TRƯỜNG ĐẠI HỌC
SƯ PHẠM KỸ THUẬT TP. HỒ CHÍ MINH
KHOA ĐÀO TẠO QUỐC TẾ
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UNDERGRADUATE CURRICULUM MANUAL

ELECTRONIC AND COMMUNICATION ENGINEERING TECHNOLOGY

2021

ELECTRONIC AND COMMUNICATION ENGINEERING TECHNOLOGY

I. CURRICULUM

1st Semester

No.	Code	Course Title	Credit	Prerequisite
1.	IECE130564E	Introduction to ECET	3	
2.	MATH132401E	Calculus 1	3	
3.	PHYS130902E	Physics 1	3	
4.	GCHE130603E	General Chemistry for Engineers	3	
5.	EHQT130137E	Academic English 1	3	
6.	EHQT230237E	Academic English 2	3	
7.	LLCT130105E	Philosophy of Marxism and Leninism	3	
8.	PHED110513E	Physical Education 1	0(1)	
	Total		**21**	

2nd Semester

No.	Code	Course Title	Credit	Prerequisite
1.	AMEE341944E	Applied Mathematics for EEE	4	
2.	MATH132501E	Calculus 2	3	MATH132501E
3.	PHYS131002E	Physics 2	3	
4.	ELCI140144E	Electric Circuit	4	
5.	PHYS110602E	Physics - Lab 1	1	PHYS110602E
6.	LLCT120405E	Scientific socialism	2	
7.	LLCT120314E	Ho Chi Minh’s ideology	2	
8.	PHED110613	Physical education 2	0(1)	
9.	CPRL130064E	C program language	3	
10.	TEEN120145E	Technical English 1	2	

11.	EHQT330337E	Academic English 3	3	
12.	LLCT120205E	Political economics of Marxism and Leninism	2	
	Total		**29**	

3rd Semester

No.	Code	Course Title	Credit	Prerequisite
1.	BAEL340662E	Basic Electronics	4	ELCI240144E
2.	LLCT220514E	History of Vietnamese communist party	2	
3.	MATH132601E	Calculus 3	3	
4.	PHYS111302E	Physics - Lab 2	1	
5.	DIGI330163E	Digital Systems	3	
6.	TEEN230245E	Technical English 2	3	
7.	PHED130715	Physical education 3	0(3)	
8.	EHQT430437E	Academic English 4	3	
	Free Electives	Free Electives of Electronics and Communication Advanced Core 1 (6 Cr)	6	
9.	COEL330264E	Communication Electronics	3	
10.	ELFI230344E	Electromagnetic Field	3	
11.	ACSY330346E	Automatic Control Systems	3	
12.	EMSE232244E	Instrumentation and Sensors	3	
13.	EEMA320544E	Electronic and Electrical Materials	3	
14.	ELIN320444E	Electricity instrument	3	
	Total		**25**	

4th Semester

No.	Code	Course Title	Credit	Prerequisite
1.	SISY330164E	Signals and Systems	3	
2.	MATH131901E	Mathematical Statistics for Engineers	3	
3.	DACO430664E	Data communication	3	
4.	MICR330363E	Microprocessor	3	DIGI330163E
5.	ELPR320762E	Basic Electronics Lab	2	
6.	PRDI310263E	Digital Systems Lab	1	
7.	Integrated-Circuits And Communications (ICC)			
8.	COSY330464E	Communication Systems	3	SISY330164E

9.	ICSD336764E	Integrated Circuits and Systems Design	3	
10.	Industry Electronics System (IES) Area Core			
11.	POEL330262E	Power Electronics	3	
12.	PLCS 330846E	Programmable Logic Controller	3	
	Total		**21**	

5th Semester

No.	Code	Course Title	Credit	Prerequisite
1.	DSPR431264E	Digital Signal Processing	3	
2.	PRMI320463E	Microprocessor Lab	2	MICR330363E
3.	GELA220405E	General Laws	2	
	Integrated-Circuits And Communications (ICC)			
4.	EMSY435664E	Embedded Systems	3	
5.	WCSY431364E	Wireless Communication Systems	3	
6.	VICD436264E	VLSI Circuits Design	3	
7.	DSPL411264E	Digital Signal Processing Lab	1	
8.	ICSL316764E	Integrated Circuits and Systems Design Lab	1	
9.	COSL420764E	Communication Systems Lab	2	
10.	DACL411164E	Data Communication Lab	1	
	Industry Electronics System (IES) Area Core			
11.	EMIN432563E	Embedded Systems in Industry	3	
12.	DSIC330563E	Digital Systems Design with HDLs	3	
13.	PPLC321346E	Programmable Logic Controller Lab	2	
14.	POEP320262E	Power Electronics Lab	2	BAEL340662
15.	IMPR432463E	Image Processing	3	
16.	PRDC312663E	Digital Electronic Circuit Design Lab	1	
	Total		**21**	

6th Semester

No.	Code	Course Title	Credit	Prerequisite
		Humanities/Social Science Elective	2	
1.	GEEC220105E	General Economics	2	
2.	INMA220305E	Introduction to Management	2	
3.	INSO321005E	Introduction to Sociology	2	
4.	IQMA220205E	Introduction to Quality Management	2	
5.	INLO220405E	Introduction to Logics	2	
6.	SYTH220505E	Systems Thinking	2	
7.	IVNC320905E	Vietnamese Culture	2	

	Integrated-Circuits And Communications (ICC)			
8.	EMSL415664E	Embedded Systems Lab	1	
9.	ITFA336064E	IoT: Foundations and Applications	3	
10.	MIEN330364E	Microwave Engineering	3	
11.	ITFL416064E	IoT: Foundations and Applications Lab	1	
12.	ICDL416264E	VLSI Circuits Design Lab	1	
13.	WCSL411364E	Wireless Communication Systems Lab	1	
14.	PRTE411464E	Senior Design Project 1	1	
		Free Electives of ICC Area Core (Choose 2 courses of these courses)	6	
15.	MOCO431864E	Mobile Communication	3	
16.	MICI431964E	Microwave Circuits	3	
17.	FOCO432064E	Optical Communication	3	
18.	DICO432264E	Digital Communication	3	
19.	AWPR330964E	Antenna and Wave Propagation	3	
20.	AICD433164E	Analog Integrated Circuit Design	3	
21.	CONE337764E	Computer and Communication Networks	3	
22.	Industry Electronics System (IES) Area Core			
23.	EMSL412763E	Embedded Systems in Industry Lab	1	
24.	WITE332463E	Wireless Technologies	3	MICR330363
25.	SETE331963E	Sensor Technology	3	
26.	PRIM311063E	Image Processing Lab	1	
27.	PRDS320663E	Digital Systems Design with HDLs Lab	2	DSIC330563
28.	ELPR310863E	Senior Design Project 1	1	
		Free Electives of IES Area Core	6	
29.	CIDE431163E	Electronics Circuit Design	3	
30.	TVMU331563E	Digital Television and Multimedia	3	
31.	MALE331063E	Machine Learning	3	
32.	ITFA336064E	IoT: Foundations and Applications	3	
33.	BISI331863E	Bio-Signal And -Image Processing	3	
34.	ELPS330345E	Electrical Power Supply	3	
35.	SCDA430946E	Data acquisition system and SCADA	3	
36.	INCO331546E	Intelligent Control	3	
37.	BIME331965E	Computer aided Design	3	

	Total	**19**	

7th Semester

No.	Code	Course Title	Credit	Prerequisite
	Integrated-Circuits And Communications (ICC)			
2	PRTE411664E	Senior Design Project 2	1	
3	ATCE423164E	Advanced Topics In ICC	2	
4	INTE443064E	Internship (ICC)	4	
	Industry Electronics System (IES) Area Core			
2	ELPR310963E	Senior Design Project 2	1	
3	ATIE320763E	Advanced Topics In IES	2	
4	INTE344463E	Internship (IES)	4	
	Total		**7**	

8th Semester

No.	Code	Course Title	Credit	Prerequisite
	Integrated-Circuits and Communications (ICC)			
1	CAPR473964E	Capstone Design Project (ICC)	7	
	Industry Electronics System (IES) Area Core			
1	THES474563E	Thesis	7	
	Total		**7**	

II. COURSE DESCRIPTION

Introduction to ECET **Credits: 3**

Prerequisites: None

Course Description: This course provides the learner with the expected learning outcomes for the Electrical and Electronics Engineering Technology education program and framework, as well as the roles, positions, and missions of an engineer in the electrical and electronics engineering field. Training fields and technology will be used whilst studying at the Electrical & Electronics Engineering Technology programme.

Textbook:

Electric Circuits **Credits: 4**

Prerequisites: Advanced Mathematics & General Physics

Course Description: This course provides the learner with basic contents about circuit analysis, established circuit under impact sine, circuit analysis methods, circuit theorems, two-port network, circuit analysis in time-domain, circuit analysis in the frequency domain, and the frequency characteristics of the transfer function.
Textbook:

Basic Electronics **Credits: 4**

Prerequisites: Advanced Mathematics 3 & General Physics
Course Description: This course provides the learner with knowledge of electronic components and the structure and principles of operation of the electronic components. It enables the students to analyse and explain the principle of operation of simple electronic circuits, analyse the frequency response of the amplifier circuit, analyse and design the audio power amplifier circuits, distinguish the type of feedback, analyse and design application circuits using operational amplifier, analyse the principle of operation of the oscillator circuits, and analyse and design the simple DC sources provide electronic circuits.
Textbook:
1) Floyd, Thomas L. *Electronic Devices*. Prentice Hall, 2012.
2) Malvino, Albert. *Electronic Principle*. Mc Graw Hill, 2015

Digital Systems **Credits: 3**

Prerequisites: Basic Electronics
Course Description: This course provides the learner with knowledge of digital systems, the basic logic gate, the fundamental theorem of Boolean algebra, the combinational circuits, the sequential circuit, the basics of digital integrated circuits TTL and CMOS, the characteristic parameters of digital integrated circuits, the classification of integrated circuits, the principle of changing between analog and digital signals, the operational structure and application of the memory, and the principles of the digital oscillator circuit.
Textbook:
1) Maini, Anil K. *Digital Electronics*. John Wily & Sons, 2007
2) Tocci, Ronald J., and Neal S. Widmer. *Digital Systems: Principles and Applications.* 12th ed., Prentice Hall, 2015.

Microprocessor **Credits: 3**

Prerequisites: Basic electronics, Digital Systems
Course Description: This course provides the learner with knowledge of the role and functions of the processor and the processor system; historical development of processor generations and the basic parameters to assess the ability of the processor; the structure and the role of the components in the block diagram of 8-bit microprocessors and principles of operation of 8-bit microprocessors; historical development of microcontrollers; advantages and disadvantages of

using microcontrollers; internal and external structure of 8-bit microcontroller; the function of peripheral devices: timer/counter, interrupts, data transfer of microcontroller, Assembly language, and C language to program the microcontroller.

Textbook:

1) Barnett, Richard H., Sarah Cox, and Larry O'Cull. *Embedded C Programming and the Microchip PIC*. Delmar Publishers Inc., 2003.
2) Bates, Martin P. *PIC Microcontrollers. An Introduction to Microelectronics*. 3rd ed., Newnes, 2011

Embedded Systems in Industry **Credit: 3**

Prerequisites: Microprocessor

Course Description: This course provides students with the necessary knowledge to construct embedded systems with many functions. In addition, students will learn how to combine hardware and software in an embedded system that can be applied in many fields such as industry, agriculture, medical equipment, household appliances, etc. In particular, students will learn more about programme design with codes and functions, simulation of embedded systems, and participate in testing and evaluation.

Textbook:

Image Processing **Credits: 3**

Prerequisites: Programming Language.

Course Description: This course introduces the fundamental knowledge of image processing. This concept includes basic operations on the image domain and its applications. The issues concerning image filtering, image enhancement, segmentation, and edge detection will also be discussed.

Textbooks:

Digital Systems Design with HDLs **Credits: 3**

Prerequisites: Digital System

Course Description: This course provides knowledge of various device technologies and how to apply the HDL to describe basic circuits in digital systems. The basic device technologies taught in this course include ASIC, FPGA, and PLD. The Very High Speed Hardware Description Language (VHDL) is applied to design combinational circuits and sequential circuits in digital systems. After acquiring the basic structures of IC design in VHDL, the tasks are moved to a higher level by concentrating on the optimization of timing and resources in order to get the suitable required performance of the IC circuits. The two main optimization methods being provided to students are operating sharing and functionality sharing. Moreover, the Finite State Machine (FSM) model is provided to design large sequential digital systems using VHDL.

Finally, students are able to use the simulation software supported by Xilinx and Altera co-operations to verify the functions of designed IC circuits.
Textbook:

Advanced Microprocessor **Credits: 2**

Prerequisites: C Programming Language
Course Description: This course provides the knowledge of 32-bit ARM cortex microcontrollers, a family of powerful microcontrollers, fully integrated, from basic to advanced. This course will help future graduates get better job opportunities due to current social needs and high demand in the ARM programming field.
Textbook:

Electronics Circuit Design **Credits: 1**

Prerequisites: Electronic Circuits, Basic Electronics
Course Description: This course provides students with the basic and advanced knowledge of electronic circuits design and real applications, such as amplifiers with small signals, power amplifiers, filters, and power supply circuits. In particular, students will learn how to design electronic circuits of digital and analog systems with active and passive devices.
Textbook:

Bio-Signal and Image Processing **Credits: 3**

Prerequisites: Digital Signal Processing, Digital Image Processing, Programming Languages, Circuit Simulation and System.
Course Description: This course provides students with knowledge of bio-signal and –image processing, such as EEG, EMG, fNIRS, CT-Scanner and MRI. This course also instructs students on the basics of bio-signals and bio-images and the operators related to the processing of bio-signals and bio-images. These operators include transformations, filtering, feature extractions, and neuron networks.
Textbook:

Machine Learning **Credits: 3**

Prerequisites: Programing Language
Course Description: This course provides students with fundamental knowledge about pattern recognition and machine learning. This course introduces fundamental supervised and unsupervised learning algorithms as well as the recommendation system.
Textbook:

Digital Television and Multimedia **Credits: 2**

Prerequisites: Basic electronics

Course Description: This course provides students with the following contents: systems of audio and video signal processing and simulation of audio and video signal processing.
Textbook:

Wireless Technologies **Credits: 2**

Prerequisites: Signals and Systems
Course Description: This course provides students with knowledge of popular wireless technologies such as Wi-Fi, Bluetooth, ZigBee, NFC, and RFID. Students will also learn about the basics of radio information, including band, modulation techniques, multi-access techniques, etc. In each wireless technology, security and application issues of that technology will also be introduced.
Textbook:

Computer-Aided Design **Credits: 3**

Prerequisites:
Course Description: This course aims to provide learners with basic knowledge in the technical design process and the skills to use software in order to design, assemble and export technical drawings for products with Basic block shape. In addition, learners are also equipped with knowledge and design skills to meet machining methods.
Textbook:

Sensor Technology **Credits: 3**

Prerequisites: Basic Electronics
Course Description: The use of different types of sensors increases rapidly in modern technology. Currently, many sensor-related applications are found in many different areas, including environmental technology, manufacturing technology, auto industry, and biomedical technology. The content of this course focuses on the theoretical basis, working principles, and applications of different types of sensors. In addition, this course also covers measurement techniques, sensor processing, and sensor measurement system.
Textbook:

Practice of Digital Systems **Credits: 1**

Prerequisites: Digital System
Course Description: This course instructs students on how to use digital electronic circuits such as logic gates, Flip-Flops, counters, registers, integrated circuit designs and sequential circuits, memory ICs, ADC, DAC circuits, and applications.
Textbook:
1) Maini, Anil K. *Digital Electronics*. John Wily & Sons, 2007.
2) Tocci, Ronald J., and Neal S. Widmer. *Digital Systems*: *Principles and Applications*. 12th ed., Prentice Hall, 2015.

Practice of Microprocessor **Credits: 2**

Prerequisites: Digital System

Course Description: This course gives students hands-on experience programming the microcontroller used to control objects to display information such as LED, LED 7-segment, LCD, GLCD, and matrix LED. The students will also get the opportunity for practical work related to the input objects such as buttons, keyboard matrix, temperature sensors, distance measurement sensor, motion sensor, and communication devices such as standard I2C real-time clock, serial EEPROM memory, ADC/DAC, as well as counting pulses and counter, timing control and timer, step motor and DC motors control, and PWM modulation.

Textbook:

1) Barnett, Richard H., Sarah Cox, and Larry O' Cull. *Embedded C Programming and the Microchip PIC*. Delmar Publishers Inc., 2003.
2) Bates, Martin P. *PIC Microcontrollers. An Introduction to Microelectronics*. 3rd ed., Newnes, 2011

Practice of Digital Electronic Circuit Design **Credits: 1**

Prerequisites: Digital Systems.

Course Description: This course provides students with the opportunity for practical work regarding the design, simulation, and construction of digital electronic circuits such as EPROM, counting circuit, combinational circuit, semiconductor memory, and other practical application circuits.

Textbook:

Practice of Embedded Systems in Industry **Credits: 1**

Prerequisites: Embedded Systems in Industry

Course Description: This course instructs students on how to do embedded systems and analyse their operation. Moreover, students will get the opportunity to design microcontroller-based embedded systems and learn how to interface between hardware and software. In particular, students will do applications with functions including audio, data acquisition, and communication systems in the industry.

Textbook:

Practice of Image Processing **Credits: 1**

Prerequisites: Image Processing

Course Description: The image processing lab aims to offer students practical knowledge and skills. Students will practice image processing tasks on computers with software (Matlab), camera systems and microprocessor hardware (Raspberry modules). In addition, they will design a small system for obstacle recognition.

Textbook:

Practice of Digital Systems Design with HDLs **Credits: 2**

Prerequisites: Digital IC Design Using HDL, Digital Systems
Course Description: This course instructs students on the whole process of combinational and sequential circuit designs using VHDL. The students first design digital IC systems in VHDL hardware description languages on EDA software supported by Xilinx and Altera. The functions of the designed digital systems are then verified by simulation software before being tested on FPGA platforms.
Textbook:

Internship (IES) **Credits: 2**

Prerequisites:
Course Description: This course prompts students to consider problems in the real working environment and manufacture chains in companies/industrial zones related to electric and electronics engineering. In addition, it helps students consolidate both professional knowledge and professional skills for improving and developing their careers.
Textbook:

Senior Design Project 1 **Credits: 1**

Prerequisites: Digital Systems, Electronic Circuits.
Course Description: This course requires students to conduct an application circuit by applying the knowledge gained previously in subjects such as Electronic Circuits, Digital Systems, and Microprocessor. Furthermore, this course helps students improve their ability to research documents, write reports, and make a presentation in front of the grading council.
Textbook:

Senior Design Project 2 **Credits: 1**

Prerequisites: Digital Systems, Electronic Circuits, Microprocessor
Course Description: This course requires students to conduct a larger application circuit than the Senior Design Project 1 course, by applying the previous knowledge in subjects such as Electronic Circuits, Digital Systems, Microprocessor, Digital IC Design Using HDL, and Programmable Logic Controller. Furthermore, this course helps students improve their abilities to research documents, write reports, and make a presentation in front of the grading council. Finally, this course helps students to prepare for their graduate thesis.
Textbook:

Power Electronics **Credits: 3**

Prerequisites: Electrical Circuits; Basic Electronics; Electric Machines, Electricity Instrument; Electrical Measurement and Instruments.
Course Description: This course provides learners with specialized knowledge of basic power electronic accessories. The students will be introduced to the following topics: the structure, operating principles, waveform and parameters, the uncontrolled and controller rectifier circuits,

modified circuit, switching voltage AC, transforming DC voltage, inversing and selecting the DC power supply.

Textbook:

1) Mohan, N., T. M. Underland, and W. P. Robbins. *Power Electronics: Converters, Application and Design*. 3rd ed., John Wiley, 2003.

Automatic Control Systems **Credits: 3**

Prerequisites: Electrical Circuits, Electrical Measurement and Instruments, Complex Functions and Laplace Transforms, Basic Electronics

Course Description: This course provides the learner with knowledge of the components of an automatic control system and the method of building mathematical models of the automatic control system including: transfer function, signal graph and equation of state, the problem of control and observation, the stable survey methods of automatic control systems, survey methods of quality of control system (accuracy, time domain, frequency domain), and the design methods of automatic control system.

Textbook:

1) Golnaraghi, Farid, and Benjamin C. Kuo. *Automatic Control Systems*. 9th ed., John Wiley & Sons, Inc., 2009.

2) Nise, Norman S. *Control Systems Engineering*. 6th ed., John Wiley & Sons, Inc., 2010.

Practice of Basic Electronics **Credits: 2**

Prerequisites: Basic Electronics

Course Description: In this course, learners will be introduced to instruments in electronics and will engage in the following practical activities: recognition of basic electronic components such as R, L, C, diode, BJT, FET, Opam; verification of basic application circuits of the electronic components in theory and reality, analysis of circuit operation, and analysis of operation of basic electronic circuit.

Textbook:

1) Kybett, Harry, and Earl Boysen. *All New Electronics Self-Teaching Guide.* 3rd ed., Wiley Publishing, Inc. 2008.

Practice of Power Electronics **Credits: 2**

Prerequisites: Basic Electronics, Electronic and Electrical Materials

Course Description: This course provides learners with knowledge about the installation of circuits, operating of circuits, waveforms of circuits, DC-DC converter, DC-AC converter, AC-DC converter, and IGBT. The learners will be able to recognise and repair faults in the power electronics system, and design PWM circuits.

Textbook:

1) Arora, O. P. *Power Electronics Laboratory: Theory, Practice, and Organization*. Alpha Science International Ltd., 2006.

Practice of Programmable Logic Controller **Credits: 2**

Prerequisites: Programmable Logic Controller

Course Description: This course provides learners with knowledge about sensors connecting to controllers. The learners will have the opportunity to design and choose programmable equipment and program for demanding industrial systems.

Textbook:

1) Anderson, Gary D. *PLC Programming Using RSLogix 500: Ladder Logic Diagnostics & Troubleshooting*. Createspace Independent Publishing Platform, 2015.
2) Pawla, Andrzej M. *Sensors and Actuators In Mechatronics: Design And Applications*. CRC Press, 2006.

Data Communication **Credits: 3**

Prerequisites: Signals and Systems, Electromagnetic Field, C Programming Language

Course Description: This course will explore the various types of data communication systems, networks, and their applications. Concept and terminologies such as computer networks, layer architecture (OSI, TCP/IP), network hardware, network software, standardization, network medium, and IP addressing will be explored. The practical aspect will deal with building small to medium level networks including Cabling, Configuring TCP/IP, Peer to Peer networking, and sharing resources.

Textbooks:

1) Forouzan, Behrouz A. *Data Communication and Networking.* 5th ed., McGraw Hill International Edition, 2012.

References:

1) Halsall**,** Fred. *Data Communications, Computer Networks and Open Systems. 4*th ed., Addison-Wesley, 1995.
2) Stallings, William. *Data and Computer Communications*. 10th ed., Prentice Hall, 2014.

Digital Signal Processing **Credits: 3**

Prerequisites: Signals and Systems, Electromagnetic Field, C Programming Language.

Course Description: This course provides the fundamentals of the analysis and representation of discrete-time signal systems, including discrete-time convolution, difference equations, the z-transform, and the discrete-time Fourier transform. Emphasis is placed on the similarities and distinctions between discrete-time. The course proceeds to cover digital network and nonrecursive (finite impulse response) digital filters. It concludes with digital filter design and a discussion of the fast Fourier transform algorithm for computation of the discrete Fourier transform.

Textbook:

Signals and Systems **Credits: 3**

Prerequisites: Electromagnetic Field, C Programming Language, Basic Electronics.

Course Description: This course covers the fundamentals of signal and system analysis, focusing on representations of continuous-time signals (singularity functions, complex exponentials and geometrics, Fourier representations, Laplace transforms) and representations of linear, time-invariant systems (difference and differential equations, block diagrams, system functions, poles and zeros, convolution, impulse and step responses, frequency responses). Applications are drawn broadly from engineering and physics, including feedback and control, communications, and signal processing.
Textbook:

Microwave Engineering **Credits: 3**

Prerequisites: Signal and System, Basic Electronics, Communication Electronics, Digital signal processing.
Course Description: The topics presented in this course include transmission line equations, reflection coefficient, VSWR, return loss, and insertion loss. The students will be given demonstration through examples including impedance matching networks using lumped elements, single-section and multi-section quarter wave transformers, single-stub and double-stub tuners, the design of directional couplers, and hybrids.
Textbook:

Communication Systems **Credits: 3**

Prerequisites: Signal and System, Basic Electronics, Communication Electronics, Digital signal processing.
Course Description: This course introduces the basic principles and concepts needed to design modern digital communication systems. The presented topics include major components of a communication system, various communication channel models, basic transmitter and receiver designs (baseband signal, bandpass signal, Q-signal, I-signal, modulation/demodulation process), various digital modulation techniques (PAM, PSK, QAM, FSK, NRZ, CPM, GMSK), optimum detection and error probability analysis for various modulation schemes, non-coherent detector, carrier and symbol synchronization (carrier phase and symbol timing recovery), channel capacity and channel encoding/decoding (error-correction codes, basic linear block codes, convolutional codes, TCM, Viterbi decoding algorithm).
Textbook:

Mobile Communication **Credits: 3**

Prerequisites: Signal and System, Data communication, Communication Electronics, Wireless Communication Systems.
Course Description: This course will cover recent developments in wireless communication systems. Several cutting-edge wireless communication systems and the technologies behind these systems will be discussed. The topics to be covered are listed as follows: Fundamentals of Wireless Communications, Wireless Transmission for Digital TV and Mobil TV, LTE / LTE-A

Cellular System, Near Field Communications, Underground Wireless Communications, and Underwater Wireless Communications.
Textbook:

Antennas and Wave Propagation **Credits: 3**

Prerequisites: Signal and System, Basic Electronics, Communication Electronics.
Course Description: This course deals with the analysis and the design of antennas and their application to specific wireless systems. The course begins with an overview of the fundamental electromagnetic principles underlying wave propagation and antennas. The following topics include base station and handset antennas, antenna parameters (power pattern, directivity, effective aperture, radiation resistance), antenna impedance, antenna arrays, frequency independent antennas, log-periodic and spiral antennas, microstrip antennas, and horn and satellite antennas.
Textbook:

High Frequency Circuits **Credits: 2**

Prerequisites: Signal and System, Communication Electronics, Wireless Communication Systems.
Course Description: This course examines microwave engineering with a strong emphasis on circuits. Initial topics include transmission line equations, reflection coefficient, VSWR, return loss, and insertion loss. Examples include impedance matching networks using lumped elements, single-section and multi-section quarter-wave transformers, single-stub and double-stub tuners, the design of directional couplers, and hybrids.
Textbook:

Optical Communication **Credits: 3**

Prerequisites: Signal and System, Basic Electronics, Communication Electronics.
Course Description: This course is a survey of optical communications, and provides information on the propagation medium (the fiber), lasers and detectors, passive components, optical amplification, and telecommunication systems.
Textbook:

Digital Communication **Credits: 3**

Prerequisites: Communication Systems
Course Description: This course provides students with basic concepts of digital communication systems such as block diagram of digital communication, transmission channel, source coding, channel coding, carrier synchronization problem, channel capacity, optimal receivers with AWGN noise, equalizer, multi-channel systems, multi-carrier systems, multi-user systems, spread spectrum techniques, etc.
Textbook:

Integrated Circuits and Systems Design **Credits: 3**

Prerequisites: Digital system
Course Description: This course provides students with knowledge of digital circuit design process, digital circuit design steps, and application of IC design (ASIC). The course also provides knowledge of hardware description languages to design combinational circuits, sequential circuits, synchronous and asynchronous sequential circuits, and finite state machines.
Textbook:

VLSI Circuits Design **Credits: 3**

Prerequisites: Advanced Digital Systems Design
Course Description: This course provides students with the concepts of modern VLSI design at CMOS level. In addition, learners will set up complex CMOS systems with high performance from RTL to the electronic circuit level.
Textbook:

Internet of Things: Foundations and Applications **Credits: 3**

Prerequisites: Embedded Systems
Course Description: This course provides students with the concepts of IoT which focuses on platforms (hardware platforms and application software platforms that can be applied in IoT), M2M protocols (transfer protocols applied in IoT: Zigbee, Bluetooth, IEEE 802.15.4, IEEE 802.15.6, IEEE 802.15.11), and data and information processing mechanisms.
Textbook:

Advanced Topics in Communication **Credits: 3**

Prerequisites: Finish all specialized courses
Course Description: This course introduces selective topics being applied now in the communication field. It focuses on research overview and analysis, evaluation of technology and technical methods, and the intensive theories of the communication field. Common practical matters are also presented and discussed in class. Detailed contents of this course can be changed by selecting specialized topics. These topics include overview introduction of communication networks, details about Public Switched Telephone Network (PSTN), principles of WCDMA system, SDH HiT 7070 transmission, NGN, radio optimization, power system, KPI, MPLS, etc. Finally, the results of the overview analysis and evaluation will be included in research topics that are suitable for students.
Textbook:

Senior Design Project 1 **Credits: 3**

Prerequisites: Basic Electronics, Digital Signal Processing, Digital Systems
Course Description: This course introduces principles and practices of product designs including specifications, evaluation of design solutions, technical reports, and presentations. The course also covers topics such as intellectual property, industry standards and conventions, technical

economics, reliability, safety, technical ethics, and current topics in the electrical engineering field.
Textbook:

Senior Design Project 2 **Credits: 3**

Prerequisites: Senior Design Project 1, Embedded Systems, Communication Systems, Internet of Things: Foundations and Applications
Course Description: This course provides practical and specialized knowledge of product designs focusing on specifications, evaluation of design solutions, technical reports, and presentations.
Textbook:

Computer and Communication Networks **Credits: 3**

Prerequisites: Data Communication, Communication Systems.
Course Description: This course provides students with knowledge about communication-computer networks, network services, protocols in TCP / IP model, network devices (hub, switch, router, etc.), fixed network systems, services in telecommunications networks, etc.
Textbook:

Analog Integrated Circuit Design **Credits: 3**

Prerequisites: Digital Systems Design with HDLs.
Course Description: This course helps students to design analog IC applications such as amplifiers, current mappers, differential amplifiers, voltage references, current mirrors, charge pumps, DRAM, SRAM, flash memory, etc. while considering constraints such as area, energy efficiency, gain, stability, and frequency response. The course analyses technical solutions of advantages and disadvantages to provide the optimal circuit technique solutions.
Textbook:

Practice of Embedded Systems **Credits: 1**

Prerequisites: Embedded Systems.
Course Description: This course equips students with the information needed to understand the embedded system architectures, the principles of embedded operating systems, real-time operating systems, I / O structures, memory, and embedded programming. This course also provides learners with the knowledge and skills to be able to build and develop applications on the embedded kit. In addition, this course helps learners to formulate proper behaviour in the programming process.
Textbook:

Practice of Data Communication **Credits: 1**

Prerequisites: Data Communication, Basic Electronics Practice.
Course Description: This course equips learners with the basic skills in cable pressing techniques, utilizations of line code simulation software, ability to analyse, install, and test bandpass and baseband data transmission systems through different transmission environments.

Textbook:

Internet of Things: Foundations and Applications Practice **Credits: 1**

Prerequisites: Internet of Things: Foundations and Applications, Embedded Systems.
Course Description: This course provides students with the skills to use the operating system platforms used for IoT systems. In addition, students will explore the IoT application system in many different areas based on the basic components of the IoT system including the central processor, communication standard, data communication protocol, and webserver.
Textbook:

Practice of VLSI Circuits Design **Credits: 1**

Prerequisites: VLSI Circuits Design.
Course Description: This course provides students with the knowledge and skills in the field of integrated circuit design based on CMOS technology, methods design, and analysis of analog circuits and digital circuits using tools and simulation software.
Textbook:

Practice of Wireless Communication Systems **Credits: 1**

Prerequisites: Communication Systems, Wireless Communication Systems
Course Description: This course provides students with the opportunity for practical work related to the wireless channel models, the effects of Fading and ISI on wireless transmission performance, multi-carrier systems, OFDM, spectrum spreading techniques, MIMO, and multi-user system.
Textbook:

Practice of Digital Signal Processing **Credits: 1**

Prerequisites: Digital Signal Processing
Course Description: This course provides students with the skills to use Matlab software to simulate continuous time signals and discrete time signals. Through the simulation of signals, students can analyse, design, and evaluate continuous and discrete time systems on both time and frequency domains. In addition to Matlab simulations, students are also able to analyse and evaluate discrete systems on dedicated DSP kits of Texas Instruments such as C6713 DSK, C6416 DSK, and C6437 EVM.
Textbook:

Practice of Integrated Circuits and Systems Design **Credits: 1**

Prerequisites: Advanced Digital Systems Design.
Course Description: This course provides students with knowledge and skills in digital circuit designs using Verilog hardware description language. The course also equips students with skills in the utilization of tools to design and simulate combinational circuits, sequential circuits, synchronous and asynchronous circuits, and finite state machines.
Textbook:

Practice of Communication Systems **Credits: 1**

Prerequisites: Communication Systems, Basic Electronics Practice
Course Description: This course provides learners with basic skills in analysing operational principles, measuring parameters, examining and repairing analog modulation systems and analog demodulation systems (AM, FM), digital modulations and demodulations (ASK, FSK, PSK, etc.), pulse modulations (PAM, PWM, PPM, etc.), multiplexing and demultiplexing (FDM, TDM), and other systems.
Textbook:

Internship (ICC) **Credits: 2**

Prerequisites: Senior Design Project 2
Course Description: This course aims to provide students with opportunities to explore career interests while applying the knowledge and skills they have acquired in the classroom into the work environment. This internship also helps students to gain a better understanding of potential gaps in knowledge and create opportunities to build a professional network.
Textbook:

Capstone Design Project (ICC) **Credits: 7**

Prerequisites: All subjects in the training program
Course Description: Capstone design project provides students with in-depth knowledge and skills in project management and significant experience in developing, designing, prototyping, proving, and verifying their design. Capstone design project must be related to the field of electronics engineering, computer engineering, or communications engineering. Students choose a project from the published list of capstone design projects by capstone design project coordinators. Each capstone design project is executed by a group of two or three students. A faculty advisor will be assigned to each design project to supervise and guide the project throughout its duration.
Textbook:

Programmable Logic Controller **Credits: 3**

Prerequisites: Digital Systems
Course Description: This course provides students with knowledge of sensors, actuators, PLC hardware, and PLC operation. In addition, students will learn programming languages, PLC instructions, as well as how to design a flowchart for a control system. Finally, the course provides students with an understanding of how to design the hardware and program the software for an industrial system.
Textbook:

Power Supply System **Credits: 3**

Prerequisites: Circuits, Electric Machine, Electric-Electronic Instruments; Electronic Measurement and Instrumentation; Electrical Safety

Course Description: This course equips learners with knowledge about the method for determining the load calculation and the ability to calculate voltage loss, power loss, and short circuit calculations, as well as select the number and transformer capacity. The students are also introduced to the concepts of diagrams distribution substations and redundant power, function and operating principle of the switchgear, medium and low voltage protection, the method selected conductors, cables, switchgear protect-sectioning measurement, distribution cabinet low and medium voltage, offset low voltage network power plant, and industrial lighting calculations.
Textbook:
1) Sivanagaraju, S. *Electric Power Transmission and Distribution*. Pearson, 2008.
Reference books:
1) Gonen, T. *Electric Power Distribution Engineering*. 3rd ed., 2008.
2) McDonald, John D. *Electric Power Substations Engineering*. CRC Press, 2012.
3) Miller, Robert, and James Malinowski. *Power System Operation*. 3rd ed., McGraw Hill, 1994.
4) Pansini, Anthony J. *Electrical Distribution Engineering*. 3rd ed., Fairmont Press, 2006
5) Short, T. A. *Electric Power Distribution Equipment and Systems*. CRC Press, 2004*:*

Data Acquisition System and SCADA **Credits: 3**

Prerequisites: Digital systems, Electric Circuit
Course Description: This course provides students with knowledge of the structure, classification, and application of the data acquisition system and control. The topics of the processing and operating principle of the signal processing unit, the practical signal processing units, and the programming technics are introduced in order to collect the data in real systems. Furthermore, students are introduced to knowledge of the SCADA system and some specific software to design the SCADA system.
Textbook:

C Programming Language **Credits: 3**

Prerequisites:
Course Description: This course provides an introduction to computing and program development in the C programming language with a brief introduction to basic computer concepts while studying the syntax and semantics of the basic control structures of C, learning C's fundamental data types, structures, and pointer, understanding the design and methodical construction of computer programs, learning how to test and debug programs, etc.
Textbook:
1) Deitel, Paul, and Harvey Deitel. *C: How to Program.* 7th ed., Pearson, 2012.