical thinking.	95	75	80	80
2.4	Creative thinking and lifelong learning ability.	95	80	80	80
2.5	Honesty and professional responsibility.	95	85	70	60
3	Essential social skills needed to work effectively in multidisciplinary teams and in an international environment.				
3.1	Work independently and collaboratively in a multidisciplinary work environment.	95	90	95	95
3.2	Communicate through written documents, presentations, and discussions, utilizing electronic media and communication.	95	95	95	95
3.3	Use English in communication and professional activities.	95	90	95	95
4	Capability to apply knowledge in practice in social and environmental contexts (CDIO).				
4.1	Recognize the relationship between technical solutions and economic, social, and environmental factors.	95	85	70	60
4.2	Identify the culture, strategy, and production and business organization of enterprises.	95	90	90	90

Code	Electrical Engineering Program Learning Outcomes (FIT)	Compatibility Level with the Program Learning Outcomes of Domestic and International Training programs (%)			
		(1)	(2)	(3)	(4)
4.3	Recognize problems and form technical solution ideas, participate in project development.	90	95	50	90
4.4	Participate in the design of systems, processes, and products and propose technical solutions in the field of electrical engineering.	90	90	50	80
4.5	Participate in the manufacturing of products, implement systems, and deploy technical solutions related to electrical engineering.	95	90	60	60
4.6	Operate and maintain systems, processes, and products related to electrical engineering industries.	70	70	70	70

VII. TRAINING PROGRAM IMPLEMENTATION:

1. The training program is implemented according to the regulations of undergraduate training currently in place by the Ministry of Education and Thai Nguyen University of Technology.

Teaching load can be determined by:

1 credit = 15 teaching or class discussion hours

= 30 experiment/practice hour

= 45 self-study hours

= 90 internship hours

= 60 project or thesis hours

2. Foreign Language Proficiency Standards: According to the University's regulations. During their studies, the University may monitor students' language proficiency development each academic year to determine the number of credits that students are allowed to register for. Students may choose to self-study or enroll in the language proficiency development program according to the University's project.

FACULTY DEAN

RECTOR

Assoc. Prof. Dr. Nguyen Thi Thanh Nga

Assoc. Prof. Dr. Do Trung Hai