1.2. School of Electronics, Telecommunication and Computer Engineering

General Information

The School of Electronics, Telecommunication, and Computer Engineering offers programs that are suited to educate the leaders of high-tech industries that are yet to come as well as those of today. The courses offered to freshmen mainly consist of introductions to the basic principles that are commonly desired by all specializations in the school. Courses will help students understand the courses required to major: Electronics and Avionics Engineering, Information and Telecommunication Engineering, and Computer Engineering. At the end of the first year, each student should select an area which he/she will pursue as his/her major for the remaining school years.

The School puts an emphasis on cultivating creative thinking in the minds of students as well as promoting problem solving skills. The curricula offer students many opportunities to obtain hands-on experiences. Students are offered the opportunities to participate in experiments in addition to acquiring knowledge gained from classroom lectures. The curricula undergo major and regular reviews to keep them up to date and keep the program competitive with the new technologies appearing in electronics, avionics, telecommunication, and computing areas. After graduation, graduates can join industry and research centers, aircraft and satellite industries, civil and government institutes, broadcasting companies, software developing companies, domestic and foreign airline companies. Students can also choose to continue their studies in master's or doctoral programs in the graduate school for more professional research in their respective field.

Objectives

Electronics and Avionics Engineering Major

The Electronic Engineering and Avionics major prepares students for the 21st century of high advanced technology and the air age with a well-balanced education in theory and practice in the area of Electronic Engineering and Avionics. Since Avionics is an integrated discipline of many areas of electrical engineering, the curriculum is designed to cover the basics of electrical engineering and offer highly technological disciplines: microelectronics and circuits, computers and digital systems, telecommunications and signal processing, automatic control and robotics, electromagnetic waves and antennas, and image processing and artificial intelligence, satellite navigation and radar systems. In order to meet the demand

from high-tech industries and research institutes, the program also offers special projects which introduce state-of-the-art technologies in Electronic Engineering, and their integration schemes in the area of Avionics.

After graduation, students can find career positions as practicing engineers in a variety of electronic, information and telecommunication, and aviation industries or can pursue advanced research at the graduate level in the department.

Information and Telecommunication Engineering Major

The Information and Telecommunication Engineering Major aims to train students to become creative and competent engineers in the field of information and telecommunication engineering. Students study the basic theories and techniques for information and telecommunication engineering through various practical experiments. Courses in this major two sub-fields, wireless communication are divided into the field and the information-telecommunication field. The first field focuses on mobile telecommunication, satellite communication, optical communication, broadcasting, and microwave communication. The second field concentrates on computer communication topics such as computer networks, switching engineering, computer architecture, operating systems, and data communication. Students may go on to manufacturing companies, government and research centers, or continue on their studies in masters and doctoral programs of the graduate schools.

Computer Engineering Major

The Computer Engineering Major aims to educate students to become creative and competent engineers in computer science and engineering. Students study theories and applications of computer systems, cultivating computer programming skills and problem solving abilities in various computer applications. The courses encompass all aspects of computer systems and applications including computer architecture, operating systems, algorithms, database systems, software engineering, internet computing, computer graphics and various programming languages. Graduates of the Computer Engineering Major can advance into information technology industries, financial companies, research institutes, or continue their studies in graduate schools to deepen their knowledge in advanced computer technologies, including parallel and distributed processing, databases, object-oriented systems, internet computing, artificial intelligence, simulation, multimedia, network security, and computer graphics.

Courses Offered

*Remarks:

1) Listed after the course title are the academic year-semester, and credit hour(credit)

<Electronics and Avionics Engineering Major>

Required core courses

EC7101 Computer Programming I 4(3) 1-1 EC7104 Computer Programming II 4(3) 1-2 RC7130 Differential Equation 3(3) 1-2

Required major courses

EC3101 Introduction to Engineering Design 3(3) 1-2 EA3212 Applied Engineering Mathematics I 3(3) 2-1 EA3205 Electric Circuits I 3(3) 2-1 EA3204 Electromagnetics I 3(3) 2-1 EA3207 Electronic Circuits Laboratory I 4(2) 2-2 EA3213 Applied Engineering Mathematics II 3(3) 2-2 EA3302 Electronic Circuits Laboratory II 4(2) 3-1 EA3303 Electronic Circuits I 3(3) 3-1 EA3305 Electronic Circuits Laboratory III 4(2) 3-2 EA3306 Electronic Circuits II 3(3) 3-2 EA3308 Electronic Circuits II 3(3) 3-2 EA3308 Electronic Circuits Design 3(3) 3-2 EA3401 Capstone Design I 3(3) 4-1

EA3402 Capstone Design II 3(3) 4-2

Elective major courses

- EA4409 Introduction to Avionics 3(3) 2-1
- EA3209 Electric Circuits II 3(3) 2-2
- EA3208 Electromagnetics II 3(3) 2-2
- EA4201 Semiconductor Physics 3(3) 2-2
- EA4203 Probability and Random Process 3(3) 2-2
- EA4204 Digital Logic Design 3(3) 2-2
- EA4309 Analog Communications Systems 3(3) 3-1
- EA4310 Semiconductor Device Engineering 3(3) 3-1
- EA4311 Signals and Systems 3(3) 3-1
- EA4302 Computer Architecture and Microprocessor 3(3) 3-1
- EA4312 Introduction to Display Engineering 3(3) 3-1
- EA4305 Digital Communications 3(3) 3-2
- EA4307 Microwave Engineering 3(3) 3-2
- EA4306 Digital Avionics 3(3) 3-2
- EA4304 Control System Design 3(3) 3-2
- EA4413 Radar Engineering 3(3) 4-1
- EA4414 Autonomous Navigation Systems 3(3) 4-1
- EA4407 Digital Signal Processing Design 3(3) 4-1
- EA4408 Antenna Engineering 3(3) 4-1
- EA4415 Semiconductor Process Engineering 3(3) 4-1
- EA4416 Introduction to Robot Engineering 3(3) 4-1

- EA4417 Introduction to VLSI Systems Design 3(3) 4-1
- EA4418 RF System Design 3(3) 4-1
- EA4422 Aircraft Instruments and Integrated Systems 3(3) 4-1
- EA4410 Satellite Electronics System 3(3) 4-2
- EA4419 Avionics Systems 3(3) 4-2
- EA4405 Introduction to Multimedia Communications 3(3) 4-2
- EA4411 Integrated Circuits Design 3(3) 4-2
- EA4421 Introduction to Image Processing 3(3) 4-2
- EA4457 Introduction to LCD Processes 3(3) 4-2
- EA4412 Remote Sensing Sensor Engineering 3(3) 4-2
- EA4420 Engineering Management 3(3) 4-2

<Information and Telecommunication Engineering Major>

Required core courses

- EC7101 Computer Programming I 4(3) 1-1 RC7131 Computer Programming II 4(3) 1-2
- RC7130 Differential Equation 3(3) 1-2

Required major courses

- EC3101 Introduction to Engineering Design 3(3) 1-2
- IT3213 Basic Electric Circuits Laboratory 4(2) 2-1
- IT3214 Engineering Mathematics I 3(3) 2-1
- IT3203 Electric Circuits I 3(3) 2-1
- IT3204 Electromagnetics I 3(3) 2-1
- IT3210 Digital Logic Design 3(3) 2-2
- IT3209 Programming Laboratory 4(3) 2-2
- IT3303 Electronic Circuits I 3(3) 3-1
- IT3211 Digital Engineering Experiment 4(2) 3-1
- IT3302 Electronic Laboratory 4(2) 3-2
- IT3405 Capstone Design I 3(3) 4-1
- IT3406 Capstone Design II 3(3) 4-2

Elective major courses

- IT4239 Data Structures 3(3) 2-1
- IT4205 Discrete Mathematics 3(3) 2-1
- IT4234 Electric Circuits II 3(3) 2-2
- IT4236 Electromagnetics II 3(3) 2-2
- IT4240 Engineering Mathematics II 3(3) 2-2
- IT4235 Probability and Random Variables 3(3) 2-2
- IT4305 Information Theory 3(3) 3-1
- IT4375 Telecommunication Theory 3(3) 3-1
- IT4374 Operating Systems 3(3) 3-1

- IT4312 Data Communication 3(3) 3-1
- IT4381 Signals and Systems 3(3) 3-1
- IT4378 Microwave Engineering 3(3) 3-2
- IT4376 Computer Networks and Data Communication 3(3) 3-2
- IT4379 Digital Communication 3(3) 3-2
- IT4382 Multimedia Engineering 3(3) 3-2
- IT4380 Computer Architecture 3(3) 3-2
- IT4377 Communication System Programming 4(3) 3-2
- IT4410 Mobile Communication Engineering 3(3) 4-1
- IT4407 Digital Signal Processing 3(3) 4-1
- IT4483 Image Signal Processing 3(3) 4-1
- IT4484 Network Security and Laboratory 3(3) 4-1
- IT4485 Telecommunication Networks 3(3) 4-1
- IT4496 IPTV Theory and Laboratory 3(3) 4-1
- IT4487 Next Generation Communication Systems 3(3) 4-2
- IT4495 Satellite Communication and Broadcasting Engineering 3(3) 4-2
- IT4494 Broadcasting and Communication Systems 3(3) 4-2
- IT4474 Information Security Theory 3(3) 4-2
- IT4492 Mobile Broadcasting Network 3(3) 4-2
- IT4493 Optical Communication and Information Engineering 3(3) 4-2
- IT4490 Aerospace IT Engineering 3(3) 4-2
- IT4491 Engineering Management 3(3) 4-2
- IT4497 Practical Issues in Communication and Broadcasting 3(3)4-2

<Computer Engineering Major>

Required core courses

- EC7101 Computer Programming I 4(3) 1-1
- EC7101 Computer Programming II 4(3) 1-2
- RC7130 Differential Equation 3(3) 1-2

Required major courses

- EC3101 Introduction to Engineering Design 3(3) 1-2
- CE3209 Mathematics for Computer Engineering 3(3) 2-1
- CE3208 Object-Oriented Programming 4(3) 2-1
- CE3205 Digital Logic Design 3(3) 2-1
- CE3202 Data Structures 3(3) 2-2
- CE3211 Computer Network 3(3) 2-2
- CE3211 Digital Logic Laboratory 4(2) 2-2
- CE3209 Statistics 3(3) 2-2
- CE3303 Computer System Architectures 3(3) 3-1
- CE3306 Operating Systems 3(3) 3-1
- CE3308 Software Engineering 3(3) 3-1

CE3301 Programming Languages 3(3) 3-2 CE3304 Introduction to Database 3(3) 3-2 CE3309 Software Design 4(3) 3-2 CE3403 Capstone Design I 3(3) 4-1 CE3406 Capstone Design II 3(3) 4-2

Elective major courses

CE3213 System Programming 3(3) 2-1 CE3215 Introduction to Multimedia System 3(3) 2-1 CE3214 Window Programming 3(3) 2-2 CE3207 Engineering Mathematics 3(3) 2-2 CE4351 Network Programming 3(3) 3-1 CE3307 Analysis and Design of Algorithms 3(3) 3-1 CE4326 Computer Graphics 3(3) 3-2 CE3310 Microprocessor 3(3) 3-2 CE4426 Embedded System Design 3(3) 4-1 CE4427 Data Mining 3(3) 4-1 CE4428 Database Design 3(3) 4-1 CE4452 Artificial Intelligence 3(3) 4-1 CE4455 Information Security 3(3) 4-1 CE4415 Information Retrieval 3(3) 4-2 CE4453 Compilers 3(3) 4-2 CE4456 Web Programming 4(3) 3-2 CE4457 Introduction to Parallel Processing Systems 3(3) 4-2

Course Descriptions

<Electronics and Avionics Engineering Major>

EC7101 Computer Programming I 4(3)

This course is an introduction to computer programming. Topics include the history of computing, basic computer operations, the notion of an algorithm, and programming constructs such as variables, expressions, input/output, branches, loops, functions, parameters, arrays, and strings.

EC7104 Computer Programming II 4(3)

This course is an intermediate course in problem solving and computer programming using the C programming language. The course focuses on the fundamental concepts of problem solving and the techniques associated with the development of algorithms and their implementation as computer programs.

RC7130 Differential Equation 3(3)

The course covers the essential applied mathematics such as first, second and higher order differential equations, the power series method, Legendre polynomials, the Frobenius method, Bessel functions, Laplace transform and its application to engineering problems, and applications to circuit analysis.

EC3101 Introduction to Engineering Design 3(3)

As a preliminary step in engineering design, this course aims to allow students to obtain basic capabilities that may be required to become advanced electrical engineers with in-depth knowledge in the field of electronics and electrical industry. This course will deliver concepts of engineering design procedures and help students to achieve skills on how to approach a given problem with engineering techniques.

EA3212 Applied Engineering Mathematics I 3(3)

This course provides students with fundamental concepts in mathematics for electronics. The course covers vector analysis, the basic theory of complex analysis, and Fourier series.

EA3205 Electric Circuits I 3(3)

This course covers circuit elements, Kirchhoff's law, the node voltage method, mesh current methods, RC circuits, RL circuits, and RLC circuits.

EA3204 Electromagnetics I 3(3)

This course gives an introduction to electrostatics and magnetostatics, vector calculus, concepts and applications of electromagnetic laws, the method of images, boundary-value problems, the relationship between electromagnetics and circuit theory.

EA3207/3302/3305 Electronic Circuits Laboratory I, II, III 4(2)

These courses provide students with theory and laboratory skills along with design projects for basic electronic circuits. These courses cover various diode circuits and power supply circuits, various transistor amplifiers such as cascade amplifiers, push-pull power amplifiers and differential amplifiers, OP Amps with active filters, various oscillators, function generators, digital logic circuits, and modulation and demodulation circuits.

EA3213 Applied Engineering Mathematics II 3(3)

This course covers the applications of complex analysis, Fourier transformation, basic methods for solving partial differential equations, probability and statistics.

EA3303 Electronic Circuits I 3(3)

This course teaches the basic concepts for the analysis and design of electronic circuits.

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Topics include basic models for semiconductor devices, the concept of small-signal analysis, DC and AC characteristics of linear amplifiers, analysis of operational amplifiers, and frequency response of amplifiers.

EA3209 Electric Circuits II 3(3)

This course deals with AC source, three phase network, Fourier transformation, Fourier series, circuit analysis using Laplace transformation, and transformer circuits.

EA3308 Electronic Circuits Design 3(3)

This course deals with integration and measurement skills for applied electronic circuits. Topics include the understanding of microprocessor chips and their control commands, and the application skills for various digital systems with programming languages.

EA3401/3402 Capstone Design I, II 3(1)

These courses teach how to obtain capabilities of creative design and of carrying out a project in a specific area. Topics include concept design, idea development and simulation, system implementations and presentations.

EA4409 Introduction to Avionics 3(3)

This course covers the principles and application techniques on aeronautical communication, air navigation, air traffic control and landing systems for the safe operation of aircraft. The major topics include indicators, horizontal situation indicators, automatic directional finders, flight management systems, integrated electronic display systems, autopilot, flight simulators, area navigation computers, radio altimeters, communication systems and air traffic control.

EA3306 Electronic Circuits II 3(3)

This course focuses on the analysis and design of advanced electronic circuits. It includes the analysis of feedback amplifiers, frequency compensation methods, multi-stage amplifier design, output stage and power amplifier design, and various filters and wave-shaping circuit analysis.

EA3208 Electromagnetics II 3(3)

This course deals with time varying fields, potential functions, solutions of Maxwell's equations, concepts of electromagnetic waves, reflections of plane waves, and the theories and applications of transmission lines.

EA4201 Semiconductor Physics 3(3)

This course is designed to aid in the understanding of the physics of semiconductor devices, basic concepts of quantum physics and solid-state physics including wave and particle properties, energy bands, and carrier densities. It also deals with detailed operations in the p-n junction of semiconductors.

EA4203 Probability and Random Processes 3(3)

This course teaches basic theory on probability and random processes commonly used in

electronic engineering and telecommunication and information engineering. Topics include basic probability theory, discrete random variables and probability distribution functions, expected values, continuous random variables and their functions, Bernoulli, Poisson & Gaussian processes, the central limit theorem, Chebyshev's inequality, bivariate Gaussian distributions, random (stochastic) processes and their application to linear systems.

EA4204 Digital Logic Design 3(3)

This course is designed to provide students with a thorough understanding of digital logic design principles and design processes. The course covers Boolean algebra, basic logic components and manipulation, combinational and sequential logic design, storage components, and practical design examples.

EA4309 Analog Communications Systems 3(3)

This course covers various analog modulation schemes and their performance analyses in AWGN environments. Topics include amplitude modulation (AMDSB), SSB and VSB AM, amplitude shift keying (ASK), quadrature amplitude modulation (QAM), frequency division multiplexing (FDM), phase modulation, narrowband and wideband frequency modulation (FM), PLL circuits, and the performance of analog modulation in AWGN environments

EA4310 Semiconductor Device Engineering 3(3)

This course is an advanced course on semiconductor devices which is designed to teach the operational principle and electrical characteristics of metal-oxids-semiconductors (MOSs) transistors, bipolar junction transistors, semiconductor lasers, p-n-p-n junction diodes, and microwave devices with negative resistance to foster the ability to analyze various electronic circuits.

EA4311 Signals and Systems 3(3)

This course deals with continuous and discrete signals and systems, convolution, impulse response, differential and difference equations, Laplace transformation and its application to network analysis, 2-transformation, transfer function and stability, and courier series and transformation.

EA4302 Computer Architecture and Microprocessor 3(3)

This course provides students with a comprehensive coverage of computers in both hardware and software aspects with emphasis on hardware design and architectural tradeoffs required during the design. Topics include basic concepts of computer architecture, CPUs, BUS systems, the interface of peripheral devices, the management of memory and peripheral devices, instruction codes, the processes of DB, and the processes of distributed and parallel data transmissions.

EA4312 Introduction to Display Engineering 3(3)

This course will begin with an overview of the display market and a discussion of the dominant and emerging FPD technologies. It then covers the basics of human vision and metrics for evaluating display performance. Various display technologies will then be discussed in detail. Topics to be covered include liquid crystal displays, thin-film transistors

for active-matrix displays, field-emission displays, plasma display panels, electroluminescent displays, light-emitting diode displays, and CRT.

EA4305 Digital Communications 3(3)

This course provides students with firm concepts and knowledge on digital communication systems. The course covers various digital modulations/demodulations, data transmission schemes, PCM systems, information theory and data compression theory, coded modulation, and performance of digital communication systems with AWGN environments.

EA4307 Microwave Engineering 3(3)

The objective of this course is to introduce students to the design processes of specific microwave circuits and components such as passive microwave devices, microwave resonators, microwave filters, microwave semiconductor devices, ferrimagnetic components, microwave amplifiers, oscillators and mixers for practical applications. In addition, microwave engineering includes an introduction to microwave systems and distributed circuit analysis to apply the electromagnetic (EM) theory and techniques to practical problems.

EA4306 Digital Avionics 3(3)

This course deals with various subjects in digital avionics systems, such as databases, crew interfaces, power systems, fault tolerance, maintainability, reliability, computer architecture, hardware and software design, assessment and validation.

EA4304 Control System Design 3(3)

This course deals with fundamental concepts and applications of control systems, and their descriptions: state variables and transfer function representations, time response of control systems, stability analysis using Routh-HurwitB criterion, root locus, and Nyquist and Bode methods.

EA4413 Radar Engineering 3(3)

This course introduces the radar concept and principles, operation and applications based on primary ground radar. The major topics include radar fundamentals, radar systems, radar equations, radar target and clutter models, radar detection probability and CFAR detectors, radar antennas, transmitters, receivers, tracking, MTI filtering, radar signal processing, and high resolution radar principles including pulse compression.

EA4414 Autonomous Navigation Systems 3(3)

This course includes the major topics on modern navigation systems such as FANS (Future Air Navigation System), GNSS (Global Navigation Satellite Systems), GPS (Global Positioning System), GPS space segment, GPS control segment, GPS user segment, GPS applications to air navigation, error correction methods, GLONASS, Galileo, WASS, LAAS, INS (Inertial Navigation System), Accelerometers, Gyroscopes, Platforms, and alignments.

EA4407 Digital Signal Processing Design 4(3)

This course provides students with fundamental theory and MATLAB practice of digital signal processing for information and telecommunication areas. The course covers the theory and application of discrete signals and systems, z-transformation, discrete Fourier transformation (DFT), fast Fourier transformation (FFT), design and implementation of finite impulse response (FIR) and infinite impulse response (IIR) filters.

EA4408 Antenna Engineering 3(3)

This course deals with solutions of time-varying Maxwell's equations with application to antennas, concepts of electromagnetic radiation from sources, array antennas, broad-band antennas, and analysis of aperture antennas employing Huygens' Principle.

EA4415 Semiconductor Process Engineering 3(3)

In this course, the basics of semiconductor processing technology for the fabrication of integrated circuits are introduced. It includes various processing steps such as ion implantation, diffusion, oxidation, deposition, and thermal processing. Various methods for measuring impurity profiles and thickness are also understood with simulations and experiments.

EA4416 Introduction to Robot Engineering 3(3)

This course introduces the fundamental concepts of robot engineering, dynamic equations, path planning methods, control schemes, actuators, sensors and robot vision, and the application of robot systems.

EA4417 Introduction to VLSI Systems Design 3(3)

For building system-level design concepts, this course introduces various VLSI system architectures such as microprocessors, DSP and memory, and focuses on studying various system design methodologies and basic computer-added design (CAD) tools as design support.

EA4418 RF System Design 3(3)

The objective of this course is to provide students with a systematic introduction to microwave theory and devices and to familiarize them with microwave technology and measurement skills. In order to simulate real systems enhancing the experience, some training modules and commercially available software are provided with several topics: simulation of coupler, design of dividers/combiners, design of band pass filters, low noise amplifier (LNA) design, the measurement of linear antennas, standing waves, directional couplers, reflection coefficient measurement, and SWR measurement. In addition, as a term-project, each group should choose a topic issued in microwave frequencies, carry out the simulation and measurement of fabricated devices, and present the results with an emphasis on accomplishment, complexity, and creativity.

EA4422 Aircraft Instruments and Integrated Systems 3(3)

This course deals with aircraft instruments and integrated systems including display media, heads up displays, helmet mounted displays, audio and video systems, gyroscopes, inertial

navigation systems, global positioning systems, air data computers, flight management systems, engine control systems, power control systems, and internal broadcasting systems.

EA4410 Satellite Electronics System 3(3)

This class focuses on providing unique opportunities to senior students to understand general satellite systems, operations and their applications. The topics range from the general knowledge on space environments and orbit design to detailed satellite system designs including satellite system engineering, subsystems including telecommunications, C&DH, power, and control and propulsion systems. A practical technique to design, manufacture and test spacecraft systems is discussed and small satellite design examples are analyzed.

<u>EA</u> Aviation Electronic Systems 3(3)

Major topics of the course include conventional radio navigation aids such as VHF omni-directional radio range (VOR), distance measuring equipment (DME), tactical air navigation (TACAN), LORAN, PSR, secondary surveillance radar (SSR), traffic alert and collision avoidance systems (TCASs), search and rescue (SAR), air data computers (ADCs), and modern global navigation satellite systems (GNSSs).

EA4405 Introduction to Multimedia Communications 3(3)

This course covers basic theories and practices in image and speech processing for video communications. Topics include the characteristics of multimedia, principles of data compression and quantization, MPEG and JPEG systems and their international standards with applications.

EA4421 Introduction to Image Processing 3(3)

This course teaches fundamental knowledge in digital signal processing and in particular, understanding theories using a variety of non-contact instrumentation, monitoring, classification, and analysis.

EA4457 Introduction to LCD Processes 3(3)

This course gives an introduction to the fundamental concepts of TFT-LCD processes. PECVD, sputtering, photolithography, dry etching, wet etching, color filters, PI, rubbing, filling, assembly, ODF, and so on are covered during the course.

EA4412 Remote Sensing Sensor Engineering 3(3)

This course covers the concepts and characteristics of remote sensing sensors from various aerospace platforms to ground automotive vehicle platforms for earth environment monitoring and surveillance applications. The active sensors include microwave radar, millimeter wave radar, synthetic aperture radar imaging, UWB radar and passive sensors include the electro-optical camera, IR, thermal imaging, radiometer, and so on. Topics also include multi-sensor fusion, target detection and classifications.

EA4420 Engineering Management 3(3)

This course covers basic concepts and principles in management for modern manufacturing and technology-oriented companies. Topics include characteristics of modern management, managing types, management systems, and types of companies.

<Information and Telecommunication Engineering Major>

EC7101 Computer Programming I 4(3)

This course is an introduction to computer programming. Topics include the history of computing, basic computer operations, the notion of an algorithm, and programming constructs such as variables, expressions, input/output, branches, loops, functions, parameters, arrays, and strings.

RC7131 Computer Programming II 4(3)

This course is an intermediate course in problem solving and computer programming using the C programming language. The course focuses on the fundamental concepts of problem solving and the techniques associated with the development of algorithms and their implementation as computer programs.

EC3101 Introduction to Engineering Design 3(3)

As a preliminary step in engineering design, this course aims to allow students to obtain basic capabilities that may be required to become advanced electrical engineers with in-depth knowledge in the field of electronics and electrical industry. This course will deliver concepts of engineering design procedures and help students to achieve skills on how to approach a given problem with engineering techniques.

RC7130 Differential Equation 3(3)

The course covers the essential applied mathematics such as first, second and higher order differential equations, the power series method, Legendre polynomials, the Frobenius method, Bessel functions, Laplace transform and its application to engineering problems, and applications to circuit analysis.

IT3213 Basic Electric Circuits Laboratory 4(2)

This course deals with the principles of basic electric circuits and measurement skills for advanced experiments in upper grades. Topics include the principles and usage of measurement equipment such as multimeters, function generators and oscilloscopes, the measurement of circuit parameters using oscilloscopes and the proof of network theory, and characteristics measurement of various electronic devices.

IT3214/4240 Engineering Mathematics I II 3(3)

The course covers the essential applied mathematics such as first order differential equations,

second order differential equations, higher order differential equations, the power series method, Legendre polynomials, the Frobenius method, Bessel functions, Laplace transformation and its application to engineering problems, and applications for circuit analysis.

IT3203 Electric Circuits I 3(3)

This course covers circuit elements, Kirchhoff's law, the node voltage method, Mesh current methods, RC circuits, RL circuits, and RLS circuits.

IT3204 Electromagnetics I 3(3)

This course covers Coulom's law and electric field intensity, electric flux density, Gauss's law, divergence, energy and potential, conductors, dielectrics, capacitance, experimental mapping methods, and Poisson's and Laplace's equations.

IT3210 Digital Logic Design 3(3)

This course is designed to provide students with a thorough understanding of digital logic design principles and design processes. The course covers Boolean algebra, basic logic components and manipulation, combinational and sequential logic design, storage components, and practical design examples.

IT3209 Programming Laboratory 4(3)

This course teaches the principles of Windows programming based on Microsoft Windows using the Visual C++ programming tool to improve the development capability for application programs of information and telecommunication engineering. The course covers Windows programming using API and MFC provided by Microsoft.

IT3303 Electronic Circuits I 3(3)

This course teaches the interrelationship between graphical, mathematical, and circuit representations of devices. It also covers how to visualize electronic circuit in terms of functional modules, bias circuits, bipolar junction transistor amplifiers, and field effect transistor amplifiers.

IT3211 Digital Engineering Experiment 4(2)

This course covers digital circuit design methodologies for combinational circuits, sequential circuits, finite state machines, memory blocks, and simple processors. It also covers FPGA prototyping and verification methodologies using hardware description languages.

IT3302 Electronic Laboratory 4(2)

This course deals with the principles of the operation of electrical and electronic test equipment and their application to the measurement of circuit parameters, and transient and steady state response of RSC circuits and diodes, bipolar and field effect transistors, integrated circuits, gain, and bandwidth.

IT3405/3406 Capstone Design Ⅰ, Ⅱ 3(3)

These courses teach capabilities for creative design and for carrying out a project in a

specific area It also covers concept design, idea development and simulation, system implementations, and presentations.

IT4239 Data Structures 3(3)

This course teaches various data structures and algorithms to develop efficient computer programs. It covers data structures such as arrays, linked lists, graphs, and hash tables and basic algorithms such as sorting, searching and so on. Also, it covers the relation of data structures and algorithms, and the concept of time and space complexities.

IT4205 Discrete Mathematics 3(3)

This course provides the basic concepts, results, methods, vocabulary and notation associated with contemporary discrete mathematics. It also covers set theory, concepts of relations, functions and operations, graph theory, and algebra systems.

IT4234 Electric Circuits II 3(3)

This course teaches AC sources, three phase networks, Fourier transformation, Fourier series, circuit analysis using Laplace transformation, and transformer circuits.

IT4236 Electromagnetics II 3(3)

This course deals with steady magnetic fields, magnetic forces, materials and inductance, time-varying fields and Maxwell's equations, uniform plane waves, transmission lines, and several other applications of Maxwell's equations.

IT4235 Probability and Random Variables 3(3)

This course teaches basic theories of probability and random processes commonly used in electronic engineering and telecommunication and information engineering. Topics include principles of counting, axioms of probability, conditional probability, repeated independent events, discrete random variables, probability mass and distribution functions, expected values, continuous random variables, functions of random variables, Bernoulli, Poisson and Gaussian processes, the central limit theorem, Chebyshev's inequality, bivariate Gaussian distribution, multivariate Gaussian distribution, random (stochastic) processes, autocorrelation and powers spectral density, and linear systems and random input.

IT4305 Information Theory 3(3)

This course covers the general concept of information and its application to mathematical processing, the concept of information, information capacity, entropy, discrete channeling, information transmission and channeling, encoding and distortion of information, and channel capacity of discrete and analog communication systems with and without noise.

IT4375 Telecommunication Theory 3(3)

This course covers communication system design and performance analysis. Topics include Fourier analysis, random variables and random (noise) signals, analog modulations (AM, FM, PM) and their performances in noise, and receiver design.

IT4374 Operating Systems 3(3)

This course teaches various concepts of operating systems such as interrupts, system calls, process scheduling, memory management, file system management and deadlocks. It also covers the structure and implementation of practical operating systems.

IT4312 Data Communication 3(3)

This course teaches principles of signal characteristics, modulations, error control mechanisms, and several packet switching networks for data communications.

IT4381 Signals and Systems 3(3)

This course covers fundamental theories of signal and system and the time-domain analysis method on continuous-time and discrete-time systems, Laplace transformation and Z-transformation for analyzing the linear systems on frequency-domain, and Fourier series and Fourier transformation for analyzing the continuous-time signal.

IT4378 Microwave Engineering 3(3)

This course covers transmission lines and waveguides, microwave network analysis, passive microwave devices, microwave resonators, microwave filters, microwave semiconductor devices, active microwave circuits, design of microwave amplifiers and oscillators, and introduction to microwave systems.

IT4376 Computer Networks and Data Communication 3(3)

This course teaches network architecture, protocols, and packet switching mechanisms based on the TCP/IP protocol suite. Students are required to submit several socket programming projects.

IT4379 Digital Communication 3(3)

This course teaches the modulation and demodulation of typical digital modulation methods (ASK, FSK, PSK, QAM), optimum receivers and the error probability caused by noise, and some basic channel coding techniques.

IT4382 Multimedia Engineering 3(3)

This course covers the basic concepts of multimedia and various media technologies such as text, graphics, audio, and video which are being discussed. Students will be required to submit several multimedia programming projects such as multimedia data analysis, synthesis, conversion, and transformation.

IT4380 Computer Architecture 3(3)

This course covers the basic structure of a digital computers, instruction set architectures, the organization of control, arithmetic and logical units, pipelining and other advanced concepts, computer arithmetic, memory systems, computer I/O, and peripheral devices.

IT4377 Communication System Programming 4(3)

This course covers programming techniques such as network programming, concurrent programming and GUI programming to develop communication system programs. It also covers basic concepts of object oriented programming using the JAVA programming language.

IT4410 Mobile Communication Engineering 3(3)

This course covers the various aspects of the mobile communication environment, the propagation of radio waves, noise and interference, structure and control of systems, multiple access, design of radio channels, and CDMA systems.

IT4407 Digital Signal Processing 3(3)

This course teaches general topics of digital signal processing such as digital signals, sampling theorems, Z transformation, FFT and adaptive signal processes.

IT4483 Image Signal Processing 3(3)

This course covers digital image processing algorithms such as image enhancement, color image processing, image transformation, and image segmentation. It also covers image data compression and pattern recognition.

IT4484 Network Security and Laboratory 3(3)

This course focuses on various security protocols for virtual private networks, which covers Kerberos, S/MIME, SSL/TLS, IPSec, WEP, RADIUS, PAP, CHAP, and EAP. In addition, the course deals with fundamental security mechanisms such as encryption, data integrity, authentication, and public key infrastructure with public certificates.

IT4485 Telecommunication Networks 3(3)

This course covers the basics of telecommunication networks, standards, protocols, network structure, transmission systems, and switching. Also, the course focuses on the integration of all the knowledge, theories, and principles that students have learned in other related courses.

IT4496 IPTV Theory and Laboratory 3(3)

This course teaches basic concepts of IPTV and includes labs to develop IPTV applications. It covers basic concepts of analog, digital and IPTV broadcasting, media compression techniques, service models and IPTV application techniques such as section filtering and media control.

IT4487 Next Generation Communication Systems 3(3)

This course covers wireless channel characteristics, propagation loss estimation models and diversity principles. CDMA mobile communication systems such as IS-95 and IMT-2000, WLAN and Bluetooth are studied.

IT4495 Satellite Communication and Broadcasting Engineering 3(3)

This course covers the Earth station, link analysis, and multiple access techniques in addition to general telecommunication theories.

IT4494 Broadcasting and Communication Systems 3(3)

This course gives a broad introduction to the theory and practice of digital broadcasting. The topics include the generation, compression, multiplexing, error-control and transmission of digital broadcasting signals, and the principle of digital broadcasting receivers. Also the current digital TV standards such as DVB-T, ATSC, and T-DMB are covered.

IT4474 Information Security Theory 3(3)

This course teaches the basic concepts of coding theory which are regarded as the infrastructure of an information society, and to investigate coding protocols for information security on the application of theory. Topics include the theoretic concepts of integer theory, algebra theory, coding algorithms and key distribution algorithms, and real applications such as electronic voting and electronic commerce.

IT4492 Mobile Broadcasting Network 3(3)

This course covers issues related to layers higher than the physical layer in mobile communication networks, especially wireless resource scheduling, radio link protocols, wireless TCP, handoffs, mobile IP and security. 3G and 4G mobile communication systems are primarily focused upon.

IT4493 Optical Communication and Information Engineering 3(3)

This course deals with the fundamental principles of optical communication theory, wave equations, optical wave guides, and the properties of materials such as attenuation and dispersion. It also covers the basic concepts of optical information processing and its applications. Lectures are intended to introduce optical communications and optical information/signal processing to undergraduate level students. The lectures are designed to help students to understand the theoretical analysis of optical systems, optical imaging system design methods and their applications. Main topics are as follows: geometrical optics, wave optics, Fourier transformation, Fraunhofer and Fresnel diffraction, optical information processing, and electron holography.

IT4490 Aerospace IT Engineering 3(3)

This course constitutes a review of various information technologies for aircraft including fault-tolerant computers, wireless communications and networks, data buses, aeronautical instruments, realtime operating systems, flight control software, and computerized reservation systems.

IT4491 Engineering Management 3(3)

This course covers basic concepts and principles in management for modern manufacturing and technology-oriented companies. Topics include characteristics of modern management, managing types, management systems, and types of companies.

IT4497 Practical Issues in Communication and Broadcasting 3(3)

This course covers the basic issues of communication and broadcasting systems. Also, it includes various seminars by technical experts and leaders from communication and broadcasting industries.

<Computer Engineering Major>

EC7101 Computer Programming I 4(3)

This course is an introduction to computer programming. Topics include the history of computing, basic computer operations, the notion of an algorithm, and programming constructs such as variables, expressions, input/output, branches, loops, functions, parameters, arrays, and strings.

EC7101 Computer Programming II 4(3)

This course is an intermediate course in problem solving and computer programming using the C programming language. The course focuses on the fundamental concepts of problem solving and the techniques associated with the development of algorithms and their implementation as computer programs.

RC7130 Differential Equation 3(3)

The course covers the essential applied mathematics such as first, second and higher order differential equations, the power series method, Legendre polynomials, the Frobenius method, Bessel functions, Laplace transform and its application to engineering problems, and applications to circuit analysis.

EC3101 Introduction to Engineering Design 3(3)

As a preliminary step in engineering design, this course aims to allow students to obtain basic capabilities that may be required to become advanced electrical engineers with in-depth knowledge in the field of electronics and electrical industry. This course will deliver concepts of engineering design procedures and help students to achieve skills on how to approach a given problem with engineering techniques.

CE3209 Mathematics for Computer Engineering3(3)

This course focuses on the mathematical foundation of digital computers, covering subjects such as set theory, logic, graph theory, algebraic structures, lattice theory, and Boolean algebra.

CE3208 Object-Oriented Programming 4(3)

This course introduces the concept of object-oriented programming and object-oriented software development. After studying how to program with objects, class, inheritance, and dynamic binding is covered and students are introduced to the concept of object-oriented

analysis and design.

CE3205 Digital Logic Design 3(3)

This course covers the fundamental concepts of digital systems. Topics include number systems, coding theory, logic theory, logic circuits, combination circuits, memory elements, digital circuit design, and their applications.

CE3202 Data Structures 3(3)

This course teaches the basic building blocks of computer programming. Techniques for representing data in the computer are the focus of the course. It covers basic data structures such as arrays, stacks, queue, linear lists, and tree structures.

CE3211 Computer Network 3(3)

This course introduces the fundamental concepts of computer networks. It deals with internetworking, TCP/IP protocol, LAN, and ATM. It also covers various aspects of wireless communication environments.

CE3211 Digital Logic Laboratory 4(3)

This lab course covers the analysis and design of basic logic circuits, encoders, A/D converters, D/A converters, multiplexers, switching theory, combinational logic circuits, and sequential logic circuits. Students will gain hands-on experiences through experiments in these subjects.

CE3209 Statistics 3(3)

This course deals with the basic theory of probability and random processes commonly used in electronic engineering and telecommunication and information engineering. Topics include the principles of counting, axioms of probability, conditional probability, repeated independent events, discrete random variables, probability mass and distribution functions, expected values, continuous random variables, functions of random variables, Bernoulli, Poisson & Gaussian process, the central limit theorem, Chebyshev's inequality, bivariate Gaussian distribution, multivariate Gaussian distribution, random (stochastic) processes, autocorrelation and powers spectral density, and linear systems and random input.

CE3303 Computer System Architectures 3(3)

This course deals with the concepts of arithmetic logical units, memory, input and output, and control units that comprise the computer architecture. It also covers the methods for evaluating the performance of computers using simulation techniques.

CE3206 Operating Systems 3(3)

This course covers the concepts of operating systems, system operation, process scheduling, memory management, file management, interprocess communication, and 1/0 management and deadlock.

CE3308 Software Engineering 3(3)

The course teaches the principles and techniques that can be applied to the development of software. It covers requirement analysis, design, software development tools, validation, and verification techniques.

CE3301 Programming Languages 3(3)

This course introduces the fundamental concepts of programming language designs and implementations. It deals with the concepts and history of programming languages, the theories behind various implementations of programming languages, and different language paradigms.

CE3304 Introduction to Database 3(3)

This course teaches databases, the basic concepts of data models, file system structures, relational database system structures, and database languages. It also provides some experience with database languages and database application skills by accompanying laboratory sessions.

CE3309 Software Design 3(3)

This course deals with the practice of team-based S/W project development by using the unified modeling language (UML)S/W tools. Students are expected to perform managing S/W based projects, analyzing S/W requirements, designing S/W architectures and components, and finally deploying computer-based systems.

CE3403/3406 Capstone Design Ⅰ, Ⅱ 3(3)

These courses teach how to be capable for creative design and for carrying out a project in a specific area. It deals with concept design, idea development and simulation, system implementations and presentations.

CE3213 System Programming 3(3)

The goal of this coursework is to gain an understanding of how the Intel IA-386 microprocessor works in terms of architecture and its own assembly languages. Writing application programs in the assembly language is an important training component of the course. Once attendees understand the background of microprocessors and assembly language, students will learn about how an assembler works and a small simple assembler will be made as a term project.

CE3215 Introduction to Multimedia Systems 3(3)

This course deals with the basic concepts of multimedia and various media technologies such as audio, text, and graphics. It also teaches techniques for integrating media.

CE3214 Window Programming 3(3)

This course introduces the fundamental concepts of Windows programming. It deals with object-oriented programming, a Windows programming model, and graphics programming. It also

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covers various aspects of GUI development environments including Windows and X Windows.

CE3207 Engineering Mathematics 3(3)

Students in this class are expected to learn probabilities, graph theory, problem-solving techniques, and the basics of computation theory. They will also learn how to solve problems regarding the writing of computer programs.

CE4351 Network Programming 3(3)

This course involves the design of network software and Internet application programs. It deals with the software structure of TCP/IP as well as TCP/IP protocol. It also covers how to design and implement Internet application programs using TCP/IP sockets.

CE3307 Algorithm and Design of Analysis 3(3)

This course covers algorithm analysis, computation models, complexity theory, NP completeness, and techniques using sets, strings, and graphs.

CE4326 Computer Graphics 3(3)

This course is a study of the hardware and software principles of interactive raster graphics. Topics include an introduction to the basic concepts, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques, graphical software packages and graphics systems. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms.

CE3310 Microprocessor 4(3)

This course covers characteristics of basic embedded processors. It mainly deals with the ARM7 processor. Topics include talking about registers, control units, pipelining, and assembly level instruction set architecture of ARM processors. A term project requires students to comprehend a VHDL description of ARM cores.

CE4426 Embedded Systems Design 4(3)

This course focuses on software development on embedded systems. Students are expected to perform an installation of core software such as loaders, kernels, network software, file systems, device drivers, and applications programs. Students will gain an understanding of JTAG fusing, serial communication, and network based communication in order to install the necessary software.

CE4427 Data Mining 3(3)

This course will provide an introductory look at concepts and techniques in the field of data mining. After covering the introduction and terminologies to data mining, the techniques used to explore large quantities of data for the discovery of meaningful rules and knowledge such as market basket analysis, nearest neighbor, decision trees, neural networks, and clustering are covered.

CE4428 Database Design 3(3)

This course introduces the basic concepts of database and database management systems. Topics include data modeling, data dependency, design problems, data integrity, concurrency, recovery, security, and distributed databases.

CE4452 Artificial Intelligence 3(3)

This course covers the basic principles of artificial intelligence and problem solving process and techniques based on artificial intelligence. It also teaches expert systems, searching, neural network, and computer vision using LISP.

CE4455 Information Security 3(3)

This course deals with the basics of information security issues. It covers three kinds of cryptographic algorithms (public key, conventional and hash). It also handles public key infrastructure (PKI), electronic commerce and Internet security.

CE4415 Information Retrieval 3(3)

This course deals with Web search systems including Web crawling, indexing, page ranking, and query processing. It also covers distributed file systems and map reduce programming models suitable for handling very large data sets.

CE4453 Compilers 3(3)

This course introduces the basic concepts of program translation. The structure of the compiler and theories behind its implementation are discussed. Techniques for defining lexical and syntactic units are discussed as well as methods for their analysis.

CE4456 Web Programming 4(3)

Approximately 60% of KAU's students who graduate from the CS department get jobs from system integrators where most of their work is heavily focused on web programming related tasks. So, it is deemed necessary to train the 4th year students on subjects including various web technologies including web programming languages, web servers, rich-client technologies, Google technologies, and cloud computings. Attendees will make teams of 4 students and administer a survey, prepare for presentation, make a presentation, and get feedback from classmates every week. After the main areas of study are completed, students must build a small web site for e-commerce based on the knowledge acquired in class.

CE4457 Introduction to Parallel Processing Systems 3(3)

This course deals with parallel computing systems such as SIMD, MIMD, Systolic arrays, and data flow computers. It covers the architectures and applications of parallel computers.

Minor Courses

<Electronics and Avionics Engineering Major>

Required courses

EA3302 Electronic Circuits Laboratory II 4(2) 2-2
EA3305 Electronic Circuits Laboratory III 4(2) 2-2
EA3205 Electric Circuits I 3(3) 2-1
EA3204 Electromagnetics I 3(3) 2-1
EA3303 Electronic Circuits I 3(3) 2-2
EA3306 Electronic Circuits II 3(3) 3-2

Elective course

EA4204 Digital Logic Design 3(3) 3-1 EA4311 Signals and Systems 3(3) 3-1 EA4302 Computer Architecture and Microprocessor 3(3) 3-1 EA4310 Semiconductor Device Engineering 3(3) 3-1 EA4309 Analog Communications Systems 3(3) 3-1 EA4304 Automatic Control Systems 3(3) 3-2 EA4407 Digital Signal Processing Design 3(3) 4-1

<Information and Telecommunication Engineering Major>

Required courses

- IT3202 Electric Circuits I 3(3) 2-1 IT3204 Electromagnetics I 3(3) 2-1 IT3210 Digital Logic Design 3(3) 2-2
- IT3303 Electronic Circuits I 3(3) 3-1

Elective course

- IT4375 Telecommunication Theory 3(3) 3-1
- IT4485 Telecommunication Networks 3(3) 4-1
- IT4312 Data Communication 3(3) 3-1
- IT4495 Satellite Communication and Broadcasting Engineering 3(3) 4-2
- IT4493 Optical Communication and Information Engineering 3(3) 4-2
- IT4407 Digital Signal Processing 3(3) 4-1
- IT4483 Image Signal Processing 3(3) 4-1

<Computer Engineering Major>

Required courses

RC7130 Computer Programming II 4(3) 1-2

CE3202 Data Structures 4(3) 2-2 CE3306 Operating Systems 3(3) 3-2

Elective course

- CE3213 System Programming 3(3) 2-1
- CE3205 Digital Logic Design 3(3) 2-1
- CE3301 Programming Languages 3(3) 3-2
- CE3308 Software Engineering 3(3) 3-1
- CE3303 Computer System Architecture 3(3) 3-1
- CE3304 Introduction to Database 3(3) 3-2
- CE4326 Computer Graphics 3(3) 3-2