HANOI UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRONICS AND TELECOMMUNICATIONS

BACHELOR DEGREE IN ELECTRONICS AND TELECOMMUNICATIONS CURRICULUM

CONTENTS

Undergraduate Program

Program title: Bachelor degree in Electronics and Telecommunications
Major: Electronics and Telecommunication Engineering
Degree: Bachelor degree in Engineering

1 Program duration and number of credits

- **Program duration**: **4 years** (8 semesters).
- **Total number of credits**: **132 credits**

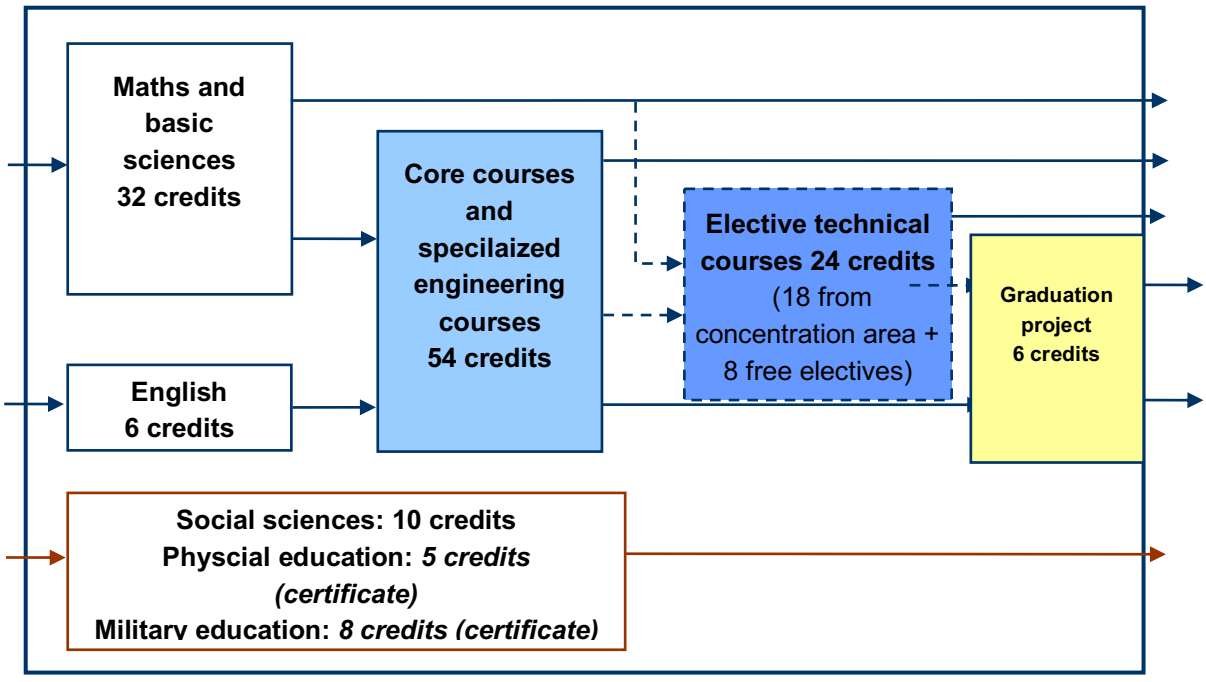
2 Grading system

	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

3 Program content

3.1 Program structure

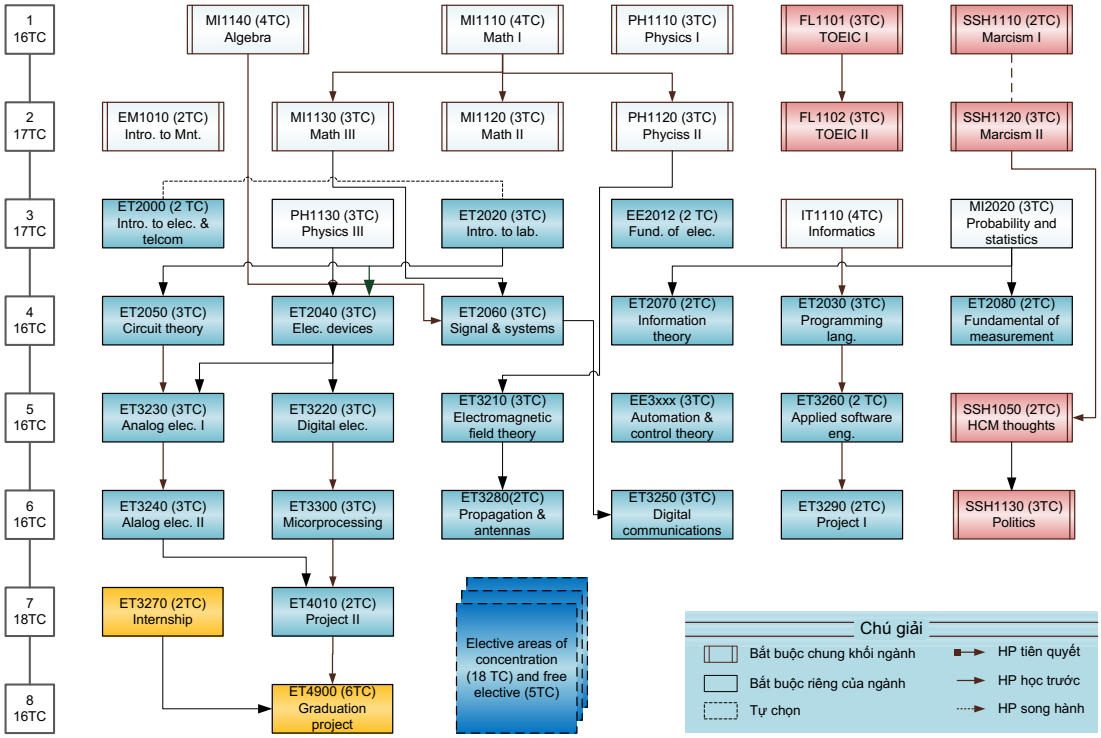
3.1.1 General structure



3.1.2 Program tree

Bachelor Program in Electronics and Telecommunications

Applied since 2009



3.2 Course list

3.2.1 Common courses for engineering

Nr	Code	Name of Courses	Nr of Credits	Standard course sequence (semester)							
				1	2	3	4	5	6	7	8
Politics			**10 credits**								
1	**SSH1110**	Marcism I	2(2-1-0-4)	2							
2	**SSH1120**	Marcism II	3(3-0-0-6)		3						
3	**SSH1050**	Hồ Chí Minh thoughts	2(2-0-0-4)			2					
4	**SSH1130**	Politics	3(3-0-0-6)				3				
Physical education			**(5 credits)**								
5	**PE1010**	Physical education A	1(0-0-2-0)	x							
6	**PE1020**	Physical education B	1(0-0-2-0)		X						
7	**PE1030**	Physical education C	1(0-0-2-0)			x					
8	**PE2010**	Physical education D	1(0-0-2-0)				x				
9	**PE2020**	Physical education E	1(0-0-2-0)					x			
Military service training			**(8 credits)**								
10	**MIL1110**	Military service training A	3(3-0-0-6)	x							
11	**MIL1120**	Military service training B	3(3-0-0-6)		X						
12	**MIL1130**	Military service training C	4(3-1-1-8)			x					
English			**6 credits**								
13	**FL1101**	TOEIC I	3(0-6-0-6)	3							

14	**FL1102**	TOEIC II	3(0-6-0-6)		3						
Maths and basic sciences			**28 credits**								
15	**MI1110**	Math I	4(3-2-0-8)	4							
16	**MI1120**	Math II	3(2-2-0-6)		3						
17	**MI1130**	Math III	3(2-2-0-6)		3						
17	**MI1140**	Algebra	4(3-2-0-8)	4							
18	**PH1110**	Physics I	3(2-1-1-6)	3							
19	**PH1120**	Physics II	3(2-1-1-6)		3						
20	**EM1010**	Introduction to management	2(2-0-0-4)		2						
21	**IT1110**	Introduction to informatics	4(3-1-1-8)			4					
22	**HE2010**	Thermal Engineering	2(2-0-0-4)		2						
		Total	**44 credits**	**16**	**17**	**6**	**3**				

Note:

1) **English requirements:** students that have TOEIC certificate above 290 points are exempted from FL1101, above 330 are exempted from FL1102. Before doing the final thesis, students should have TOEIC certificate above 330 points.
2) **For politics, physical education and military subjects**: Students will have specific certificates that are not counted into the total number of credits.

3.2.2 Electronics and Telecommunication engineering course list

Nr	Code	Name of Courses	Nr of Credits	Standard course sequence (semester)							
				1	2	3	4	5	6	7	8
Supplementary Maths and Basic Sciences			**8 credits**								
1a	**PH1130***	Physics III	3(2-1-1-6)			3					
1b	**PH1204***	Electronic physics	2(2-1-0-4)			2					
2	**MI2020**	Probability and statistics	3(2-2-0-6)			3					
3	**ME2026**	Technical drawing	2(2-1-0-4)			2					
Core Courses and Specialized Engineering Courses			**54 credits**								
4	**EE2012**	Fundamental of electrical engineering	2(2-0-1-4)			2					
5	**ET2000**	Introduction to electronics and telecommunication engineering	2(2-0-1-4)			2					
6	**ET2020**	Introductory Laboratory	3(0-0-6-0)			3					
7	**ET2030**	Programming language	3(3-0-1-6)				3				
8	**ET2040**	Electronic devices	3(3-0-1-6)				3				
9	**ET2050**	Circuit theory	3(3-0-1-6)				3				
10	**ET2060**	Signals and systems	3(3-1-0-6)				3				
11	**ET2070**	Information theory	2(2-0-1-4)				2				
12	**ET2080**	Fundamental of measurement techniques	2(2-0-1-4)				2				
13	**ET3210**	Electromagnetic field theory	3(3-0-1-6)					3			
14	**ET3220**	Digital Electronics	3(3-0-1-6)					3			
15	**ET3230**	Analog Electronics I	3(3-0-1-6)					3			
16	**EE3349**	Automation and Control Theory	4(3-2-0-6)					4			
17	**ET3260**	Applied software engineering	2(2-1-0-4)					2			
18	**ET3250**	Digital communications	3(3-0-1-6)						3		
19	**ET3240**	Analog electronics II	3(3-0-1-6)						3		
20	**ET3280**	Propagation and Antennas	2(2-1-0-4)						2		
21	**ET3290**	Design project I	2(0-0-4-4)						2		

22	**ET3300**	Microprocessors	3(3-1-0-6)						3		
23	**ET4010**	Design project II	2(0-0-4-4)							2	
24	**ET3270**	Internship	2(0-0-6-4)							2	
Elective Areas of Concentration			**18 credits**								
Electronics and Computer Engineering											
1	**ET4020**	Digital signal processing	3(3-0-1-6)								
2	**ET4030**	Digital system design and synthesis	3(3-1-0-6)								
3	**ET4250**	Communication systems	3(3-1-0-6)								
4	**ET4040**	Computer organization and architectures	3(3-0-1-6)								
5	**ET4050**	Computer networks	3(3-0-1-6)								
6	**ET4060**	Object oriented system analysis and design	3(3-1-0-6)								
Communications Engineering											
1	**ET4020**	Digital signal processing	3(3-0-1-6)								
2	**ET4030**	Digital system design and synthesis	3(3-1-0-6)								
3	**ET4250**	Communication systems	3(3-1-0-6)								
4	**ET4070**	Fundamental of data communications	3(3-1-0-6)							3	
5	**ET4080**	Communication networks	3(3-0-1-6)								3
6	**ET4240**	Radio communications	3(3-1-0-6)								
Free elective courses			**≥ 2 credits**								
1	**PH4070**	Microelectronics	2(2-1-0-4)								
2	**ET4160**	Biomedical electronics	2(2-1-0-4)								
3	**ET4270**	Television	2(2-1-0-4)								
4	**ET4260**	Multimedia	2(2-1-0-4)								
5	**ET4340**	VLSI design	3(3-1-0-6)								
6	**ET4090**	Microwave engineering	3(3-1-0-6)								
7	**xxxxxx**	German for electronic and communication engineers	2(2-1-0-4)			2					
8	**ET4180**	Biomedical material	3(3-1-0-6)								
1	**ET4900**	**Gradution project**	**6(0-0-12-12)**								6
		Total	**90 credits**	**0**	**0**						

* Students can select PH1130 or PH1204

3.2.3 Special course list for Hannover's program

1	**xxxxxx**	**German as foreign language****	**80 credits**	6	6	8	8	8	8	8	8

**In additional to the above listed subjects, students attending the joint bachelor program with Leibniz-Universitaet Hannover should visit special German courses from the 1st – 8th semester.

- The total number of credits: 80.
- Students who want to study at LUH should pass TestDAF 4x3.
- 80 credits of German are not counted into the total required 132 credits for Bachelor degree at HUT.

4 Course description

MI1110 Math I

4(3-2-0-8)

Content: Differentiation and integration of one variable functions and multi-variable functions

MI1120 Math II

3(2-2-0-6)

Content: Line integrals, surface integral, differential geometry, field theory.

MI1130 Math III

3(2-2-0-6)

Content: series theory and series function, second order and third order differential equations and system of differential equations.

MI1140 Algebra

4(3-2-0-8)

Content: logic, sets, mapping, complex numbers. Vector space structure. Theory of matrices, the system of linear equations. linear mapping and Euclidean space.

PH1110 Physics I

3(2-1-1-6)

Content: Basic physical laws such as momentum, the theorems and laws of momentum; the theorem and laws of the moment; kinetic energy, potential, the law of conservation of energy. The movement of solid objects, vibrations and waves. Using theory of molecular dynamics to calculate: temperature, pressure, internal energy (ideal gas). Manipulate the law of conservation and metabolism of energy in the process of heat transfer.

PH1120 Physics II

3(2-1-1-6)

Content: Electric field, magnetic field; the properties (intensity, voltage ..) and the related laws and theorem. Relationship between field and matters. The relationship between magnetic and electric field, electromagnetic field. Electromagnetic waves and oscillations.

EM1010 Introduction to management

2(2-0-0-4)

Content:

IT1110 Introduction to informatics

4(3-1-1-8)

Content: Information representation in computers. Computer systems. Linux OS; C programming language: introduction to C, data types, C statements and basic structrures. Complex datat types: pointer, array and string in C. Struct. Files.

PH1130 Physics III

3(2-1-1-6)

Content: particle and wave properties of light: interference, diffraction, polarization, heat radiation, Compton phenomenon. Particle-wave properties of elementary particles (electron, atom, etc.). Quantum mechanics, Schrodinger equations. Spin theory and Pauli principle. Semiconductor: p, n, p-n. Transistor. Laser effect. Special and general theories of relativity. $E = mc^2$ equation and its applications.

PH1204 Electronic physics

2(2-1-0-4)

Content: Review of quantum mechanics applied to solid-state physics, energy band theory, carrier generation and transport. Review of semiconductor process technology. Nanotechnology and related basic physics concepts. PN junction diode; diode fabrication, nanofabrication and characterization, pn junction at equilibrium, steady state, and transient behavior. Metal semiconductor junction, Schottky barrier, and Ohmic behavior. Metal-Oxide-Semiconductor (MOS) Field-Effect-Transistor: MOS capacitor, field effect, NMOS, PMOS, CMOS, current-voltage characteristics, and switching. Nanoelectronic devices, single electron device. Bipolar junction transistor: carrier transport in pnp/npn structure, amplification, current-voltage characteristics, and switching.

ET1000 Introduction to electronics and telecommunication engineering

3(2-0-2-6)

Content: What is electrical and computer engineering? Different specializations in ECE. Basic concepts and components in ECE. ECE engineering tools. Engineering problem solving.

HE2010 Thermal engineering

2(2-0-0-4)

Content: Thermodynamics engineering: basics notations, working substances and defining the states of working substance, basic thermodynamic processes, thermodynamic cycles. Thermo transfer: thermal transmission, thermal convection, thermal radiation.

ME2026 Technical drawing

2(2-1-0-4)

Content: Conception about designing, manufacturing, assembling the industrial machines, representative figure of the machine elements, assembly drawing of the machine mechanism: Content – Reading the assembly drawing, of the machine mechanism, conception about Auto-CAD.

EE2012 Fundamental of electrical engineering

2(2-0-1-4)

Content: Electrical circuit: basic concepts of electrical circuits; sinusoid current; methods for electrical circuit analysis; three-phase current. Electrical machines: general concepts; transformer; asynchronous motors; synchronous electrical machines; direct current electrical machines.

ET2020 Introductory laboratory

3(0-0-6-0)

Content:

This course will provide students with a general exposure to electronic circuits laboratory equipment, measurement techniques, and basic laboratory safety. Topics covered:

- Series and parallel circuits
- d'Arsonval meter

- Electronic digital multimeter
- Thevenin and Norton equivalent circuits
- Analog cathode ray oscilloscope
- Digital cathode ray oscilloscope

ET2030 Programming language

3(3-0-1-6)

Content: The basic concepts of programming (the historical development and classification of programming languages, the major components of a programming language. Etc), C programming language (general structure of the program C, the title and keywords, data types, pointers, operators, Control structrures for the program, function ...), C + + programming language (class structure, inheritance, virtual functions and friend function, stream and file, templates, algorithms, object function...), the basic data structures (lists, queues, binary tree ...)

ET2040 Electronic devices

3(3-0-1-6)

Content:

- Materials: dielectric, semiconductor, magnetic.
- Passive devices: resistor, capacitor, inductor.
- Active devices: structure and operation of diode, BJT, FET, thyristor, four-layer diode, silicon cotrolled rectifier, bidirectional thyristor, unijunction transistor.
- Analog and digital IC: fundamental and application.
- Opto electronics introduction.
- Display devices.

ET2050 Circuit theory

3(3-0-1-6)

Content: The basic concept of linear circuits and common methods for circuit analysis - Kirchhoff's laws, node voltage. RL , RLC, RC circuits. Bode plots. Two port circuit applications. Reciprocal and non reciprocal 2 port circuits. Passive and active circuits synthesis.

ET2060 Signals and systems

3(3-1-0-6)

Content: Mathematical methods used to describe signals and linear systems. Laplace Transform and its applications. Fourier Series. Fourier Transform and its applications. Fast Fourier Transform. Frequency Response and Filter. Sampling and Construction. Z Transform.

ET2070 Information theory

2(2-0-1-4)

Content:

- Information theory introduction: basic concepts, entropy, source encoding, channel encoding, encryption, Shannon theory.
- Random signal and noise: signal and spectrum, Fourier transform, base band, band pass, band limited, bandwidth
- Modulation: AM, FM, PM, Pulse modulation, delta modulation.
- Transfer function

ET2080 Fundamental of measurement techniques

2(2-0-1-4)

Content:

- Measurement theory: introduction, error causes, error estimation, measurement results determination methods
- Oscilloscope: principle, structure: one or more channel, digital oscilloscope
- Measurement: voltage, current, impedance, power, frequency, interval, phase
- Modulation parameters measurement, spectrum analysis
- Circuit parameters and quality measurement
- Digital circuits and microprocessor measurement
- Automatic measurement introduction

ET3210 Electromagnetic field theory

3(3-0-1-6)

Content: This course will cover concepts of electrostatics and static magnetic fields. In the beginning, vector algebra and calculus together with orthogonal coordinate systems will be discussed. Next, the time-varying electromagnetic fields described by Maxwell's Equations in their complete forms are studied. Electromagnetic wave propagation will be covered.

ET3220 Digital Electronics

3(3-0-1-6)

Content: Basic concepts: Number systems and data representation, Boolean algebra, basic logic gates, manufacturing technology (TTL, CMOS, ...); Design of combinational logic circuits: Karnaugh map, Quine McClusky, hazard, the basic RTL building blocks (encoder, decoder, ALU, MUX, DEMUX, Adder ...). Design sequential logic circuits: flip-flop types, FSM (Moore, Mealy), the basic RTL building blocks (register, shift registers, counters, queues, register files …); RTL design: FSMD (FSM with Datapath); CAD: the programmable chip (PAL, PLA, CPLD, FPGA)

ET3230 Analog electronics I

3(3-0-1-6)

Content:

- Introduction: basic parameters, 2-ports system, amplifier parameters transfer function and frequency respond
- Feedback: concept, connection types, effects on amplifier's parameters
- Small signal amplifier: BJT and FET: stage, bias, AC and DC mode, configuration, model: hybrid and transconductance, stage coupling
- Frequency response: zero and pole point, miller capacitor, low and high frequency response of BJT/ FET amplifier, frequency response of multi stages amplifier
- Resonant and broadband amplifier
- Power amplifer: class A, B, C, D, methods to improve circuit characters, practical devices and circuits
- Operational amplifiers: introductions, parameters, structure
- Op amp applications: inverter, noninvert, adder, subtractor, integrator, differenciator, clipper rectifier, comparator

EE3349 Automation and control theory

3(3-2-0-6)

Content: Control of LTI systems and introduction in nonlinear control systems

- Signal and classification of signals: Continuous, discontinuous and digital.
- Modelling of electrical and mechanical systems. Presentation in frequency and in time domain. Linearization. Transfer functions and state modele of linear systems. Algebra of block diagram. Normal form. Minimum order modele.

- Analysis of continuous LTI systems in frequency domain: stability (Routh, Hurwitz, Michailov, Nyquist), robustly (Kharitonov, Nyquist, Bode diagram), minimum phase, uncertainty and sensivity function...
- Controller design for continuous LTI systems in frequency domain: PID, root locus, Youla factorization, modele matching (modele compensation), robust controller, Wiener filter ...
- Analysis of continuous LTI systems in time domain: stability, controllability, observablility, zero dynamic ...
- Controller design for continuous LTI systems in time domain: Pole placement by state feedback, observer synthese and observer based control by output feedback (separation theorem), tracking control, LQR and LQG controller ...
- Analysis of time discrete LTI systems: stability, controllability, observablility ...
- Controller design for time discrete LTI systems: Digital PID, state feedback and output feeback control, Kalman filter, dead beat controller ...
- Introduction in nonlinear control systems: Hammerstein systems (Popov, describing function, phase plane method for switch system), Fuzzy control (Fuzzy set and fuzzy logic, inference mechanism) ...

ET3260 Applied software engineering

2(2-1-0-4)

Content: Software engineering, compilers, databases: introduction about software engineering; Database: models, ACCESS, SQL; phases in software engineering

ET3250 Digital communications

3(3-0-1-6)

Content:

- A/D and D/A conversion: sampling, quatization, PCM and their factors on signal quality.
- Base-band digital signal transmission
- Impact of noise/distortion/attenuation on the signal, Nyquist criteria, raised-cosine filter, matched filter
- Channel coding, line coding, bandpass digital signal transmission.
- Digital modulation: ASK, FSK, QPSK, QAM, I/Q modulation, multilevel modulation.

ET3240 Analog electronics II

3(3-0-1-6)

Content:

- Oscillator: principle, LC circuits, RC circuits, crystal circuits, frequency and amplitude stabilization
- Mixer: frequency converter (up and down), PLL
- Modulation circuit: principle, AM, FM, PSK, FSK circuits
- Detector circuits: theory, parameters, circuits
- Opamp advanced applications: functions generator, NIC, rotator, gyrator, circulator, PI, PID, integrated circuit, non linear circuits
- ADC and DAC: theory and circuits
- Power supply: AC-DC, DC-DC, AC-AC, DC-AC
- Practical electronics circuit design - requirement and examples

ET3280 Propagation and antennas

2(2-1-0-4)

Content: Brief review of electromagnetic field theory: electric and magnetic dipole, elemental electric and magnetic loop, elemental combined and orthogonal dipoles. Linear radiating wire. Self and mutual impedances. Array of dipoles and apertures. Theory of radiation of surface. Antenna synthesis methods. Techniques for controlling radiation pattern, broadening bandwidth, minimizing size, producing circularly

polarized field. Antenna feeding methods and techniques. Radio propagation: radio wave classification, propagation in different media, reflection, refraction and scattering of radio wave. Line-of-sight propagation. Reflection of wave by ground surface and atmospheric layers. Very long distance propagation.

ET3290 Design project I

2(0-0-4-4)

Content: Students work in group of 3 to 5 students to design a software system using C, C++ or Java.

ET3300 Microprocessors

3(3-1-0-6)

Content:

- Introduction: general architecture of a microprocessor and a microprocessor system
- The Intel 8088/8086 microprocessors: Internal structure, 8086 instruction encoding, addressing modes, 8086 instruction set
- 8086 assembly: structure of a program, programming on an IBM PC, control structures, examples
- Basic memory and I/O interface for 8086: supporting ICs for 8086, interfacing 8086 with memory or I/O devices
- Interrupts: Introduction, types, Basic interrupt processing, Priority processing, 8259A programmable interrupt controller
- Direct memory access (DMA): Introduction, Basic DMA operation, The 8237 DMA controller
- CISC and RISC microprocessor design: instruction set, Addressing mode, Instruction execution cycle, design process, CISC microprocessor design. RISC microprocessor design
- Microprocessors in practice: General purpose microprocessors, Digital signal processors (DSP), Microcontroller, PSoC

ET4010 Design project II

2(0-0-4-4)

Content: Students work in group of 3 to 5 students to design a hardware system.

ET3270 Internship

2(2-0-6-4)

Content: Students make the internship at industrial companies on the fields of electronics or communications. At the end of the internship, students should submit final reports.

ET4020 Digital signal processing

3(3-0-1-6)

Content: Transforms. System and signal representation in continuous and discrete frequency region. System stability. Discrete system theory, convolution, spectral analysis; digital filter design: FIR and IIR; quantization effects. Applications to music and speech analysis.

ET4030 Digital system design and synthesis

3(3-1-0-6)

Content: Review of combinational and sequential logic design, strutural models of combinational logic, logic simulation, propagation delay, user defined primitives, behavioral models of combinational and sequential logic, synthesis of combinational and sequential logic, design and synthesis of datapath controllers, arithmetic proessors, postsynthesis design tasks.

ET4250 Communication systems

3(3-1-0-6)

Content:

- Introduction: analog and digital sources, overview of telecommunication systems in Vietnam and in the world
- AM, FM systems: wave propagation, AM systems, FM systems
- Microwave systems: concept, system construction, main technologies, environment effect, quality improve methods, practical systems
- Satellite systems: concept, fundamental knowledge, construction link budget, practical setellite system
- CDMA systems: concept, standard, practical systems
- Mobile phone system: concept, fundamental knowledge, system construction and operation, practical mobile phone system
- Radar and positioning and navigation systems: concept, system construction and operation, practical radar, positioning and navigation systems
- Television: concept, television systems, advanced technologies, practical systems
- Optical fiber: concept, physical phenomenon of light in optical fiber, light emitting devices, photodiode, system, new technologies, practical optical fiber systems
- Data network: introduction, X25, frame relay, ATM, ISDN, ADSL, NGN and other networks
- Telephone network: switch, telephone network operation

ET4040 Computer organization and architectures

3(3-0-1-6)

Content:

- Introduction: history of computers, basic components
- CPU: ALU, Pipelining, CPU Structure, CISC and RISC computers
- Computer memory organization: characteristics of memory systems, memory hierarchy, semiconductor memory (RAM, ROM, PROM, EPROM...), cache memory, virtual Memory
- Storage and peripheral devices: Magnetic storage devices. Optical disks (CD-ROM, CD-RW, DVD-ROM/RW...)
- Peripheral devices: input/Output devices, Interface standards: RS232, USB, and IEEE 1394..., System Buses
- Parallel Computer architectures: overview, Parallel computer architectures, synchronization mechanism, cache coherence, Interconnection networks

ET4050 Computer networks

3(3-0-1-6)

Content:

- Overview: OSI model vs. TCP/IP model. Classification of networks: LAN, MAN, WAN – bus, star, ring, meshed
- Local area networks: performance evaluation of MAC schemes: roll call/hub polling, token ring, token bus, ALOHA, CSMA/CD/CA; layer-2 protocols: LLC, HDLC, SDLC, SLIP/PPP. Layer-2 internetworking: layer-2 addressing (MAC), learning bridge, spanning tree, source routing bridge.
- Layer-3 internetworking: IP, layer-3 addressing, ARP, NAT (Address Translation Table), sub-netting and supernetting, DNS, DHCP, BOOTP. Control protocol: ICMP. Autonomous system. Routing protocols: forwarding table and routing table, table lookup algorithms – RIP, OSPF, BGP. VPN and its applications.
- UDP and TCP: TCP/UDP packet headers, TCP state machine, TCP flow and congestion control, retransmission/fast retransmission. Random Early Discard (RED). Problems when transmitting TCP over wireless networks.

ET4060 Object oriented system analysis and design

3(3-1-0-6)

Content:

- Introduction to systems analysis and design: Introduction, system development life cycle, system development methodologies
- Introduction to object-oriented systems analysis and design with Unified Modeling Language UML: introduction, basic characteristics of object oriented systems, UML, Object oriented system analysis and design
- Planning phase: project identification, project management
- System analysis: requirements determination, functional modeling, structural modeling, behavioral modeling
- System design: evolving the analysis models into design models, models, class and method design, constraints and contracts, method specification, data management layer design, human computer interface layer design, physical architecture layer design
- System implementation: implementation, designing tests, developing documentation, installation and operations.

ET4070 Fundamentals of communication networks

3(3-1-0-6)
Content:

- Queuing theory and teletraffic: M/M/1, M/M/N, M/G/1, M/D/1. Queue networks. Reservation systems; Priority queues;
- Introduction to graph theory. Routing: flooding, random walk, hot potatoes; source routing and minimal spanning tree; shorstest-path routing with Dijktra and Bellman algorithms.
- Flow and congestion control: concept of fairness, window-based flow control, rate-based flow control
- Simulation techniques: discrete-event simulation, generating random numbers, analysis of statistic outcomes; simulation tools.

ET4080 Communication networks

3(3-0-1-6)

Content:

- Overview: communication network components
- Switching methods: circuit switching, packet switching, ATM switching
- Communication networks: ISDN, NGN
- Signaling: Introduction, SS7, IN
- Design of telecom networks

ET4240 Radio Communications

3(3-1-0-6)
Content:

- Theory of radio channel: concept of multipath transmission, channel impulse response, channel transfer function, propagation delay, frequency and time selectivity, Doppler effect, pathloss model, mathematical description of the channel, channel sounding and modeling.
- Channel equalization and interference reduction methods: intersymbol interference, interchannel interference, co-channel interference, multiple access interference, zero forcing filter, least mean square filter, minimum mean square filter.
- Radio Resource Management: frequency re-use, TDD and FDD concept, medium access control, fixed and dynamic channel assignment, ALOHA, CSMA/CD protocol.
- Radio communication system design: Receiver and transmitter structure, RF front end.
- Modulation techniques in air interface: OFDM, CDMA, applications

PH4070 Microelectronics

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

- Introduction: history, micro electronic technology, technical standard of electronic devices, IC classification
- Thin, thick and hybrid film technology
- Planar technology: material preparation, diffusion, ion implantation, epitaxy, vapor deposition, thermal oxidization, metallization, optical lithography, etching, packaging
- Processes for BJT, MOS: well, gate making, biCMOS
- Bipolar Transistor: introduction, current amplifier, early voltage, breakdown voltage, base and collector resistor, frequency respond, switch transistor pnp
- Diode, resistor and capacitor introduction diode schottky Diode resistor capacitor limitation
- Bipolar IC, digital IC, analog IC, DC shifting standard
- MOS capacitor introduction
- MOS transistor: fundamental parameters, long channel approximation, threshold voltage, short channel effect, MOS memory, EPROM, EEPROM
- IC MOS: design rules, NMOS inverter, CMOS inverter

ET4160 Biomedical electronics

2(2-1-0-4)

Content:

- Bioelectricity Fundamentals: Electricity of tissue, membrane transportation, ECG.
- Biomedical signal amplifier circuits: definition of biomedical signals, classification of biomedical signals, biomedical signals processing and receiving, Instrumentation amplifiers, Isolated amplifiers.
- Biomedical instrumentations: functional diagnostic equipment/system, medical imaging diagnostic equipment, therapy equipment, Labor equipment…
- Electrocardiography equipment.
- X-ray equipment: Introduction and classifications, fundamentals of X-rays, X-ray image, X-ray equipment, High- frequency X-ray equipment, fluoroscopy, and digital X-ray. Quality control and safety in X-rays.
- Medical information systems: standards for data in medical information system (HL7, DICOM). Hospital information system HIS, RIS, PACS. Telemedicine.

ET4270 Television

2(2-1-0-4)

Content:

- Fundamental of color and brightness, RGB, YUV, etc. Methods of picture analysis and synthesis in television.
- Picture, sync, frame, line, chrominance, luminance signals.
- Fundamental of color television. Standards of color TV: PAL, NTSC, SECAM.
- Block and schematic diagrams of color TV. Color CRT tube. TV transmitter station. TV studio. Nonlinear TV effects.
- CATV and sattelite TV. Digital TV systems: DVB-T, DVB-C, DVB-S, MMDS.
- Introduction on digital modulation of TV signal: QAM, COFDM. Digital Set-Top-Box.

ET4260 Multimedia

2(2-1-0-4)

Content:

- Fundamental of compression technologies: entropy, RLC, VLC, Huffman
- Audio & Video compression mechanisms and standards: MPEG-1, MPEG-2, MPEG-4, MPEG-7 Video, H.263, H.264; MPEG-1, MPEG-2 Audio, JPEG),
- Model-based Video Coding (MBVC).
- Digital Media: CDR, CDRW, DVD, Digital Camera, Video Camera, WebCam.
- Media Content Creation and Publishing.

- Multimedia networks: VoIP, SIP, RTP, RTCP, RTSP, H.323.

ET4340 VLSI design

3(3-1-0-6)
Content:

ET4090 Microwave engineering

3(3-1-0-6)
Content:

- Microwave transmission line
- Impedance matching and tuning methods
- Microwave network analysis
- Microwave components and circuits: hybrid, filter, resonator, oscillator, power divider, coupler, and amplifier.

xxxxxx German for electronic and communication engineers

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

ET4180 Biomedical material

3(3-1-0-6)
Content: Protein, cell, tissue. Blood coagulation, inflamation, immunity, contamination, infection. Metal, ceramic, composite, polyme, absorable material, natural material. Biological properties of materials.

ET4900 Graduation project

6(0-0-12-12)
Content: doing research project under supervision of instructors. Reseach can be conducted at home, lab at the unversity or companies. Student should submit graduation thesis and defend the results in a committee.