HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL ENGINEERING

TRAINING PROGRAM

Engineer
ELECTRICAL ENGINEERING

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Ministry of Education and Training
Hanoi University of Science and Technology

Socialist Republic of Vietnam
Independence – Freedom - Happiness

UNIVERSITY EDUCATION
Undergraduate Program

Name of Program: Electrical Engineering
Level of education: Undergraduate
Field of study: Electrical Engineering
Code: 52520201
Level of award: Engineer
(Issued in Decision No. / QĐ-ĐHBK-ĐTĐH dated by the Rector of Hanoi University of Science and Technology)

1 Educational objectives

The objectives of the Training program in Electrical Engineering is to provide learners with

(1) Solid basic and fundamental knowledge to adapt to different fields in engineering; solid knowledge in one specialized field of the Electrical and Power Engineering

(2) Professional skills and personal qualities to succeed

(3) Social skills to work effectively in the multi-disciplinary and international workplaces.

(4) Ability to set up projects, design and operate equipment, devices in the generation, transmission and distribution network, as well as in commercial and industrial systems.

(5) Political awareness, spirit to serve the society, health quality to fulfill the tasks of building and defending the country

Graduates of the Electrical Engineering program can take on the role as

- Project management engineer
- Design and development engineers
- Engineer of operation and maintenance
- Engineer for inspection and evaluation
- Design, supervision, consulting service

at companies that provide solutions or at facilities that design, manufacture, operate and trade electrical equipment and systems in almost all areas of the economy and defense.

2 Expected Learning Outcomes

After graduation, the electrical engineer of Hanoi University of Science and Technology (HUST) must obtain:

1. Solid professional knowledge to adapt to different tasks such as research, development, consulting, management and production in the broad field of Electrical Engineering

1.1 The ability to apply the basic knowledge of mathematics, physics, and computing in the calculation and simulation of electrical equipment and power systems

1.2 The ability to apply basic knowledge of circuit theory, electric machine, control systems, power systems, electronic engineering in research, analysis of electrical equipment and power systems

1.3 The ability to apply the core and advanced knowledge in electrical equipment and power systems combined with the ability to exploit the use of software tools in the design, implementation, and evaluation of electrical equipment and power systems.

2. Professional skills and personal qualities needed to succeed at work

2.1 Analytical and problem-solving skills

2.2 Ability to carry out experiments, to do research and to explore knowledge

2.3 System thinking and critical thinking

2.4 Dynamic, creative and serious in work

2.5 Professional ethics and responsibilities

2.6 Understanding contemporary issues and lifelong learning

3. Social skills needed to work effectively in a multi-disciplinary team and in an international environment

3.1 Organizational skills, leadership and teamwork (multi-disciplinary)

3.2 Effective communication skills through writing, presenting, discussing, negotiating, mastering situations, using effective and modern tools

3.3 Effective usage of English at work, TOEIC score $\geq$ 450.

4. Capacity for project planning, design, implementing and operating of electrical equipment and power systems in accordance with the economic, social and environmental context

4.1 Awareness of the essential relationship between electrical equipment & systems solutions with economic, social and environmental factors in the globalized world

4.2 Capability to identify problems and formulate solution ideas, to propose and develop electrical engineering projects and applications

4.3 Capability to design electrical-electronic equipment and power systems

4.4 Capability to deploy, adjust and put into operation the electrical equipment and power systems

4.5 Capability for operation and maintenance of electrical equipment and power systems

5. Political awareness, spirit of serving the people and the country, having good health, meeting the requirements for building and defending the country

5.1 Having the level of political understanding according to the common requirements of the Ministry of Education and Training

5.2 Having a Physical Education Certificate and a Certificate of National Defense Education according to the requirement of the Ministry of Education and Training

3 Training duration and number of credits

3.1 High school entrance

- Standard study duration is 5 years
- Total number of credits: 160

3.2 Entrance from college

Applied to students who have a Bachelor in Electrical Engineering (4 years) or closely related majors. The program duration and the required courses depend on the courses students have chosen in his/her bachelor program

- Program duration: 1-1,5 year.
- Total credits: 34-44

4 Admission requirements

4.1 Baccalaureates admitted to the relevant specialized sector of Hanoi University of Science Technology will be enrolled in a 5-year program or 4 + 1-year program.

4.2 Graduates of the "Bachelor in Engineering in Electronics and Telecommunications" program of Hanoi University of Science and Technology are directly enrolled in the 1-year articulation program.

4.3 Graduates from other Bachelor or Engineering programs in Control and Automation Engineering will be enrolled in the 1-year program after completing pre-requisite courses.

4.4 Graduates from other Bachelor or Engineering programs at Hanoi University of Science and Technology can enroll in the double-degree program in accordance with HUST regulations on the second undergraduate program.

4.5 Graduates of Hanoi University of Science and Technology or other universities can enroll in the second undergraduate program under the general regulations of the Ministry of Education and Training and specific regulations of Hanoi University of Science and Technology

5 Training process, graduation conditions

- The training process and graduation conditions apply the regulations on the University's credit-based higher education training and vocational training. Students enrolled in the double- degree program must also follow the regulation on studying the second undergraduate program of HUST.

6 Scores

The grades (A, B, C, D, F) and the corresponding 4-point scale offcicial scores of the students' performance. The 10-Point scale is used by lecturers during the course assessment.

	10-point system	4-point system	
		grade	points
Pass grade	from 9,5 to 10	A+	4,5
	from 8,5 to 9,4	A	4,0
	from 8,0 to 8,4	B+	3,5
	from 7,0 to 7,9	B	3,0
	from 6,5 to 6,9	C+	2,5
	from 5,5 to 6,4	C	2,0
	from 5,0 to 5,4	D+	1,5
	from 4,0 to 4,9	D	1.0
Fail grade	< 4,0	F	0

* for the graduate thesis, the student must obtain a grade of C and above to be considered PASS.

7 Program Specification

7.1 Program Structure (in comparison with the Bachelor of Engineering program)

Ind	Curriculum	Bachelor	Engineer	Notes
I	General Education	48CR	48CR	General requirements for the Engineering programs
1.1	Mathematics and basic science	32	32	26 general credits for the Engineering programs and 6 additional credits
1.2	Political theory	10	10	

1.3	Physical Education	(5)	(5)	In accordance with the general regulations of the Ministry of Education and Training. Credit-based training and National defense and security education is not counted in the total credits of the education program
1.4	National defense and security education	(10)	(10)	
1.5	English	6	6	
II	Professional education of the Bachelor degree	46	46	Common for bachelor and Engineer program
III	Technical Internship	2	2	Common for bachelor and Engineer program
IV	Elective courses	9	9	Common for bachelor and Engineer program (from a course list proposed by SEE)
V	Professional education of the Engineer degree	26	44	Student choose one of the two majors Electrical-Electronic Equipment, or Power systems
5.1	Bachelor courses	20	20	Common for bachelor and Engineer
5.2	Compulsory major	14	15	Specific requirements of the Engineer degree program, different from the Bachelor of Engineering program from Semester 8 Engineering graduation thesis follows each individual major, including graduation Internship (3 credits)
5.3	Elective major	-	8	
5.4	Pre-graduation internship		3	
5.5	Graduation thesis	6	9	
	Total number of credits	131CR	160/162CR	

Notes:

- Admittee 4.1 must take full 160/162 credits
- Admittee 4.2, 4.3 only need to take V (professional education) and some pre-requisite courses.

7.2 General education

Nr	Code	Name of Courses	Nr of Credits	Standard course sequence (semester)							
				1	2	3	4	5	6	7	8
Politics			12 credits								
1	EM1170	Introduction to Law	2(2-0-0-4)	2							
2	SSH1110	Fundamental Principles of Marxism-Leninism I	2(2-1-0-4)	2							
3	SSH1120	Fundamental Principles of Marxism-Leninism II	3(3-0-0-6)		3						
4	SSH1050	Ho-Chi-Minh Ideology	2(2-0-0-4)			2					
5	SSH1130	Revolution Policy of VCP	3(3-0-0-6)				3				
Physical education											

6	PE1010	Physical education A	1(0-0-2-0)	x							
7	PE1020	Physical education B	1(0-0-2-0)		x						
8	PE1030	Physical education C	1(0-0-2-0)			x					
9	PE2010	Physical education D	1(0-0-2-0)				x				
10	PE2020	Physical education E	1(0-0-2-0)					x			
Military service training											
11	MIL1110	Military service training A	3(3-0-0-6)	x							
12	MIL1120	Military service training B	3(3-0-0-6)		x						
13	MIL1130	Military service training C	4(3-1-1-8)			x					
English			6 credits								
14	FL1101	TOEIC I	3(0-6-0-6)	3							
15	FL1102	TOEIC II	3(0-6-0-6)		3						
Maths and basic sciences			26 credits								
16	MI1110	Calculus I	4(3-2-0-8)	4							
17	MI1120	Calculus II	3(2-2-0-6)		3						
18	MI1130	Calculus III	3(2-2-0-6)		3						
19	MI1140	Algebra	4(3-2-0-8)	4							
20	PH1110	Physics I	3(2-1-1-6)	3							
21	PH1120	Physics II	3(2-1-1-6)		3						
22	EM1010	Introduction to Management	2(2-0-0-4)		2						
23	IT1110	Introduction to Computer Science	4(3-1-1-8)			4					
Total			44 credits	18	17	6	3				

7.3 Core courses

Code	Name of course	Credit	Standard course sequence (semester)									
			1	2	3	4	5	6	7	8	9	10
	Supplementary Maths and Basic Sciences	6 Credit										
MI2020	Probability and Statistics	3			3							
	Choose 3 CR											
PH1131	Physics 3	3				3						
ME2040	Mechanical Engineering	3				3						
	Core Courses	48 Credit										
EE1010	Introduction to Electrical Engineering	3(2-0-2-6)			3							
EE2000	Signals and Systems	3(3-1-0-6)			3							
EE2020	Circuit Theory 1	4(3-1-1-8)			4							
EE2030	Electromagnetics	2(2-0-0-4)				2						
EE2110	Analog Electronics	3(3-0-1-6)				2						
EE2021	Circuit Theory 2	2(2-0-1-4)				3						

EE2120	Digital System Design	3(3-0-1-6)				3						
EE3110	Measurement and Instrumentation Principles	3(3-0-1-6)				3						
EE3140	Electric Machines I	3(3-0-1-6)					3					
EE3242	Electrical Apparatuses	2(2-0-1-4)					3					
EE2100	Automatic Control Theory I	3(3-1-0-6)					3					
EE3410	Power Electronics	3(3-0-1-6)					3					
EE3425	Electric Power Distribution Systems	3(3-1-0-6)					3					
EE3490	ProgrammingTechniques	3(2-2-0-6)						3				
EE3510	Electric Drives	3(3-0-1-6)						2				
EE3810	Project I	2						3				
EE3820	Project II	2						3				
III	Technical Practicum											
EE3910	Technical Practicum	2						2				

7.4 Specialized courses in Electrical Engineering

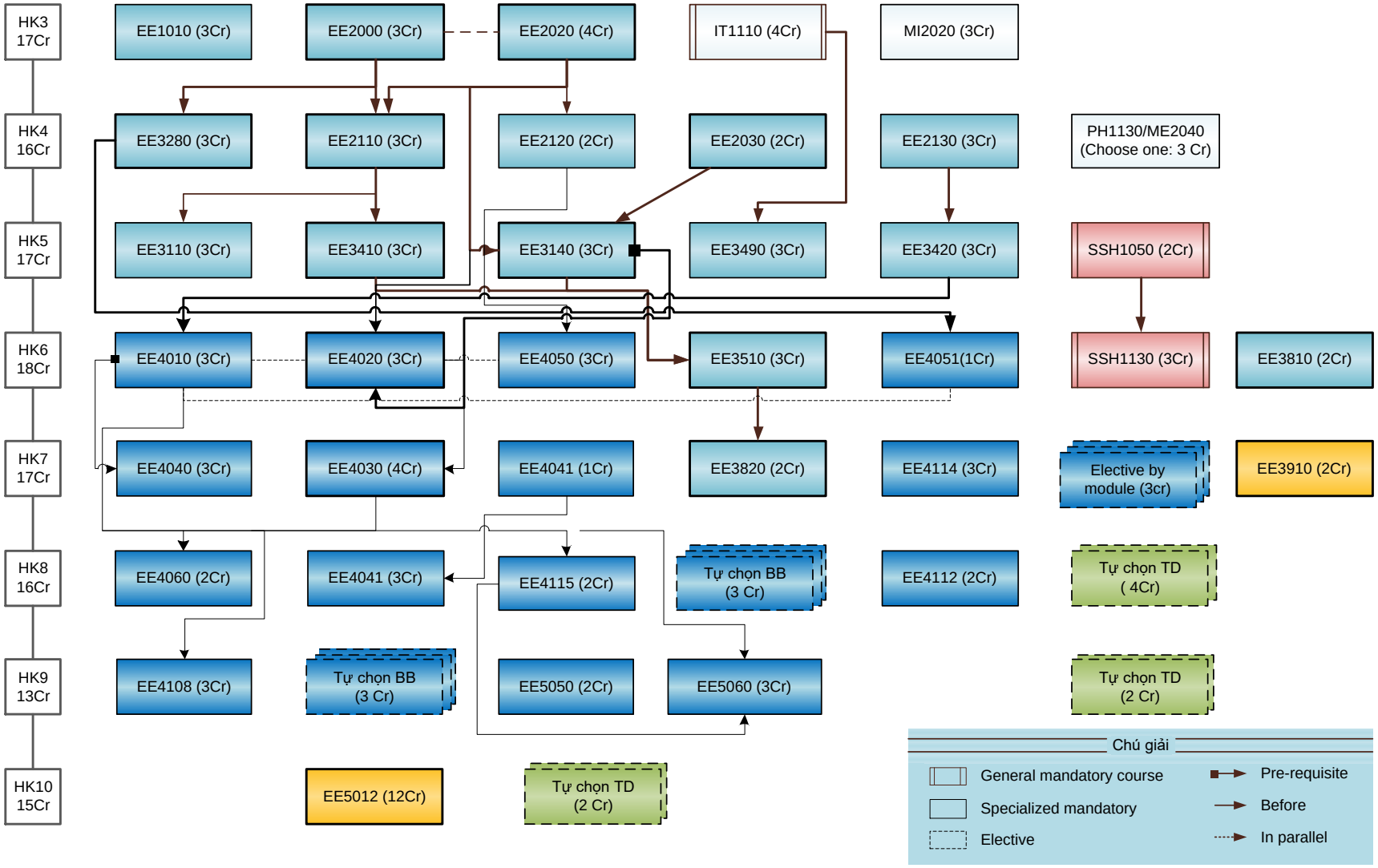
Index	Course names	No. of credits	Standard semester									
			1	2	3	4	5	6	7	8	9	10
I	General education	44										
II	Core courses	46										
III	Technical Internship	2										
IV-1	Electives (Electrical and electronic equipment)	9CR										
IV-2	Electives (Power systems)	9CR										
V-1	Electrical and Electronic Equipment	55CR										
EE3600	Industrial measurement and control	3(3-0-1-6)							3			
EE4070	Electrical equipment control	3(3-0-1-6)							3			
EE4080	Electrical machines II	3(3-0-1-6)						3				
EE4081	Electric materials	2(2-0-1-4)						2				
EE4082	Lighting techniques	3(3-1-0-6)							3			
EE4090	High voltage equipment	3(3-0-1-6)							3			
EE4422	Microprooressor and application	3(3-0-1-6)						3				
EE4207	Design of control devices	3(3-1-0-6)									3	
EE4211	Electric machine design	3(3-1-0-6)								3		

EE4267	Electrical apparatus manufacturing technology	3(3-1-0-6)								3		
EE5211	Electrical apparatus design	3(3-1-0-6)								3		
	Elective 1: Choose 4 CR											
EE4261	Project: Electrical machine design	2(2-1-0-4)										
EE4262	Project: Control devices	2(2-1-0-4)										
EE4263	Project: Electrical apparatus	2(2-1-0-4)										
	Elective 2: Choose 7 CR									4		
EE4114	Power system planning	3(3-1-0-6)										
EE4204	Electric machines in automatic control devices	2(2-1-0-4)										
EE4215	Design of automatic devices	2(2-1-0-4)										
EE4221	Special topics in Electric apparatus	2(2-1-0-4)										
EE4241	Power supply system for building	2(2-1-0-4)										
EE4264	Electrical heating equipment	3(3-1-0-4)										
	Graduate thesis	12CR									7	
EE5100	Pre-graduation internship	3(0-0-6-6)										3
EE5010	Graduate thesis	9										9
V-2	Power system Major	55CR										
EE4010	Electrical power network	3(3-1-0-6)						3				
EE4020	Short-circuit	3(3-1-0-6)						3				
EE4030	The electrical part of power plant and substations	4(4-0-0-8)							4			
EE4040	Power system protection and control I	3(3-1-0-6)							3			
EE4050	High voltage Engineering I	3(3-1-0-6)						3				
EE4051	Power system Laboratory I	1(0-0-2-2)						1				
EE4041	Power system laboratory II	1(0-0-2-2)							1			
EE4060	Project III	2(0-0-4-4)								2		
EE4061	Power system protection and control II	3(3-1-0-6)								3		

EE4108	Power system optimization	3(3-1-0-6)									3	
EE4112	Hydro powerplant	2(2-0-0-4)								2		
EE4115	Power system stability	2(2-1-0-4)								2		
EE5050	High voltage Engineering II	2(2-1-0-4)									2	
EE5060	Computer-based analysis of power system	3(3-1-0-6)									3	
	Electives: Choose 8 credits	8									8	
EE4121	High Voltage Measurement and Non-destructive Testing	2(2-0-0-4)										
EE5070	Special topics in Nuclear Power plant	2(2-0-0-4)										
EE5071	Renewable Energy	2(2-0-0-4)										
EE5072	Mechanical design of Overhead transmission lines											
ME3661	Energy Economy	3(3-0-0-6)										
TE3602	Applied fluid mechanics	2(2-1-0-4)										
	Graduate thesis	12CR										
EE5100	Pre-graduate internship	3(0-0-6-6)										3
EE5010	Graduate thesis	9										9

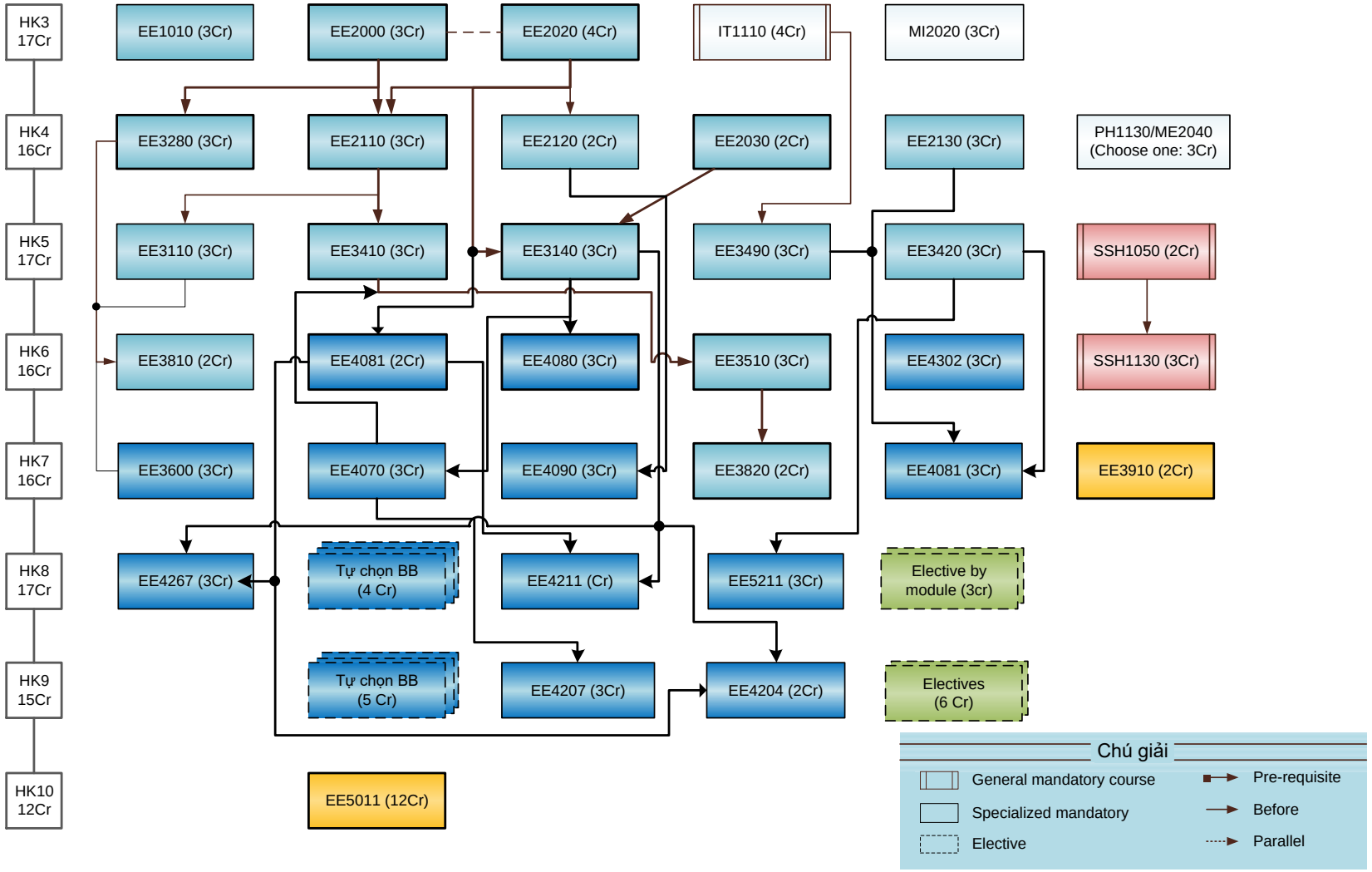
Electrical Engineering Program – Power Engineering Major

Standard study plan (effective since 2009)



Electrical Engineering program – Electrical and Electronic equipment Major

Standard study plan (effective since 2009)



8 Brief outline of program courses

8.1 Mandatory courses

8.2 General courses for engineering programs

MI1110 Calculus I

4 (3-2-0-8)

Provide students with basic knowledge about single variable and multiple variables functions. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.

MI1120 Calculus II

3 (2-2-0-6)

Requisite: MI1110

Provide students with basic knowledge of dependent integral, Integrating multiples of two and three multiples, Integrating line and face, Application of differential equation to Geometry and Field theory. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.

MI1130 Calculus III

3 (2-2-0-6)

Requisite: MI1110

Provide students with basic knowledge of String number, Function string, Exponential string, Fourier chain, along with the basic knowledge of First-order differential equations, Second-order differential equations and the basic part about System of first-order differential equations. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.

MI1140 Algebra

4 (3-2-0-8)

Provide students with basic knowledge of Theory of matrices, Determinant, and System of linear equations, minimal knowledge of Logic, Collection, Logical mapping, Complex number fields, and simple ideas about second-order surface, second-order line. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.

IT1110 General informatics

4 (3-1-1-8)

Requisite:

Objectives: Equip students with basic knowledge of computer structure and organization, computer programming and mechanisms for implementing basic programs, basic skills to effectively use computers in learning, researching and working in engineering and technology areas.

Contents: Basic informatics: Performing information in computers. Computer system. Linux operating system. Programming in C language: C Language overview. Data structure, expression and

programming structure in C. Complex data types: pointers, arrays and strings in C. Arrays. Structure. Data file.

EM1010 General of management

2 (2-0-0-4)
Requisite:
Objective: Equip students with basic knowledge and skills of managing business activities.
Contents: Nature, content and role of business management; implementing method of each type of work and enterprise management staff.

PH1110 Physics I

3 (2-1-1-6)
Requisite:
Objective: Provide students with basic knowledge of General Physics (mechanical, thermal), as a basis for technical students.
Contents: Basic physical quantities and related rules such as Momentum, Theorems and laws of momentum; theorems and laws of momentum moments; kinetic energy, potential energy, conservation law of energy. Apply to study solid rotation, oscillation and mechanical wave motion.
Molecular dynamics theory uses explanatory statistics and calculating amounts: temperature, pressure, internal energy (ideal gas). Apply conservation and convert laws of energy on thermal transition processes. Study the direction of the evolution of thermal processes, the principle of increasing entropy.

PH1120 Physics II

3 (2-1-1-6)
Requisite:
Objective: Provide students with basic knowledge of General Physics (electromagnetism).
Contents: Types of fields: Electric and magnetic fields; properties, specific quantities (intensity, voltage, magnetic flux, ..) and related theorems and laws. The interaction between field and material. The relationship between the magnetic field and the electric field, unification of electromagnetic field. Apply to oscillations and electromagnetic waves.

8.3 Additional modules in Math and fundamental science

MI2020 Probability

3 (2-2-0-6)
Requisites: MI1110 (Mathematical analysis I), MI1140 (Algebra).
Objective: Provide students with the knowledge of probability such as concepts and rules of deductive probability as well as random variables and joint probability distributions (one and two dimensions); The basic concepts of mathematical statistics in order to help students handle statistical problems in estimating models, verification of linearity and linear regression. On that basis, students can approach actual models to gather needed knowledge for solving those problems.
Contents: Random event and probability calculation, random quantities, probability distribution, random vector, statistical estimation theory, statistical decision theory.

PH1130 Physics III

3 (2-1-1-6)

Requisites: PH1110 (Physics I), PH1120 (Physics II).
Objective: To provide students with basic knowledge of General Physics (optics, quantum physics) as a basis for technical students.
Contents: The properties of light: Wave calculation (interference, diffraction ..), particle count (thermal radiation, Compton), emission (natural, induction) and absorption of light and laser.
Applying wave-particle amphoteric of electrons (microparticles) to study atomic energy and spectra, Pauli state and principle, study electrical properties of materials (metals, semiconductors), spins and Quantum statistics.

ME2040 Technical mechanics

3 (3-1-0-6)
Requisite: No
Objective: Students gain knowledge of building the force-model, establishing the equilibrium of force equation, two basic problems of motivation and basic methods to solve them, the equations of the machine's motion.
Contents:
Part 1. Static studies: Building force model, reducing flat force system, establishing an equilibrium equation of flat force system acting on solid objects. Simplify the space force. Etablish equation of the space force system. Mass and gravity center of a solid object.
Part 2. Kinetics: Kinetic characteristics of solid objects and its physical points. The formula to calculate velocity and acceleration for basic movement of solid objects. Summary of points and object movements.
Part 3. Dynamics: Point and object dynamics. Newton's laws, the general theorems of dynamics, the D'Alembert principle, the method of Static geometry - The dynamics, the moving equations of the machine.

8.4 Basic and core courses in Electrical Engineering

EE 1010 Introduction to Electrical Engineering

3 (2-0-3-6)
Objective: Help new students get acquainted with Electrical Engineering, Automation and Control Engineering to further understand the industrial characteristics, knowledge and skills requirements for the engineer. At the same time helping students gain the passion and confidence in learning and career path; Facilitate students to take the first step in solving practical problems, practice at least minimum required skills as well as teamwork skills, writing reports and presentations skills.
Contents: Teaching class or discussing subject: career introduction, introduction of training programs, skills in writing reports, presentations, teamwork, introduction to industrial projects ... Industrial manufacturing facilities tour. Divide students into groups of 3 to implement a simple automatic device at home or practical workshops under the guidance of instructors (according to the registration plan of each group). Require students to write a report (in the form of a sub-project) and protect it before the class.

EE2000 Signal and system

3 (3-0-1-6)
Requisites: MI1110 (Mathematical analysis I), MI1140 (Algebra)
Objectives: Equipping students with basic knowledge of signal description, analysis and processing signals, describe linear system models, create a basis for other modules of technical engineering course, especially in Electrical Engineering as well as Automation and Control Engineering. Students

will understand the method of describing and solving technical problems based on a systematic, independent and complementary approach beside the traditional physical-chemical approach.
Contents: Signal and system concept, signal characteristics and classification, typical signal types, system characteristics and classification. Describe and analyze signals on the time domain and on the frequency domain: real functions, correlation functions and spectral density, Fourier transformation, Laplace transformation, sample extraction and signal recovery, Z transformation Describe linear system on time domain: differential equation, transient response, steady state model; Describe the linear system on the frequency domain: frequency characteristics, transfer functions. Introduction of model building by the experimental method. Practice to solve problems with Matlab software tool.

EE2020 Circuit theory I

4 (3-1-1-8)
Requisite: MI1120 (Mathematical analysis II), PH1120 (Physics II).
Objective: Present the circuit model of electrical equipments. Basic concepts of electrical circuits, basic methods to analyze linear circuits in steady state and transient state.s
Contents: Provide basic knowledge of electromagnetic fields and applications for students of Electrical Engineering, including models, methods of analyzing and synthesizing linear circuits in steady and transient states.

EE2120 Circuit theory II

2 (2-0-1-4)
Requisite: EE2020 (Circuit theory I).
Objective: Guide students to study the circuit model of nonlinear elements of electrical equipment system and the model of distributed parameters.
Contents: Provide students with nonlinear circuit analysis methods in steady state, sinusoidal oscillation, transient state analysis in linear circuits and study a circuit model new - distributed parameter system (long line model).

EE2102 Electromagnetics

2 (2-0-0-4)
Requisites: MI1120 (Mathematical analysis II), PH1120 (Physics II).
Objective: Equip the most important basic technical knowledge about the model and research methods, abalyze the electromagnetic field.
Contents: Basic concepts of electromagnetic fields. Static electric field. The static electric field in the conductor. The static magnetic field. Variable electromagnetic field.

EE2110 Analog electronics

3 (3-0-1-6)
Requisite: EE2020 (Circuit theory I).
Objectives: Equipping learners with knowledge on: Basic electronic components, small signal equivalent models of components; Principle of amplifier circuits, amplifier analysis and design; introduction of application electronic circuits such as rectifier, DC voltage stabilizer, oscillator, comparator, active filter using op-amp.
Contents: Diode and applications. Bipolar transistor and amplifier applications. Field effect transistor and amplifier applications. Amplify art and its applications. DC voltage regulator circuit. Active rectifier circuit.

EE2130 Digital system design

3 (3-0-1-6)
Parallel module: EE2020 (Analog Electronics).
Objectives: Equip students with basic knowledge about digital information performance and processing in electronic devices, creating a basis for students to acquire other modules of Electrical Engineering and Automation and control Engineering programs.
Contents: Digital signal representation in electronic devices, binary code and arithmetic-logic processing for binary variables. Electrical characteristics of function blocks in digital electronic devices, input and output relationships and time characteristics of digital electronic circuits. Combined logic circuits, logic sequences and theirs describe methods. Digital electronic circuit design method. Digital-analog and analog-digital signal converters.

EE3280 Control theory I

3 (3-1-0-6)
Requisite: EE2000 (Signal and system).
Objectives: Equip students with basic knowledge of system quality analysis; basic control principles (forward, feedback); design methods of linear continuous controllers in the frequency domain and in the time domain.
Contents: Control continuous system in the frequency domain: describe linear system, transfer function, system quality analysis based on transfer function, frequency characteristic function. Quality evaluation criteria of the system. Control of continuous system in the time domain: Structure of state model. Determine free state trajectories and forced state trajectories. Kinetic quality analysis Design the state feedback controller.

EE3110 Measurement techniques

3 (3-0-1-6)
Requisite: EE2030 (Analog Electronics).
Objective: To provide students with basic knowledge of measurement techniques (error, the measurement range of measurement technology, processing measurement results, operation principles of equipment, constituent elements). Help students understand how to use measuring devices in production systems as well as independent working devices in laboratories. The module also provides students with the knowledge to access other modules such as process control, measurement and industrial control.
Contents:
Part 1: Theoretical basis of measurement technology: basic concepts in measurement techniques such as errors, measurements, measuring devices and processing of measurement results (measurement uncertainty, steps to evaluate a measuring device).
Part 2: Methods and measurement of common power quantities: current, voltage, charge, resistance, inductance, capacitance, frequency, phase deflection, power and electrical energy.
Part 3: Methods and equipment for measuring non-electrical quantities. The concept of sensing and components of devices for measuring common non-electrical quantities in industry: temperature measurement, force measurement, pressure, weight, flow, engine velocity, movement, level ...

EE3140 Electrical machine I

3 (3-0-1-6)
Requisite: EE2030 (Electromagnetic field).
Objective: Provide students with basic knowledge of electrical machines. After completing this module, students must understand the structure and working principles of electrical machines,

mathematical models of the physical processes in electrical machines and the main characteristics of electrical machines.

Contents: Research on: transformers, asynchronous electrical machines, synchronous electrical machines, DC motors. The content includes the structure and working principle of electrical machines, mathematical and simplified models describing the process of energy transformation, methods to determine the main parameters and characteristics of electrical machines.

EE3410 Power electronics

3 (3-0-1-6)

Requisite: EE2110 (Analog electronics).

Objective: Provide students with a basic understanding of the process of converting electrical energy using power semiconductor converters as well as the typical application areas of power transformations. Learners will have a firm understanding of the characteristics of high-power semiconductor elements, AC - DC, AC - AC, DC - DC, DC - AC and frequency converters. The course requires learners to use some simulation software such as MATLAB, PLEC, ... to study the working modes of converters. After this subject, learners are able to calculate and design semiconductor converters in simple applications.

Contents: Characteristics of semiconductor elements: diodes, tiristo, GTO, BJT, MOSFET, IGBT. Rectifier and inverter. Voltage transformers: AC, DC, DC converter. Independent inverter: current and voltage source rectifiers. Concepts of frequency inverters: low-frequency inverter has DC intermediary, direct inverter. Current inverter, sinusoidal output, high frequency for induction heating processes. Method of constructing pulse control system for converters.

EE3242 Electrical apparatuses

3 (3-0-1-6)

Objective: Facilitate learners to apply theory to the calculation of a detailed design of a simple electric apparatus. Enable learners to actively study and understand the actual structure and operation of a specific electric apparatus and switchgear. Design calculations and verifications are then carried out on the details of the switching, protection and control device at low and high voltage networks.

Contents: Basic theory of electrical appliances and apply in the calculation of electrical equipment. Analysis of structure and working principle of low and high voltage electric apparatus; Preliminary selection of components of the electrical equipment according to the design requirements. Practice calculating the design and selection of parts and components of a complete electric appliance such as fuses, circuit breakers, magnetic contactor, relays, high voltage switch, disconnector, high voltage fuse, magnetic inductor,

EE3420 Power Supply Systems

4(3-1-1-8)

Prerequisite courses: EE2020 (Electrical Circuit Theory I).

Objectives: The course provide fundamental theory about power generation, transmision and distribution, as well as the structures and working principles of medium and low voltage network components. Students are capable of calculating, designing, planning and operating power distribution system to meet the load demand.

Contents: General knowledge about power systems including economical and technical-related problems of generation, transmission and distribution systems. Medium and low voltage power network, single line diagram, measurement, control and protection circuit, device sizing, electric safety analysis, grounding and lightning protection, power quality, lighting design.

EE3490 Programming Engineering

Objective: Students understand the basic programming techniques, the techniques are shown through a high-level programming language typical (C / C + +) to solve problems in science learning techniques in general and in the Electrical Engineering and Control Engineering and Automation in particular concentrate train of thinking programming and problem solving methods to achieve four basic requirements: efficiency, performance, reliability and value reuse. Expected Results for students: Understand the basic requirements for quality software and programming techniques in science and technology (efficiency, performance, reliability, value use). Understanding the element basics of a software program: variables and basic data types, functions and function calls, program control structures; ability to show that the elements C and C + +. Ability to apply basic principles in the design algorithm, design functions and library functions towards performance and value reuse Ability to interpret and use some basic data structures and algorithms related to the different viewpoints: navigation structures, user functions and object-oriented. Ability to select and apply thinking structured programming, object-oriented programming and general programming to solve the problem simply in fact, meet the basic requirements for effective performance, reliability and value reuse.

Contents: The process of software engineering and software quality requirements in science and engineering; structured programming: the basic elements of the program, algorithm design, function design and libraries, data structures, programming languages, C; object-oriented programming and general programming: abstraction, packaging data, data structures and algorithms (general) and Language C + + .

EE 3510 Electric Drives

Objective:
Provide students with the knowledge base about the process of transformation of electrical power into electrical power occur in variable speed systems. Students will deeply understand the principles of generating electromagnetic torque, how to derive the speed and torque characteristics and methods used to adjust the speed of electric drive systems in different operating modes, in presence of different load requirement. After the course, students will be able to calculate, select, integrate an electric drive system depending on various load demands
Contents:
The general issues dynamics of electric drives. Torque-speed characteristics and variable speed control. Controlled rectifier-DC motor systems. Voltage source-induction motor systems. Voltage source-Synchronous motor systems. Electric drives selection criteria.

EE3810 Project 1:

Requisite: EE2120 (Circuit theory II), EE2110 (Analog Electronics), EE2130 (Digital system design), EE3110 (Measurement technique), EE3280 (Control theory I).

Objective: Create a student can study and work in teams of industry content control and automation towards implementing transportation projects using knowledge of electronic analog, digital electronic, micro process, which technical and engineering control designed to automatically build product-specific guidance, advice of the instructors.

Contents: Requires a simulation products / food at the request of instructors.

EE3820 Project 2

Requisite: EE 3140 (Electrical machine I)

Objective: Create a student can study and work in teams of industry content control and automation projects towards implementation manipulate the knowledge of power electronics, kxy arts programming, electric power supply system and connected electrical measurement techniques applied and engineering controls designed to automatically build a product-specific guidance, advice of the instructors.
Contents: Requires a simulation product at the request of instructors.

8.5 Courses for specialized modules

EE3600 Industrial measurement and control

3(3-0-1-6)
Objective: Structure, functions and principles of operation of typical components of the industrial measurement and control systems. After learning the course, students can study, take part in the installation, operation and design of a new system.
Contents: Hierarchical structure, function, and fundamental components of an industrial measurement and control systems. Measurement and signal processing devices; smart measuring devices. Actuators: electrical, hydraulic, control valves. Special control devices: PID, programmable devices (PLC, CNC). Industrial communication system: structure, HART, field bus. Human-Machine-Interface. Security and protection.

EE3602 Applied fluid mechanics

2(2-1-0-4)
Objective: Basic knowledge of fluid mechanics; fluid dynamics in static state and form of movement. Application of fluid dynamics to solve certain engineering problem.
Contents: Static equation of fluid mechancis; dynamics of fluids; State of flows, equations and fundamental principles. Application of the equations and principles in some actual applications.

EE4070 Control of Electrical Apparatus

3(3-0-1-6)
Objective: Provides basic knowledge of the automatic control of electrical apparatus. After this courses, students can design control schemes for electrical apparatus
Contents: Construction and desgin of electrical apparatus control systems. Structure and basic components of control systems. Some control systems with contacts and without contacts. Stabilizing control for motors, generators. Control of typical devices: UPS, DC sources. Usage of programmable devices.

EE4207 Control device design

3 (3-1-0-6)
Requisite: EE4070 (Electrical equipment control)
Objective: Equip students with basic knowledge to design and calculate control electrical devices. After finishing this course, learners are able to design control parts for electrical equipment.
Contents: Basic knowledge of selecting dynamic circuits, control circuits; Considering stability and design of controllers. Optimal calibration; Design of motor control system; Design of voltage regulator and frequency controller; Design of one-way (closed) power source controller; Design controller for some typical electrical equipment.

EE4422 Microcontrollers and application

3 (2-1-1-6)
Requisites: EE2130, EE3490

Objective: Essential techniques in the design of digital systems. Concepts of hardware, software, firmware, and sequential steps in digital system design.

Contents: Structure of microcontrollers. Some specific compilers and instruction sets. Peripherical systems. Digital input and output. Connection of LED, LCD and keyboard. Timer and interrupt; ADC and DAC. Communication principles (UART, SPI, I2C, CAN). Connection with PC. Examples of design. The process of design and development of microcontroller-based systems. Application examples with DC motors and robots.

EE4082 Lighting techniques

3 (3-1-0-6)
Requisite:
Objective: Equip students with knowldege of designing industrial and commercial lighting systems.
Contents: Basic measures of luminance, luminance emittance. Types of electric lights. Control of light intensity. House lighting design. Traffic lighting system and design. Electric supply for lighting systems.

EE4211 Electric machine design

Requisites: EE3140 (Electrical Machine I), EE4081 (Electrical engineering material)

Objective: Equipped students with knowledge of electromagnetic, thermal, cooling calculations as well as structural design, mechanical calculation of important details of common electric machines. After completing this module, learners can design complete electro-static machines and rotating machines.

Contents: General about transformer design; calculate main transformer sizes; calculate transformer windings; calculating transformer parameters; thermal calculation and oil tank design; basic problems of rotating machines; materials used in rotating machines; armature wire armature; calculate magnetic circuits; parameter calculations, losses, and performance; calculation of ventilation and heat dissipation; calculate asynchronous electrical machine; calculate convex pole sync machine; calculating DC motors; Electrical machine structure and mechanical calculation.

EE5211 Electrical apparatus design

3 (3-1-0-6)
Requisites: EE3420 (Power supply system), EE4081
Objectives: To equip students with basic knowledge and methods of calculating and designing high-voltage and low-voltage electric apparatus operating in industry and civil.
Contents: Theory of electric apparatus; General problems in designing electric apparatus; Calculation of insulation; Calculation and inspection of conductive loop circuits; Calculation and inspection of arc stamping systems; Calculate and build mechanical properties; Calculate and test electromagnets; Optimal design of electromagnet; Calculation and design of mechanical switching actuators for low-voltage and high-voltage electric devices; Synthesis and finishing structure. Detailed and synthetic drawings.

EE4081 Electric materials

2 (2-0-1-4)
Requisites:

Objectives: To equip students with knowledge of electrica and dielectric materials. Methods for testing and measuring dielectric levels.
Contents: Conducting materials, magnetic materials and dielectric materials. Losses in dielectric materials. Mechanical, physical and chemical characteristics of dielectric materials. Gas, air and solid types of dielectric materials. Methods to test the high voltage withstanding capabilities.

EE4080 Electrical machines 2

3 (3-1-0-6)
Requisites:
Objectives: To equip students with advanced knowledge of static and rotating machines. After the course, students have in-depth knowldege about the structure and abnormal operating modes of conventional and special electrical machines.
Contents: Special operating modes of transformer (transient in transformers, parallel operation, overcurrent and overvoltage). Structure of transformer winding and motor windings. Generator opeartion with asymmetrical load. Parallel operation of generators, load sharing principles. Some typical single phase and two-phase motors: brushless DC motor, linear motor, servo motor.

EE4267 Technology for manufacturing electrical equipment

3 (3-1-0-6)
Requisites: EE4080 (Electrical machine 2), EE4081 (Electrical engineering material)
Objectives: To equip students with basic knowledge about the technology of manufacturing rotating machines, transformers and some electrical apparatuses. Theoretical issues are solved through the process of processing details, structures and methods of measuring and testing the above equipment.
Contents: Technology of manufacturing rotating electric machines: Manufacturing magnetic circuits; Technology for manufacturing winding wire; Assembling and testing rotating electric machines. Technology of manufacturing transformers: Technology of manufacturing circuits from transformers; Technology of manufacturing transformer windings; Technology of manufacturing transformer shells; Assembling and testing transformers. Some basic problems in electrical apparatus manufacturing technology.

EE4221 Special topics in Electrical Equipments

2 (2-1-0-4)
Requisites: EE3161/EE4080
Objectives: Provide in-depth knowledge in selected topics of electrical equipent design.
Contents: Selected topics in the design of electrical equipments. Student can choose one topic and carry out a design task under the supervision of lecturers.

EE4204 Electric machine in automatic and control equipment

2 (2-1-0-4)
Requisites: EE2120 (Circuit theory II); EE 3140 (Electric machine 1)
Objective: Equip students with knowledge about electrical machines in automatic control equipment. After completing this module, people learn more about the types of electrical machines used in magnetic devices, know how to make more reasonable use of these types of electric machines.
Contents: The basis of two-phase and single-phase machine theory; single-phase asynchronous motor; synchronous motor; ringed motor; asynchronous actuator; DC actuator motor; stepping motor; generator; synchronous communication system - interlaced; rotating transformers; small power transformers; other types of engines.

EE4090 High voltage equipment

3 (3-0-1-6)

Objective: Equip students with fundamental knowldege of the operation of high voltage equipment (operating voltage above 1000V). Selection of high voltage equipment.

Contents: Generalities of high-voltage equipment. Technical characteristics of high voltage circuit breakers (oil-based, compressed-air, SF6). Disconnection switches, earthing switches, reactor, surge arrestors, current transformers and voltage transformers. Calculation and selection of high voltage equipment in an electrical system.

EE4261 Electrical machine design project

2 (0-0-4-4)

Parallel module: EE4211 (Electrical design)

Objective: Equip students with practical knowledge about electrical machine design. After completing this course, learners can independently design a complete static or rotating electrical machine.

Contents: With the task assigned by teachers and under the guidance of the supervisor, with reference to the documents, work independently or work in groups to design a complete electrical machine (engine, generator, transformer)

EE4262 Equipment's controller project

2 (0-0-4-4)

Parallel module: EE4207 (Control device design)

Objective: Equip students with practical knowledge about designing controllers for electrical equipment. After completing this course, learners can independently design and complete the controller under the guidance of GVHD.

Contents: With the task assigned by the instructor and under the guidance of the supervisor, with references, students work independently or work in groups to design a controller for electrical equipment (engine, generators, programmable controllers, etc.)

EE4263 Electrical apparatus project

2 (0-0-4-4)

Parallel module: EE5211 (Design of electric apparatus)

Objectives: To equip students with practical knowledge on designing electric apparatus (Automat, contactors, relays, low-voltage current transformers; breakers, high-voltage contacts, high-voltage current transformers, voltage transformers, …). After finishing this course, learners can independently or operate in groups to design a complete electric apparatus under the guidance of instructors.

Contents: With the task assigned by teachers and under the guidance of instructors, also with references, students work independently or work in groups to design a complete electrical apparatus (Automat, contactor, relay, low voltage current transformers, breakers, high-voltage contactors, high-voltage current transformers, voltage transformers, ...).

EE4215 Design of automatic electrical equipment

2 (2-1-0-4)

Requisite: EE4080 (Electric machine 2)

Objectives: To equip students with methods to establish an automatic system of electrical equipment based on theoretical mathematical models, experimental mathematical models, planning electrical equipment and using computers for optimal design of electrical equipment.

Contents: Concept of electrical equipment system; Multi-layer math model of automatic systems; Optimal design module of electrical equipment; Analysis of the probability of technology error affects the output and controls the quality of electrical equipment.

EE4264 Electrical heating equipment

3 (3-1-0-6)

Requisites: EE3410 (Power Electronics), EE3140 (Electrical Machine I), EE3420 (Power supply system).

Objective: Equip students with technical knowledge of converting electrical energy into heat in production. Know the calculation of specific design of heat, electricity, know how to operate some common equipment such as resistors, drying equipment, heating equipment, sensors, arc welding equipment ...

Contents: General concepts of thermal and electrical engineering; Basic equations for thermal aspect and heating temperature, making water, calculate thermal capacity of electrical equipment; Indirect heating method by resistors; Calculation of heat for burning wire; calculate electricity for burning wire; Direct heating method by resistors; Heating method by induction; Arc heating method.

EE4264 Thematic electric equipment

2 (2-1-0-4)

Requisites: EE3140 (Electric machine 1); EE4080 (Electric machine 2);

Objective: Equip students with basic knowledge of modeling and simulation of electrical equipment. Updating new knowledge in theory and technology of manufacturing electrical equipment

Contents: Basic theory of modeling, General electrical machine, Modeling of electrical equipment; Studying dynamic characteristics of electrical equipment; Updated knowledge of theory, design, manufacture and control electrical equipment.

EE3910 Technical Practicum

2(0-0-4-4)

Objectives: Students have chance to entering the real workplaces, get to know the work environment that relevant to Electric Engineering/ Control Engineering and Automation.

Content: The third year students are sent to professional workplace to do technical practicum. Base on the real ongoing project at the workplace, students learn to solve the real problem from easy to difficult tasks. The technical practicum takes 4 weeks. Students are encouraged to find the workplaces by themselves or with the support of the school. The outcomes of the course are the internship report and presentation

EE4114 Electrical Power System Planning

3(3-1-0-4)

Prerequisite Courses: EE4108 (Optimization of Power System Operation) or EE3420 (Electrical Power Supply Systems)

Objectives: The course provides basic knowledge about the load forecast method, power system planning and project evaluation.

Contents: Energy system development, general knowledge about power system planning, energy demand and load forecast. Applying mathematical models to solve planning problems such as generation expansion planning, transmission planning, distribution planning, financial and economic evaluation of projects.

EE4241 Power supply system for building

3 (2-1-1-6)

Requisite: EE3420 (Power supply system)

Objective: To provide learners with knowledge about power distribution systems and analysis, design calculations and operation of power supply systems for buildings.

After this subject, learners will know how to calculate, design and operate, control the power supply system for buildings

Contents: Overview of IEC standards for building power system. Power supply diagram, Calculation of economic and technical targets when designing and operating the power supply system of the building. Calculation and selection of electrical distribution, protection and control devices in the building. Electrical safety for the building. Lightning protection for buildings. Calculation of lighting for buildings. The connection of BMS building management control system. Use software to support the calculation of power supply and lighting design.

EM3661 Energy economy

3 (3-0-0-6)

Objectives: After completing this course, students will be able to: Master the basic knowledge of economics and manage electrical systems. Analysis of economic targets and the relationship index between economic development and electricity. Organizing and managing electricity system model. Researching theory and practical application of the energy price issue. Prepare and analyze investment projects in the electricity industry. Analyze and evaluate the production process of transmission and distribution and consumption of electricity under an economic perspective, ie how to implement this process effectively, environmentally friendly and in a sustainable way. Students are also studying to consider the issues of organization and implementation of the production process of electricity during the establishment and development of the electricity market.

Contents: Technical and economic characteristics and organizational model of electricity production and business activities. The relationship between economic, electricity and environment. Theoretical and practical issues on electricity prices. Issues of power demand management. Basics of investment, analysis and evaluation of investment projects in the electricity industry

Requisites: EE4207 Control device design, EE4211 Electrical machine design, EE5211 Electrical apparatus design, EE4217 Electric equipment manufacturing technology; Two of three modules: EE4212 Electrical machine design project, EE4210 Equipment's controller project, EE4203 Electrical apparatus project

EE5011 Graduation Project

12 credits

Requsites: EE4207 (Equipment's controller design), EE4211 (Electrical machine design), EE5211 (Electrical apparature design), EE4217 (Electrical equipment manufacturing technology); EE4212 (Electrical engineering design project) / EE4210 (Equipment's controller project) / EE4203 (Electrical equipment project)

Objective: Students apply a combination of knowledge and skills learned in the program to detect and solve a theoretical or applied problem in the field of electrical equipment, improve research capacity, set design, build a specific electrical device and control device.

Contents: A topic is carried out independently by a student or by a group of students. Subjects proposed by students or delivered by teachers in the field of electrical equipment and controlling them. Require independent students to study materials, learn facts through internships, determine objectives

and tasks to be solved, develop a proposal for the project and solve problems raised according to orientation guide of instructors, explanatory statements and presentation of project protection.

EE4010 Electrical Power Network

- Prerequisite Courses: EE3420 Power Supply Systems

Objectives: The course provides advanced knowledge about the electric power network such as power transmission lines and transformers, synchronous machine modeling, network analysis, power system representation, load flow.

Contents: Power system operation states, modeling of generators, transmission lines, and transformers, electric power transmission characteristics, power system calculation in steady state, two-port network, calculation of long transmission line, complex power system calculation, state control and regulation of power system.

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EE4020 Short Circuit Analysis

Prerequisite Courses: EE2020 Electrical Circuit Theory I or EE3140 Electrical Machines I

Parallel Courses: EE4010 Electrical Power Network

Objectives: The course provides knowledge about short-circuit in the power system, methods to calculate short circuit current and electromagnetic transient during short circuit for design and operation of power system. After course completion, students are able to:

- Power system modeling for short circuit calculation
- Calculate balanced faults
- Calculate unbalanced faults
- Calculate faults in complex power systems
- **Contents:** Type of faults, causes and consequences, electromagnetic transient during faults, methods to calculate balance and unbalance faults, complex faults analysis.
-

EE4050 High voltage engineering I

Prerequisite Courses: EE2030 Electrical Circuit Theory II

Objectives: The course provides knowledge about breakdown mechanism in gas, liquid, solid; local breakdown measurement and detection, corona discharge, generation of high voltage and current, insulation test, lightning overvoltage.

Contents: Dielectric conductivity, dielectric polarization, dielectric loss, dielectric breakdown, gas insulator, liquid insulator, solid insulator. Mechanical, physical, chemical and thermal characteristics of insulators. High voltage insulator, the insulator in the electric power system, insulation test. The lightning phenomenon, lightning overvoltage, impulse voltage discharge, lighting protection for transformers, transformer grounding.

EE4030 Electrical Components of Power Plants and Substations

Prerequisite Courses: EE2020 Electric Circuit Theory I, EE3140 Electric Machine I, EE4010 Electric Power Network, EE4020 Short Circuit Analysis

Objectives: The course provides knowledge about the electric component structure in power plant and substation, main equipment and their working principle, primary circuit diagram, control and testing circuits. Expected outcome: Students are capable of designing and operating power plants and substations.

Contents: Electricity generation, types of power plants. Electric component structure in power plant and substation, main equipment and their working principle. Equipment rating including generator,

transformer, busbar. Primary and auxiliary circuit diagram, auxiliary consumption, battery system, control and testing unit, insulation requirement, spacing requirement.

EE4040 Power System Protection and Control I

Prerequisite Courses: EE4010 Electric Power Network, EE4020 Short Circuit Analysis

Objectives: The course provides knowledge about relay protection principles in power system. Expected outcomes: Understand the protection devices and principles in power system, relay setting for individual equipment protection.

Contents: Protection systems, measurement and fault detection principles in power system, main equipment protection, transmission line recloser, protection of generator, motor, transformer, busbar and compensation devices.

EE4060 Project III (power system)

2(0-0-4-4)

Prerequisite Courses: EE3420 Power Supply Systems, EE4010 Electric Power Network, EE4030 Electrical Components of Power Plants and Substations

Objectives: Students are expected to conduct an independent project under lecturer's instruction. Project's content is related to the courses: electric power network, short-circuit analysis, electrical part of power plants and substations. The project output is a design report.

Contents: Design power supply system/electric power network/power plant, protective relay schemes and setting for high-voltage substations.

EE4051 Power System Laboratory I

1(0-0-2-2)

Parallel Courses: EE4010 Electric Power Network, EE4050 High voltage engineering I

Objectives: Experiment designed for EE4010 Electric Power Network and EE4050 High voltage engineering I.

EE4041 Power System Laboratory II

1(0-0-2-2)

Parallel Courses: EE4030 Electrical Components of Power Plants and Substations, EE4040 Power System Protection and Control I

Objectives: Experiment designed for EE4030 Electrical Components of Power Plants and Substations, EE4040 Power System Protection and Control I.

EE5050 High Voltage Engineering II

2(2-1-0-4)

Prerequisite Courses: EE4050 High Voltage Engineering I

Objectives: The course provides basic knowledge about lightning protection grounding, equipment grounding, lightning protection in the power system, over voltage and traveling wave phenomena.

Contents: Corona discharge in the transmission line, grounding in power system, overvoltage protection devices, lightning protection for transmission line, transformer and electric machine, traveling waves in transformers and electric machines, temporary overvoltage, resonant over voltage, over voltage in long transmission lines.

EE4115 Power System Stability

2(2-1-0-6)

Prerequisite Courses: EE4010 Electric Power Network, EE4020 Short Circuit Analysis

Objectives: The course provides basic knowledge about electro-mechanic transients and calculation tools, power system stability.

Contents: General knowledge about power system stability, basic characteristic of power system components, small signal stability and dynamic stability, methods to improve the stability of the power system.

EE4108 Power system optimization

3(3-1-0-6)

Prerequisite Courses: EE4010 Electric Power Network

Objectives: The course provides knowledge about optimization problems in operating power system both economically and technically.

Contents: power system operation, improve power quality, reduce generation and transmission cost, optimize power generated between power plants, reduce energy loss, power system reliability.

EE5060 Computer-based Analysis of Power Systems

3(3-1-0-6)

Prerequisite Courses: EE4010 Electric Power Network, EE4115 Power System Stability

Objectives: The course provides knowledge about software and algorithms to calculate large scale power system for design and operation purposes.

Contents: Power system modeling in steady state and short circuit calculation, transient modeling and dynamic stability analysis, power system planning.

EE4061 Power System Protection and Control II

3(3-1-0-6)

Prerequisite Courses: EE4040 Power System Protection and Control I

Objectives: The course provides knowledge about power system control and automation.

Contents: Frequency and active power control, generator control, transformer, and distribution network automation, auto detection and prevention of abnormal conditions in power system, power system recovery after fault conditions.

EE4112 Hydro Power Plants

2(2-0-0-4)

Objectives: The course provides knowledge about hydro energy, design and operation of hydropower plants in power systems.

Contents: General knowledge about hydro energy hydropower plants, characteristics of flow, reservoir and head, flow regulation, hydropower plants operation, economical and technical based analysis of hydropower plants.

EE5071 Renewable Energy Sources

2(2-0-0-4)

Objectives: The course provides knowledge about renewable energy sources, potential growth and technology related problems.
Contents: Introduction to renewable energy sources, solar energy, wind energy, photovoltaic, small hydro energy, biomass energy and tide energy.

EE5070 Special topics in nuclear power plants

2(2-0-0-4)
Objectives: The course provides knowledge about types and operation principles of nuclear power plants.
Contents: Component of nuclear power plant. Pressurized water reactor; Boiling water reactor; Advanced Gas cooled reactor. Life type of nuclear power plants. Load following capability. Nuclear power plant in the power systems.

EE5072 Mechanical design of overhead transmission lines

2(2-1-0-4)
Objectives: The course provides knowledge about the design of transmission lines.
Contents: Structures of transmission towers. Main components: Conductors, insulators, cross arms. Loading and strength design criteria. Conductors in steady state and transient operating condition. Economical selection, bundling.

EE4121 High Voltage Measurement and Non-destructive Testing

2(2-0-0-4)
Objectives: The course provides knowledge about advance measurement and non-destructive testing of high voltage devices.

Contents: high voltage generations, high voltage and pulse current measurement, pulse recorder, high voltage measurement error, non-destructive testing and insulation condition testing, dielectric testing in frequency and time domain, monitoring systems for high voltage devices based on fiber optic.

EE5100 Pre-Graduate internship

3(0-0-6-6)
Objectives: Students have chance to entering the real workplaces, step by step learn and solve the real problem which can relevant to the bachelor thesis topic

Contents: Student has the right to choose the proper topic and supervisor, the earn work experience and attitude in the workplace in the Electrical Engineering Field. The workplaces are factories, enterprises or research institutes. The outcomes of the course are the internship report and presentation

EE5010 Graduate thesis

9(0-0-18-18)

Objectives: Students utilized all knowledge and skills obtained in the program to identify an engineering problem, propose a solution in electrical and electronic equipment, or in the power system.
Contents: Student can carry out the graduate project individually or in groups. The students need to work independently, under the supervision of the assigned teaching staff. The students need to prepare a graduate thesis and defense in front of a jury.