# ELECTRONICS & TELECOMMUNICATIONS ENGINEERING

**MA001IU** **4 credits**

**Calculus 1**

Functions; Limits; Continuity; Derivatives, Differentiation, Derivatives of basic elementary functions, differentiation rules; Application of Differentiation: L'Hopital's rule, Optimization, Newton's method; Anti-derivatives; Indefinite integrals, definite integrals; Fundamental theorem of calculus; Technique of integration; Improper integrals; Applications of integration.

**MA003IU** **4 credits**

**Calculus 2**

Sequence and series; Convergence tests; Power series; Taylor &Maclaurin series; Cartesian Coordinates; Lines, Planes and Surfaces; Derivatives and integrals of vector functions; Arc length and curvature; parametric surfaces; Functions of several variables; Limits, continuity, partial derivatives, tangent planes; Gradient vectors; Extrema; Lagrange multipliers; Multiple integrals: double integrals, triple integrals, techniques of integration; Vector fields, line integrals, surface integrals.

*Prerequisite: MA001IU (Calculus 1)*

**MA023IU** **4 credits**

**Calculus 3**

Complex numbers, complex series, complex functions, complex derivatives; Laplace transform; z- transform; Fourier series, Fourier transform, the inverse transform, transforms of derivatives and integrals; first-order differential equations, second-order differential equations, difference equations, applications to electrical circuits and signal processing.

*Prerequisite: MA003IU (Calculus 2)*

**MA027IU** **2 credits**

**Applied Linear Algebra**

Matrices; Linear independence, Rank of a matrix, linear systems of equations, Gauss elimination, Solutions of linear systems: Existence, uniqueness, determinants, Cramer's rule, inverse of a matrix, Gauss-Jordan elimination, vector spaces, inner product spaces, linear transformations, eigenvalues, eigenvectors, applications; Symmetric, Skew-symmetric, and orthogonal matrices, Eigenbases, diagonalization; Quadratic forms, complex matrices and forms.

**MA024IU** **4 credits**

**Differential Equations Processes**

First-order differential equations; second-order linear differential equations, undetermined coefficients, variation of parameters, applications, higher-order linear differential equations, systems of first-order linear equations, elementary partial differential equations and the method of separation of variables. This course also

provides the laboratory by using Maple and Matlab to solve many different types of differential equations.

*Prerequisite: MA003IU (Calculus 2)*

**MA026IU** **3 credits**

**Probability & Random Processes**

Probability: sample space and events, Venn Diagram and algebra of events, probability of event, additive rules, conditional probability, Bayes rules, random variables and their distributions, mathematical expectation, some discrete probability distributions, some continuous probability distributions, functions of random variables, independence.

Mathematical Statistics: Sampling distributions and data descriptions, estimation problems, hypothesis tests, linear regressions, analysis of variance, nonparametric statistics, simulation.

*Prerequisite: MA003IU (Calculus 2)*

**PH013IU** **2 credits**

**Physic 1 (Engineering Mechanics)**

An introduction to mechanics including: planar forces, free body diagrams, planar equilibrium of rigid bodies, friction, distributed forces, internal forces, shear force and bending moment diagrams, simple stress and strain and associated material properties, kinematics and kinetic of particles, work and energy, motion of rigid bodies in a plane.

**PH014IU** **2 credits**

**Physic 2 (Thermodynamics)**

This course provides students basic knowledge about fluid mechanics; macroscopic description of gases; heat and the first law of thermodynamics; heat engines and the second law of thermodynamics; microscopic description of gases and the kinetic theory of gases.

**PH015IU** **3 credits**

**Physics 3 (Electricity & Magnetism)**

To provide a thorough introduction to the basic principles of physics to physics and engineering students in order to prepare them for further study in physics and to support their understanding and design of practical applications in their fields. Content: Electrostatics, particles in electric and magnetic fields, electromagnetism, circuits, Maxwell's equations, electromagnetic radiation.

*Prerequisite: PH013IU (Physic 1)*

*Co-requisite:PH016IU (Physics 3 Laboratory)*

**PH016IU** **1 credit**

**Physics 3 Laboratory**

This laboratory includes the topics on vector and uncertainties; electrostatic; Ohm’s law; magnetic force; ampere law; faraday law and RLC circuits.

*Co-requisite:PH015IU (Physics 3)*

**PH012IU** **2 credits**

**Physics 4 (Waves and Optics)**

Waves and optics, relativity, quantum properties of electrons and photons, wave mechanics, atomic, solid state, nuclear and elementary particle physics.

*Prerequisite: PH013IU (Physic 1)*

**CH011IU** **3 credits**

**Chemistry for Engineers**

This course is designed for non-chemistry majors, as it is intended for students pursuing a degree in information technology, electronic and telecommunication. The course is designed to provide a strong background in the fundamentals of chemistry, preparing students for further study in their major field. Topics include important principles, theories, concepts of chemistry, and chemical calculations necessary for a comprehension of the structure of matter, the chemical actions of the common elements and compounds. The impact of chemistry on everyday life and on the environment is also introduced wherever possible.

*Co-requisite:CH012IU (Chemistry for Engineers Laboratory)*

**EN007IU & EN008IU** **4 credits**

**Academic English 1**

This course concentrates on academic English listening and writing skills.

Strategies for Academic Listening, Note-taking, and Discussion will help the student face the challenges of learning English in an Academic environment. The student will learn to do all the things that successful international college students do – listen actively to lectures, take effective notes, and participate confidently in discussions about the lecture with classmates and the lecturer. While learning these strategies, you will also learn and use common academic vocabulary as well as useful idioms.

Writing skills are developed for pre-advanced academic writers. It focuses on composition writing using Writing process, Building Framework, Description, Opinion, Process, Comparison-Contrast, Cause-Effect, Problem-Solution, and Argument. Students will have writing practice in "Real-World Writing" formats.

**EN011IU & EN012IU** **4 credits**

**Academic English 2**

This course concentrates on academic English speaking and writing skills.

Speaking subject provides students with the skills to be able prepare and deliver effective formal, structured presentations that are appropriate to the specific environment and audience.

Writing subject provides an overview of the organizational format for a research paper and assists students in completing research projects in any content area course by providing assistance in writing effective research papers using a step-by-step process approach. Course content includes the components of a research paper, and techniques of selecting and narrowing topics; writing thesis statements; outlining; locating and documenting sources; taking notes; writing introductions, body paragraphs, and conclusions; and writing rough and final drafts. Students work with projects relating to their content area courses.

*Prerequisite: EN007IU & EN008IU (Academic English 1)*

**PE008IU** **3 credits**

**Critical Thinking**

This course provides students the fundamental knowledge of critical thinking concept. This is a general thinking skill that is useful for all sorts of careers and professions. The course covers introduction to critical thinking; meaning analysis and argument analysis; basic logic, sentential logic (SL) and predicate logic; Venn diagrams; scientific reasoning; basic statistics; strategic thinking; values and morality; fallacies & biases; and introduction to creativity thinking.

**EE049IU** **3 credits**

**Introduction to Electrical Engineering**

This course is an introduction to engineering processes for future electrical engineering. This course provides the students with the fundamental concepts of the electrical engineering profession. In addition, the students will learn the proper usage of engineering tools, including computers and measurement equipment. Students will also perform statistical analysis of experimental data, define engineering requirements, and implement simulation.

**EE050IU** **3 credits**

**Introduction to Computer for Engineers**

This course is an introduction to solving engineering problems through the use of the computer. It introduces general problem-solving techniques including the concepts of step-wise refinement applied to the development of algorithms. This course will cover elementary programming concepts using the programming language Matlab and apply those concepts towards the solution of engineering problems.

**EE051IU** **3 credits**

**Principles of Electrical Engineering 1**

This course is an introduction to basic circuit elements; independent sources; dependent sources; circuit analysis in DC and AC steady state; network theorems; operational amplifiers; and power computations.

*Prerequisite: MA001IU (Calculus 1)*

*Co-requisite: EE052IU (Principles of EE 1 Laboratory)*

**EE052IU** **1 credit**

**Principles of Electrical Engineering 1 Laboratory**

This course provides experimental exercises in use of laboratory instruments; voltage, current, impedance, frequency, and waveform measurements; rudiments of circuit modeling and design.

*Co-requisite: EE051IU (Principles of EE 1)*

**EE055IU** **3 credits**

**Principles of Electrical Engineering 2**

This course includes the following topics: transient analysis by classical methods and by Laplace transform analysis, step and impulse response, three-phase circuit and two-port networks. Passive and active filter circuit design, Butterworth filter design. Introduction to Fourier series.

*Prerequisite: EE051IU (Principles of EE 1)*
*MA023IU (Calculus 3) for EE*
*EEAC002IU (Mathematics for Engineers) for AC*
*Co-requisite:EE056IU (Principles of EE 2 Laboratory)*

**EE056IU** **1 credit**
**Principles of Electrical Engineering 2 Laboratory**
This laboratory includes topics on transient analysis; frequency response; filters design; two port network and Fourier series.
*Co-requisite: EE055IU (Principles of EE 2)*

**EE053IU** **3 credits**
**Digital Logic Design**
This course introduces the basic tools for design with combinational and sequential digital logic and state machines. To learn simple digital circuits in preparation for computer engineering. Main content: Binary arithmetic, Boolean algebra, K-maps, Combinational circuit synthesis, Combinational MSI circuits, Sequential logic, Synchronous state machine design, Sequential MSI circuits.
*Co-requisite: EE054IU (Digital Logic Design Laboratory)*

**EE054IU** **1 credit**
**Digital Logic Design Laboratory**
This laboratory includes topics on combinational SSI and MSI circuits; four-bit arithmetic circuit; sequential circuits; state machine analysis and state machine synthesis.
*Co-requisite: EE053IU (Digital Logic Design)*

**EE057IU** **3 credits**
**Programming for Engineers**
This course provides the basics of programming and data structures in C++ include: basic data types: loops, arrays, recursion, and pointers; object oriented design: classes, inheritance, overloading, and polymorphism; abstract data types: lists, linked lists, stacks, and queues; introduction to algorithm analysis: O notation, searching and sorting.
*Prerequisite: MA001IU (Calculus 1)*
*Co-requisite: EE058IU (Programming for Engineers Laboratory)*

**EE058IU** **1 credit**
**Programming for Engineers Laboratory**
This is a co-requisite course with EE057IU (programming for engineers).
*Co-requisite: EE057IU (Programming for Engineers)*

**EE067IU** **3 credits**
**Electromagnetic Theory**
Electrical conduction theories, conducting materials and insulators, magnetic and dielectric properties and materials, electrostatics and magneto-statics, steady electric currents, the magnetic field of steady electric currents, Ampere's law and its

applications, electromagnetic induction, Faraday's law and its applications, electromagnetism, simple transmission lines, magnetic circuits, permanent magnets, inductors, transformers, introduction to electrical machines.

*Prerequisite: Calculus 3 (MA023IU)*

**EE090IU** **3 credits**

**Electronic Devices**

Fundamentals of semiconductor devices and microelectronic circuits, characteristics of p-n, Zener diodes, and analog diode circuits. Principles of MOSFET and BJT operation, biasing, transistor analysis at mid-band frequencies.

*Prerequisite: EE051IU (Principles of EE 1)*

*Co-requisite: EE091IU (Electronic Devices Laboratory)*

**EE091IU** **1 credit**

**Electronic Devices Laboratory**

Laboratory experiments in microelectronic circuits using semiconductor devices, including diodes, MOSFETs and BJTs. Employing a learn-by-doing approach, emphasizing the hands-on-experimental experiences and computer simulation.

*Co-requisite: EE090IU (Electronic Devices)*

**EE094IU** **3 credits**

**Digital Electronics**

Principles of digital electronics, implementation of logic gates with MOSFETs and BJTs. Understanding and analysis of different logic families including NMOS CMOS, TTL and ECL. Fundamentals of digital memory circuits.

*Prerequisite: EE090IU (Electronic Devices)*

*Co-requisite: EE095IU (Digital Electronics Laboratory)*

**EE095IU** **1 credit**

**Digital Electronics Lab**

Laboratory experiments in transistor-level realization of CMOS, BiCMOS, TTL and ECL logic gates.

Employing a learn-by doing approach, emphasizing the hands-on-experimental experiences and computer simulation.

*Co-requisite: EE094IU (Digital Electronics)*

**EE083IU** **3 credits**

**Micro-processor Systems**

This course provides students the fundamentals of microprocessors and microcomputers; data flow; machine programming; assembly languages, architectures and instructions sets; stacks, subroutines, I/O, and interrupts; interfacing fundamentals; designing with microprocessors, and applications of micro-processing systems to some practical problems.

*Prerequisite: EE053IU (Digital Logic Design)*

*Co-requisite: EE084IU (Micro-processor System Laboratory)*

**EE084IU** **1 credit**

**Micro-processor Systems Lab**

This is a co-requisite course of EE083IU. The laboratory includes location and description the components on the 32-Bit Microprocessor circuit board; demonstration of basic data transfer operations, memory transfers and describe memory control signals, the signals needed to transfer data between the CPU and its components, how the CPU processes hardware and software interrupts, addressing modes of the 80386 CPU; Use machine codes to write instruction for use in memory test programs and real-world applications.

*Prerequisite: EE053IU (Digital Logic Design)*

*Co-requisite: EE083IU (Micro-processor System)*

**EE088IU** **3 credits**

**Signals & Systems**

Introduction to continuous- and discrete-time systems and signals, basis function representation of signals, convolution, Fourier Series, Fourier, Laplace, Z-transform theory, state space variable analysis of linear systems, basic feedback concepts.

*Prerequisite: EE055IU (Principles of EE 2)*

*Co-requisite: EE089IU (Signal & Systems Laboratory)*

**EE089IU** **1 credit**

**Signals & Systems Lab**

Experimental exercises via simulation using MATLAB to get understanding of frequency and time domain analysis of linear dynamic systems and corresponding signals. Finding the response of continuous- and discrete-time linear systems via simulation.

*Co-requisite: EE088IU (Signal & Systems)*

**EE092IU** **3 credits**

**Digital Signal Processing**

Introduction to digital signal processing, sampling and quantization, A/D and D/A converters, discrete time systems, convolution, z-transforms, transfer functions, digital filter realizations, fast Fourier transforms, filter design, and digital audio applications.

*Prerequisite: EE088IU (Signal & Systems)*

*Co-requisite: EE093IU (Digital Signal Processing Laboratory)*

**EE093IU** **1 credit**

**Digital Signal Processing Lab**

To carry out software and hardware experiments illustrating the basic principles and techniques of digital signal processing and to illustrate some concrete applications, such as filtering for noise reduction and digital audio effects.

*Prerequisite: EE088IU (Signal & Systems)*

*Co-requisite: EE092IU (Digital Signal Processing)*

**EE068IU** **3 credits**

**Principles of Communication Systems**

To understand basic analog and digital communication system theory and design, with an emphasis on wireless communications methods. Main content: Analog Communication, Random processes and Noise, Quantization, Digital Communication.

*Prerequisite: EE088IU (Signals and Systems)*
*MA026IU (Probabilities and Random Processes)*
*Co-requisite: EE115IU (Principles of Communication Systems Laboratory)*

**EE115IU** **1 credit**

**Principles of Communication Systems Laboratory**

This course provides experiments dealing with basic fundamental concepts of communication systems. It includes the following topics: Amplitude Modulation/Demodulation; Angle Modulation/Demodulation; Sampling, Holding and Reconstruction of PAM signals; Pulse Code Modulation; Amplitude Shift Keying, Phase Shift Keying.

*Co-requisite: EE068IU (Principles of Communication Systems)*

**EE114IU** **3 credits**

**Entrepreneurship**

In this course the student will learn the essential skills needed to start and manage a successful new business venture. Topics will cover: the challenge of entrepreneurship, building a business plan, marketing and financial issues with a start-up company, and how to gain the competitive advantage.

**EE130IU** **2 credits**

**Capstone Design 1**

This course is an introduction to engineering design process. This course consists of two semesters of lecture and design. This course requires students to develop a project based on the knowledge and skills acquired in earlier coursework and integrate their technical knowledge through practical design effort. Students will learn to define a problem, conduct research to propose the solutions, determine the realistic constraints, prepare project scheduling, and create a planned budget for the project. The work will be performed as a team in accordance with ABET requirements. Each team is comprised of two to four students

**EE132IU** **2 credits**

**Capstone Design 2**

Students will be assigned a faculty member to oversee the progress of the project. The student will follow the design process, under the guidance of the assigned faculty member, and to develop the prototype based on the design specifications from Capstone Design Project 1. The work will be performed as a team in accordance with ABET requirements. Each team is comprised of two to four students

*Prerequisite: EE131IU (Capstone Design 1)*

**EE107IU** **2 credits**

**Senior Project**

In the field of Electrical Engineering, the senior focuses on design projects related to the EE field. In addition to the accumulation of theoretical knowledge, the thesis requires solving difficulties encountered in practice as well as addressing safety issues and ethics.

**EE097IU** **10 credits**

**Thesis**

These are industry type projects, designed to ensure students have master their studies in the program. All projects are based on "Real projects" provided by industry for students to work on developing skill and applying knowledge gained from all courses throughout the program. Students will work in teams to develop requirements, design, implementation, and provide a solution to the business problems. Students may follow any suitable process model, must manage the project themselves, following all appropriate project management techniques. Success of the project is determined in large part, by whether students have adequately solved their customer's problem.
Students will be expected to deliver the final products along with all artifacts appropriate to the process model they are using (i.e.: project plan, requirements specification; system and software architect documents, design documents, test plans, source code, and installable software products).

*Prerequisite: EE107IU (Senior Project)*

**EE061IU** **3 credits**

**Analog Electronics**

Feedback amplifier analysis, frequency response of BJT and FET amplifiers, and frequency response with feedback stability, power amplifiers, filters and tuned amplifiers, signal generator and waveform-shaping circuits.

*Prerequisite: EE090IU (Electronic Devices)*
*Co-requisite: EE062IU (Analog Electronics Laboratory)*

**EE062IU** **1 credit**

**Analog Electronics Laboratory**

This laboratory includes topics on differential transistor amplifiers; cascode amplifiers; the constant current source; current mirrors; high frequency transistor amplifiers; feedback amplifiers; stability of feedback amplifiers and feedback compensation.

*Co-requisite: EE061IU (Analog Electronics)*

**EE105IU** **3 credits**

**Antenna and Microwave Engineering**

The course provides students the understanding of radiation fundamentals, linear antennas, point source arrays, aperture antennas, antenna impedance, antenna systems. Basic concepts of microware engineering such as transmission lines, Smith plot, microwave circuits, analysis techniques, design and applications.

*Pre-requisite: EE067IU (Electromagnetic Theory)*
*Co-requisite: EE124IU (Antenna & Microwave Engineering Laboratory)*

**EE124IU** **1 credit**

**Antenna and Microwave Engineering Laboratory**

Antenna & Microwave Engineering Practical Workbook covers a variety of experiments that are designed to aid students in their profession and theory. They include a variety of topics which include antennas, transmission lines and microwave waveguides. A practical exposure to such equipment is necessary as it builds on the theory taught to students.

*Pre-requisite: EE067IU (Electromagnetic Theory)*
*Co-requisite: EE105IU (Antenna & Microwave Engineering)*

**EE063IU** **3 credits**

**Digital System Design**

This course introduces methodology and techniques to design digital systems. The topics including the basic concepts, analysis, and system design with hardware description languages (HDL). The course provides an insight of the design of asynchronous sequential circuits and complex synchronous systems. Design process is introduced by concepts, documents, and simulation.

*Pre-requisite: EE053IU (Digital Logic Design)*
*Co-requisite: EE117IU (Digital System Design Laboratory)*

**EE117IU** **3 credits**

**Digital System Design Lab**

This lab helps students understand better about techniques to design digital systems. This lab includes software and hardware topics: Introduction to Maxplus II software, Counter, Introduction to VHDL in Maxplus II, Digital Clock.

*Pre-requisite: EE053IU (Digital Logic Design)*
*Co-requisite: EE063IU (Digital System Design)*

**EE066IU** **3 credits**

**VLSI Design**

This course provides an introduction to digital VLSI chip design based on CMOS technology and including dynamic clocked logic, analog MOSFET timing analysis, and layout design rules. The course develops the use of computer-aided design software tools and cell library construction as well as an understanding of elementary circuit testing.

*Prerequisite: EE053 (Digital Logic Design)*
*EE094 (Digital Electronics)*
*Co-requisite: EE121IU (VLSI Design Lab)*

**EE121IU** **1 credit**

**VLSI Design Lab**

This laboratory provides an introduction to digital VLSI chip design based on the use of VLSI design tools to design a MIPS microprocessor chip. The laboratory employs a learning-by-doing approach, emphasizing hands-on practical design experiences and computer simulations.

*Prerequisite: EE053 (Digital Logic Design)*

*EE094 (Digital Electronics)*
*Co-requisite: EE066IU (VLSI Design)*

**EEAC020IU** **4 credits**
**Theory of Automatic Control**
This course is intended to introduce students to concepts and techniques of classical control and to briefly introduce some concepts of modern control and discrete-time. The main goal is to enable students to analyze, design, and synthesize linear control systems. Students will become familiar with analytical methods and will be exposed extensively to the use of computers for analysis and design of control systems.
*Pre-requisite***:** *EE055IU (Principles of EE2)*

**EE079IU** **3 credits**
**Power Electronics**
This course introduces the application of electronics to energy conversion and control. Topics cover modeling, analysis, and control techniques; design of power circuits including inverters, rectifiers, and DC-DC converters; analysis and design of magnetic components and filters; and characteristics of power semiconductor devices. Numerous application examples will be presented such as motion control systems, and power supplies.
*Prerequisite: Electronic Devices (EE090IU)*
*Co-requisite: Power Electronics Laboratory*

**EEAC003IU** **1 credit**
**Power Electronics Lab**
This course assists the theoretical course (Power electronics) involving the energy conversion and control. It covers the building and measuring rectifiers, inverters, and DC/DC converters; Analyzing and measuring filters; investigating into current-voltage characteristics of power semiconductor devices.
*Prerequisite: Electronic Devices (EE090IU)*
*Co-requisite: Power Electronics*

**EE104IU** **3 credits**
**Embedded Real-time Systems**
This course covers application and design assembly and C language programming for AVR microprocessors. Topics include system timing, bus cycles, interrupts, stacks and subroutines. Upon completion, students should be able to design, program, verify, analyze, and troubleshoot AVR assembly and C language programs
*Prerequisite: EE083IU (Microprocessor Systems)*
*Co-requisite: EE118IU (Embedded Real-time System Laboratory)*

**EE118IU** **1 credit**
**Embedded Real-time Systems Lab**
This course Integrates microprocessors into digital systems. The course Includes hardware interfacing, bus protocols and peripheral systems, embedded and real-time operating systems, real-time constraints, networking, and memory system.

*Prerequisite: EE083IU (Microprocessor Systems)*
*Co-requisite: EE104IU (Embedded Real-time System)*

**EE070IU** **3 credits**
**Wireless Communication Systems**
This course introduces: Radio Propagation, Cochannel Interference, Spectral Efficiency and Power Efficiency, Diversity Schemes, Multiple Access Interference, Radio Resource Management, Performance of TDMA, CDMA and WiFi Systems.
*Prerequisite: EE068IU (Principles of Communication Systems)*
*Co-requisite: EE116IU (Wireless Communication Systems Laboratory)*

**EE116IU** **1 credit**
**Wireless Communication Systems Laboratory**
Radio Propagation, Co-channel Interference, Spectral Efficiency and Power Efficiency, Diversity Schemes, Multiple Access Interference, Radio Resource Management, Performances of TDMA, CDMA and Wi-Fi Systems.
*Prerequisite: EE068IU (Principles of Communication Systems)*
*Co-requisite: EE116IU (Wireless Communication Systems Laboratory)*

**EE072IU** **3 credits**
**Computer and Communication Networks**
Network protocol design principles, reliable transport protocols, routing, quality of service, multimedia networking, Internet telephony, wireless networks.
*Prerequisite: MA026IU (Probability and Random Processes)*

**EE119IU** **3 credits**
**Telecommunication Networks**
This course provides the principles underlying telecommunication networks. Using a top-down approach and emphasizing data and computer communication within the framework of the OSI layers, the course will cover topics in the application, transport, network and link layers of the protocol stack. Topics includes TCP/IP protocol architectures, circuit-switching and packet-switching, network management, data link protocols including HDLC, routing flow control, file transfer protocols, cryptography, and text compression. It also introduces important merging technologies, such as, integrated voice and data networks (VOIP) and the integration of wireless and wired networks.
*Prerequisite: EE088IU (Signals & Systems)*
*EE068IU (Principle of communication systems)*
*Co-requisite: EE120IU (Telecommunication Networks Lab)*

**EE120IU** **1 credit**
**Telecommunication Networks Laboratory**
Experimental exercises via simulation and hardware to get understanding of data communications and networking.
*Prerequisite: EE088IU (Signals & Systems)*
*EE068IU (Principle of communication systems)*
*Co-requisite: EE119IU (Telecommunication Networks)*

**EE103IU** **3 credits**

**Image Processing and Computer Vision**

The course begins with one-to-one operations such as image addition and subtraction and image descriptors such as the histogram. Basic filters such as the gradient and Laplacian in the spatial domain are used to enhance images. The 2-D Fourier transform is introduced and frequency domain operations such as high and low-pass filtering are developed. It is shown how filtering techniques can be used to remove noise and other image degradation. The different methods of representing color images are described and fundamental concepts of color image transformations and color image processing are developed. The concepts of image redundancy and information theory are shown to lead to image compression. Lossless and lossy image processing algorithms such as LZW will be covered and related to image compression standards such as JPEG. Programming assignments will use MATLAB and the MATLAB Image Processing Toolbox.

*Prerequisite: EE088IU (Signals and Systems)*
*MA026IU (Probability and Random Processes)*
*Co-requisite: EE122IU (Image Processing Lab)*

**EE122IU** **1 credits**

**Image Processing and Computer Vision Laboratory**

Experimental exercises via simulation using MATLAB to get understanding of digital image processing and basic concepts of computer vision: image enhancement in time domain and frequency domain, morphology and segmentation

*Prerequisite: EE088IU (Signals and Systems)*
*MA026IU (Probability and Random Processes)*
*Co-requisite: EE103IU (Image Processing)*

**EE102IU** **3 credits**

**Stochastic Signal Processing**

Introduction to the theory and algorithms used for the analysis and processing of random signals (stochastic signals) and their applications to communications problems.

*Prerequisite: EE092IU (Digital Signal Processing)*

**EE123IU** **2 credits**

**Special Topics in Electrical Engineering**

This course provides students a broad understanding on the following topics: Optical Communication Systems, Satellite Communications, Wireless Sensor Networks, OFDM System, Microelectronics, Multimedia Signal Processing, Computer vision, and Biomedical Engineering.

**EE074IU** **3 credits**

**Digital Signal Processing Design**

Applications of DSP algorithms in the areas of speech processing, image processing, communications, and adaptive filtering using software implementations applied to realistic signals.

*Prerequisite: EE092IU (Digital Signal Processing)*

**EE125IU** **3 credits**

**RF Circuit**

The course focuses on the analysis and design of Radio Frequency circuits. It covers the design of passive and active RF circuits, including: impedance matching networks, RF filter design, power amplifier, mixers, RF Oscillator, low noise amplifier (LNA)

*Prerequisite: EE090IU (Electronics Devices)*
*Co-requisite: EE126IU (RF Circuit Lab)*

**EE126IU** **1 credit**

**RF Circuit Lab**

The course enables the student to get hands-on experience in RF circuit design through the use of computer-aided design tools to simulate and analyze RF-circuits, and perform measurements in the lab using network and spectrum analyzers.

*Prerequisite: EE090IU (Electronics Devices)*
*Co-requisite: EE125IU (RF Circuit)*

**EE127IU** **3 credit**

**Machine Learning and Artificial Intelligence**

The course is about the most effective machine learning techniques, and students gain practice implementing them and getting them to work for yourself. More importantly, you'll learn about not only the theoretical underpinnings of learning, but also gain the practical know-how needed to quickly and powerfully apply these techniques to new problems.

*Prerequisite: EE090IU (Introduction to Computer for Engineers)*

**EE128IU** **3 credit**

**Internet of Things**

Students will understand the concepts of Internet of Things and can able to build IoT applications. This course provides an overview on IoT tools and applications including sensing devices, actuation, processing and communications. The course also introduces hands-on IoT concepts including sensing, actuation, and communication through lab experiments with IoT development kits.

*Prerequisite: EE083IU (Microprocessing Systems)*
*Co-requisite: EE129IU (Internet of Things Lab)*

**EE129IU** **1 credit**

**Internet of Things**

In this course the students will study and do experiments IoT development KIT. Student will be able to practice with following topics: Design IoT applications in different domain and be able to analyze their performance, Implement basic IoT applications on embedded platform

*Prerequisite: EE083IU (Microprocessing Systems)*
*Co-requisite: EE128IU (Internet of Things)*

**EE133IU** **3 credit**

**Emerging Engineering Technologies**

This course will explore current breakthrough technologies and disruptive innovations that have recently emerged in the past few years. A close examination of the technology will be conducted to understand the application using the new technologies. The class is a series of seminars on each of the emerging technologies.

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