Undergraduate Course Descriptions for students of *Electrical Engineering*

1710104 Electric Circuits I 2 Cr.

Network graph-Kirchhoff's laws-Linear and nonlinear components-Dependent and independent sources-nodal and mesh analysis-Analysis of resistor circuits-Norton's and Thevenin's theorems -Equivalent resistance-Superposition theorem-Operational amplifier-Capacitor and inductor- RC, RL and RLC circuits- Step response-Impulse response-Transient and steady-state responses-Linear time-invariant circuits-Convolution integral-Sinusoidal steady-state analysis-Frequency response-Three-Phase circuits. **Prerequisite**, (Differential Equations), (General Physics II)

1710203 Electrical Circuits II 3 Cr.

Coupling components and coupled circuits, nodal and mesh analysis, loop and cut-set analysis, natural frequencies, system function and frequency response of LIT Networks, state equations Analysis, network analysis in frequency domain, network theorems (Reciprocity, Thevenin, Norton, substitution, superposition, Telegan), two port networks (Impedance, AdmiHance, Hybrid and Transmission Matrixes), Graph theory in network analysis, Laplace transform and its application in LIT networks . **Prerequisite** : Electric Circuits I

1710417 Industrial Electronics 3 Cr.

Introduction to power electronics, Power semiconductor devices : Diode, BJT, SCR, MOSFET, IGBT, DIAC, TRIAC, GTO, …, Rectifiers : Single phase, Three phase, Six phase, Controlled, Uncontrolled, Resistive load, Inductive load, Source inductance considerations, DC-DC switching converters : Linear regulators, Basic converters- Buck, Boost, Buck-Boost, Cuk, Isolated Buck type converters: Forward, Dual switch forward, Push-Pull, Half bridge, Full bridge, Flyback converter, Snubber circuits : Turn on snubber, Turn off snubber, Inverters : Half bridge and Full bridge inverters with inductive and resistive loads, Three phase, inverters (120 degrees conduction, 180 degrees conduction), AC-AC converters : Cycloconverters AC-DC-AC ,AC voltage controllers, Power electronics applications. **Prerequisite** : Electronics Principles, (Electric Machines)

1710404 Industrial Electronics Lab 1 Cr.

Implementation of: UJT Oscillator, single phase bridge rectifier using SCR with resistive and inductive loads, Power MOSFET gate drive circuit, Buck converter, Boot strap gate drive circuit, Half bridge single phase inverter. **Prerequisite** : Industrial Electronics, Electronic Principles Lab

1712236 Electronics Principles 4 Cr.

N and P type semiconductors, current equation for PN junctions, diode small signal equivalent circuit, diode circuits, half-wave and full-wave rectifiers, clipping circuits, clamping circuits, voltage multipliers, Bipolar Junction Transistors (BJTs) and their biasing circuits, low frequency and small signal equivalent circuits of BJT transistors, single-stage BJT amplifiers, introduction to MOS transistors, single-stage MOS amplifiers, introduction to Differential Amplifiers, introduction to Operational Amplifiers and some of their applications, Feedback Amplifiers concept, Introduction to some simple digital circuits like CMOS logical gates. **Prerequisite**: (Electrical Circuits II)

1712237 Electronic Principles Lab 1 Cr.

Familiarization with diodes and their volt-ampere characteristics, Diode rectifiers with resistive and capacitive loads, Voltage regulator using zener diode, familiarization with BJT transistors and their bias circuits, input/output characteristics curves of transistors for PNP and NPN types, Implementation of an audio amplifier using BJT (combination of common-emitter and emitter follower amplifiers), Implementation of a differential amplifier, Op-amp circuits (Inverting and non-inverting amplifiers using op-amp, Ideal rectifier using op-amp), Application of op-amp for control purposes, Simple digital gates using MOSFETs. **Prerequisite**: Electronics Principles, Electric Circuits I Lab

1712312 Pulse Techniques 3 Cr.

Pulse shaping by active and passive circuits, linear systems In pulse regimes, comparators, Schmitt triggers, single state and double state and oscillating multi vibrators, negative resistance and its uses, pulse

amplifiers, circuits for linear voltage variation, triggering, operational amplifiers in pulse techniques. **Prerequisite** : Electronic Principles

1712325 Analog and digital Electronics I

Power amplifiers, Two-Stage Amplifiers, Cascode Amplifier, Current mirror circuits, Differential amplifier, various feedback topologies, Operational Amplifiers Application Circuits, Digital Section: Analysis of the static and dynamic behavior of TTL and CMOS logic families. **Prerequisite** : Electronic Principles

1712444 Physics of Electronics 3 Cr.

Quantum mechanics basics, free carriers in semiconductors, PN-junction, Metal-Semiconductor Junction, Bipolar Junction Transistors, Metal-Oxide-Semiconductor Field-Effect-Transistor. **Prerequisites**: Electronics Principles.

1712404 Pulse Technique Laboratory 1 Cr.

Monostable multivibrator, stable multivibrator, Schmitt trigger, IC 55, free running sweep, two-tone generator, signal shaping, S & H circuits, voltage controlled oscillator, voltage controlled multivibrator, analog switch. **Prerequisites** : Pulse Techniques, Electronics Principles Lab

1712452 Filters and Circuit Synthesis 3 Cr.

Introduction to network functions and their reliability conditions, amplitude characteristics approximations (such as Butterworth, Chaebyshev,inverse chebyshev and elliptical approximations),synthesis of driving point functions, frequency transformation, transfer function realization with two ports network terminated in one and two resistors, synthesis of time – delay filters, sensitivity, introduction to active filters, active synthesis of second order transfer functions, synthesis procedures for high order transfer functions, active synthesis with element substitution, introduction to switched capacitor filters. **Prerequisite** : Signals & Systems Analysis, Electronics Principles.

1714204 Electric Machines 4 Cr.

This course teaches the fundamental concepts of electromechanical energy conversion. It covers an introduction to magnetic circuits and transformers, energy conversions, ac (induction and synchronous) and dc machines. Students are expected to learn the basics of electromechanical energy conversion and equivalent circuits for steady state analysis of transformers, dc, induction ac machines as well as synchronous machines.
Prerequisites: Electric Circuit II, (Electromagnetics)

1714303 Energy Systems Analysis I 3 Cr.

This course examines the fundamental of power systems to 3rd year undergraduate students. It covers analysis of 3 phase ac systems in depth, calculation of power transmission lines parameters, steady state and transients behavior of power transmission lines, power system model for computer simulations, dc power flow, an introduction electricity market, and an introduction to energy distribution systems.
Prerequisites: Electric Machines, Engineering Mathematics

1714328 Introduction to Power Electronics 3 Cr.

This course teaches the basics of power electronic converters with emphasis to power systems and machine drive applications. The course starts with introducing various power electronic switches, continues with analysis of high power rectifiers (Diodes and Thyristors) with inductive and capacitive loads, ac power controllers, dc/dc power converters and switching power supplies with application to dc motor drives and renewable energy systems, and inverters (circuit topologies and switching patterns). The course also includes a brief review of gate drivers and snubber circuits for power switches.
Prerequisites: Electric Machines, Electronic Principles

1714308 Electric Energy System Analysis II 3 Cr.

This course is an advance course in power system analysis for senior undergraduate students. It covers topics in power and load flow analysis, economical operation of power systems, symmetrical components, symmetrical and unsymmetrical fault analysis, power system transient stability, and an introduction to restructured power systems. **Prerequisites:** Electric Energy System Analysis I

1714316 Complementary Electric Machines 4 Cr.

This is an advance course in Electric Machinery for senior undergraduate students. It deals with 3-phase transformer connections and analysis of synchronous machines in depth. It also covers topics on single- and two-phase induction machines, stepper motors, switched reluctance machines, linear machines brushless dc motors and some other special machines. **Prerequisites:** Electric Machines, (Electromagnetics)

1714406 Electric Machines II Lab 1 Cr.

Parallel connection of transformers and load division, determination of transformer groups, investigation of on load and steady state of asynchronous machines (circle diagram), asynchronous machines, determination of efficiency of DC generators and DC motors. **Prerequisite** : (Complementary Electric Machines) , Electric Machines I Lab

1714417 High Voltage and Insulators 3 Cr.

The course examines an introduction to insulation systems for high voltage power apparatus. The course covers both theoretical and technical aspects of insulation systems in high voltage applications. The course deals with details of gaseous, vacuum, liquid and solid insulations. **Prerequisites: :** Electric Energy System Analysis I

1714428 Relaying and Protection 3 Cr.

Protective relaying philosophy, protection components, circuit breakers, relays (classification, construction), current transformers, performance of current transformers in steady state, saturation conditions and their response to DC component of short circuit currents, voltage transformers and their performance, over current relays and their characteristics, applications and settings, coordination of over-current relays in transmission line protection, earth fault relays, directional relays, amplitude and phase comparators, distance relays (types, characteristics, performance, settings), coordination of distance relays in line protection, differential relays, transformer protection, generator protection, bus bars protection sequence filters. **Prerequisite** : (Electric Energy System Analysis II)

1716312 Linear Control Systems 3 Cr.

Feedback control systems and primary definitions, block diagram and Mason's signal-flow gain formula, input-output modeling, transfer functions G(s), zeros and poles of transfer functions, DC servo-motor systems, Linearization, state space modeling and its relation to input-output modeling, analyzing of transient and steady state parts of system response, kinds of systems, dominate poles, definitions of BIBO-stability, investigation of system stability by the methods of root locus and Routh-Hurwitz, control system design and compensators in time-domain such as Lead-Lag and PID controllers, frequency response and Bode diagram, Gain margin and Phase margin, control system design and compensators in frequency-domain such as Lead-Lag and PID controllers. **Prerequisite :** Electric Circuits II, Signals & Systems Analysis, Engineering Mathematics

1716401 Linear Control Systems Laboratory 1 Cr.

Familiarization with DC servo- motors, position and speed feedback control systems. Designing Lead, Lag controllers for improvement of response of a position control system, Time – delay systems, implementation PID controller for the improvement of the response of a third order system. AC servo motor systems, **Prerequisite**: Linear Control Systems

1716320 Advanced Control Systems

Review of control systems and the concept of feedback, Review of linear algebra, Concept of state space, State space models, Solution of state space models, Realizations, Internal stability of state space models, Input-output stability of state space models, Controllability and observability, Tests for controllability and observability, Duality theorems, Reachability and detectability, Review of discrete-time state space models, Solution of discrete-time state space models, Stability of discrete-time state space models, Controllability and observability for discrete-time state space models, State feedback, Design of state feedback controllers, Pole placement, State estimation and observers, Design of full-order observers, Design of reduced-order observers, Separation principle, Design of observer-based state feedback controllers, Introduction to optimal control, LQR problem, Introduction to optimal estimation, Kalman filters, LQG problem . **Prerequisite**: Linear Control Systems

1716304 Digital Control Systems 3 Cr.

Introduction to discrete-time control systems, Quantizing, Z Transform, Inverse Z Transform, Impulse transfer function, Impulse sampling and data hold, Mapping between the s plane and z plane, Stability analysis in the z plane, Transient and steady state response analysis, Design based on the Root-Locus method, Design based on the Frequency Response method, Analytical design method, State space representations of Discrete time systems, Solving discrete time state space equations, Discretization of continuous state space equations, Lyapunov Stability analysis, Design via Pole Placement. **Prerequisite** : Linear Control Systems

1716405 Artificial Neural Networks 3 Cr.

Introduction, History, Neural networks application, Neuron model, Neural networks structure, Perception learning rule, Linear algebra, Linear Transformations for Neural Networks, Supervised Hebbian learning rule, Performance Surfaces, Performance Optimization, Adaline neural networks, Multilayer networks and Backpropagation algorithm, Unsupervised Hebbian learning rule, RBF Networks, Competitive Networks, Grossberg Network, Adaptive Resonance Theory, Hopfield Network. **Prerequisite** : (Linear Control Systems)

1716408 Industrial Automation 3 Cr.

In this course the following topics is covered by emphasis on their applications and aspects in automation and industrial control systems: , Overview of industrial computer control systems includes central control systems and distributed control systems (DCS), PC-based distributed control systems, Data acquisition, signal conditioning and transmission, field wiring and noise consideration for analog signal, selecting an A/D converter, Introduction to real-time systems, languages for real-time applications, real time operating systems, Software in automation systems: needs and evaluation, introduction to object oriented programming and activeX components, Industrial networking: Foundation FieldBus and Profibus, Databases for industrial automation, Human machine interface, The basics of industrial IT. **Prerequisite** : Linear Control Systems

1716424 Industrial Processes Control 3 Cr.

Modeling Industrial processes, conventional P, PI, PID controllers and their application, tuning controllers using Zeigler Nichols methods, industrial controller, their architectures and functions, standards in process control, feed-forward, cascade, and Override control, control of basic process units; 9heat exchangers, combustions and furnaces, etc.), control of very common process plants(thermal power plant, distillation column) computer control systems (basic structure, programming and application), distributed control system (basic structure, and application). **Prerequisite** : Linear Control Systems

1716412 Instrumentation 3 Cr.

Instrumentation Descriptions , Instrumentation Faults, Transducers and Measurement Bridges, Electrical Measurements and Calibration, Temperature Measurement, Pressure Instrumentation, Liquid and Gas Flow Instrumentation, Level Instrumentation, pH, Humidity, and Moisture Measurement, Gases, Smoke, and Fire Detection, Control Valves. **Prerequisite** : Electronics Principles , (Linear Control Systems)

1716436 Mechatronics 3 Cr.

Displacement Measurement, Linear and Angular : Resistive Displacement Sensors, Inductive Displacement Sensors , Capacitive Sensors Displacement , Piezoelectric Transducers and Sensors, Laser

Interferometer Displacement Sensors, Time-of-Flight Ultrasonic Displacement Sensors, Optical Encoder Displacement Sensors , Magnetic Displacement Sensors , Synchro/Resolver Displacement Sensors, Optical Fiber Displacement Sensors, Optical Beam Deflection Sensing. Thickness Measurement. Proximity Sensing for Robotics . Position, Location, Altitude Measurement. Altitude Measurement. Attitude Measurement . Inertial Navigation . Satellite Navigation and Radiolocation . Occupancy Detection . Angle Measurement. . Tilt Measurement . Velocity Measurement. Acceleration, Vibration, and Shock Measurement . Strain Measurement Force Measurement . Torque and Power Measurement. Tactile Sensing. **Prerequisite** : Linear Control Systems

1716416 Intelligent Control Systems 3 Cr.

An Introduction to Computational Intelligent Fuzzy Logic, Neural Network and Evolutionary Computing. Fuzzy Sets, Linguistic Variables, Rectangular Norms, Fuzzy Logic and Fuzzy Inference Systems, Fuzzy Models (mamdani model –Takagi Sugeno model…), Design of Fuzzy Controllers and Fuzzy PID Controllers, Evolutionary Computing, Genetic Algorithms, PSO Algorithms, Design of Controllers with Genetic Algorithms, Neural Networks, Neuron and Perceptron, Multi Layer Perceptron, Back Propagation. **Prerequisite** : Linear Control Systems

1716456 Nonlinear Control Systems

Review of control systems and the concept of feedback, Nonlinear differential equations, Nonlinear state-space models, Types of nonlinearity, Simulation of nonlinear systems, Equilibrium points, Phase trajectories and phase planes, Phase portraits, Plotting phase portraits, Phase portrait of linear systems, Concepts of Lyapunov, asymptotic and exponential stability, Linearization of nonlinear systems, Lyapunov's indirect (linearization) stability theorem, Lyapunov's direct stability theorem, Invariant sets, Stability of invariant sets, Building Lyapunov functions, Lyapunov's method for linear systems, Instability theorems, Review of discrete-time nonlinear systems, Stability of discrete-time nonlinear systems, Lyapunov's theorems for discrete-time nonlinear and linear systems, Review of linear controllers for nonlinear systems, Nonlinear controllers for linear systems, Circle and Popov criteria, Linear controllers for nonlinear systems, LTI equivalent of nonlinear systems, Nonlinear controllers for linear systems, Feedback linearization. **Prerequisite** : Linear Control Systems

1718217 Electromagnetics 3 Cr.

Vector analysis, Coulomb's and Gauss' laws, electric potential, Laplace's and Poisson's equations, electrostatic fields in material media, electrostatic energy, electric current, Biot Savart's law, magnetic potentials, Faraday's law, magneto static fields In material media, magneto static energy, inductance and mutual inductance, magnetic circuits, displacement current, Maxwell`s Equations, Transmission lines . **Prerequisite** : Calculus II , General Physics II

1718312 Fields and Waves 3 Cr.

Maxwell's equations in time varying fields; boundary conditions, wave equations, plane wave propagation in unbounded media, polarization, pointing·s theorem, reflection and transmission at boundaries between media, wave equation in cylindrical waveguides, rectangular and cylindrical waveguides ,dielectric waveguides, transmission lines, steady state and transient response, Smith chart, impedance matching, stub tuning. **Prerequisite** : Electromagnetics, Engineering Mathematics

1718204 Signals & Systems Analysis 3 Cr.

Primary definitions of systems and signal, various kinds of systems, introduction to modeling of various physical systems, analysis of linear and time independent (continuous and discrete) systems, impulse response, convolution integral, Fourier analysis, energy density, spectrum and power sampling theorem, system analysis by Laplace transform, signal flow graphs, system analysis in state space (continuous and discrete), Z transform, discrete systems analysis by the Z transform.

Prerequisite : (Engineering Mathematics)

1718303 Communication Systems Principles 3 Cr.

Short description of an analog communication system, analysis of deterministic signals in frequency domain, analysis of random signals, noise in communication systems, white noise, noise temperature, noise band-width, signal transmission in base band, linear distortion, nonlinear distortion, analog modulation systems, analysis of linear modulations such as AM,VSB,DSB,and SSB, linear modulation and demodulation techniques also combined with FDM, nonlinear modulation techniques such as PM and FM, noise and interference effects on

various types of modulation, pulse modulation, survey of sampling techniques for analog pulse modulations such as PAM, PPM, and PDM, familiarity with digital modulation systems such as FSK,PSK,and ASK. **Prerequisite** : Engineering Probability and Statistics, signals and Systems Analysis

1718425 Communication Circuits 3 Cr.

Introduction to RF circuits, impedance matching circuit design. RF transistors and small signal RF amplifier design, LC oscillator design, introduction to phase locked loops (PLL), design and their application in RF circuits. Mixer, Modulator/ Demodulator circuits, Architecture of transceivers. Noise and noise modeling. **Prerequisite** : Communication Systems Principles, Electronics Principles

1718404 Communication Circuits Laboratory 1 Cr.

Modulation and demodulation, Transmitters and receivers, Frequency response of LC and ceramic filters, Tunable RF resonant circuits, Buffers and Antenna impedance matching, AM/FM super heterodyne receiver, FSK demodulator, FM quadrature detector, various types of oscillators, VCO and PLL. **Prerequisite** : Communication Circuits

1718412 Antenna I 3 Cr.

Fundamentals and definitions, solution of Maxwell;s equations for radiation, potential functions, current element, pattern, field pattern, directivity, gain, impedance, efficiency, power, polarization, receiving properties of antennas, applications of antennas in communications and radar, reciprocity, short dipole, half-wave dipole, antennas above a perfect ground plane, image method, small loop antennas, duality. Arrays: linear arrays, array factor, uniformly and (nonuniformly) excited and equally spaced linear arrays, endfire and broadside arrays, Hansen-Woodyard endfire array, pattern multiplication, mutual impedance,phased arrays. Line sources, uniform line source, tapered line source. Wire antennas: dipoles, folded dipoles, Yagi-Uda,travelling wave antennas (such as vees and rhombic),circular and rectangular loops, feeding wire antennas, wire antennas in front of an imperfect ground plane. Broadband Antennas: helical, biconical, sleeve spiral, log periodic antennas. Aperture antennas : radiation from apertures and Huygen's principle, rectangular apertures, rectangular horns (E and H plane), pyramidal horns, circular apertures, reflector antennas, gain calculation. Antenna synthesis: line source method (Fourier transform, Woodward-Lawson sampling), linear array methods (Fourier series,Woodward-Lawson sampling, Dolph-Chebyshev,Taylor). **Prerequisite** : Fields and Waves

1718417 Microwaves I **3** Cr.

S- parameter definition and properties, Cavity resonators, microwave network analysis , waveguide and cavity excitations, passive microwave components, directional couplers, power dividers, microstrip lines and coplanar waveguides, propagation of waves In ferrites, ferrite components, microwave tubes, klystrons, magnetrons, TWT. **Prerequisite :** Fields and Waves

1718428 Microwave Laboratory 1 Cr.

Investigation of the characteristics of reflex Klystron, modulation and detection, measurement of SWR, propagation and reflection of waves, determination of the radiation pattern of horn antennas, measurement of power and impedance, characteristics of directional couplers, tees, filters, isolators and circulators, measurement of return loss, internal loss, reflection coefficient and SWR by directional couplers: measurement of scattering parameters. **Prerequisite** : Microwaves I

1718436 Introduction to Wireless Communications 3 Cr.

Preliminaries : historical overview, modern wireless communication systems, overview of wireless standards,Cellular Architecture : cellular layout, channel reuse and system capacity, cell splitting and sectorization, Erlang capacity, Handoff, power control, Channel modeling : free space propagation, large – scale path loss and shadowing, small – scale multi – path fading, Raleigh and Rican models, delay spread and frequency coherence, Doppler shift and time coherence, level crossing and average fade duration. Modulation Techniques : digital modulation for fading channels, PSK, MPSK, FSK, Differential MPSK, OPSK, MSK, GMSK, Multi carrier communications and OFDM, Error probability in the Absence and presence of channel fading. Diversity, coding and equalization : channel impairment, mitigation techniques, diversity techniques, methods of combining, MIMO systems, channel coding and interleaving, equalization. 1 G and 2G TDMA standards : AMPS, GSM, a quick review of digital AMPS, control channels in GSM. Mobility management : handoff, location update, paging, exchange of control message for mobility management, optimization of location areas. CDMA systems and standards : direct sequence and frequency hopping spread spectrum systems, CDMA

CDMA , rake receivers. an introduction to modern wireless networks. **Prerequisite** : Communication Systems Principles, Engineering Probability

1734102 Advanced Computer Programming and Lab 4 Cr.

In depth C++ programming, Introduction of UI design QT and mobile programming (Android, IOS). Complementary issues of C programming, Memory management, In depth understanding of C++ codes, Coding relation with operating system, file management, IO streams, clear implementing basic data structures like link lists, Generic programming, Implementation of inheritance and its related issues in C++, Operator overloading, Graphical interface design using QT. Multithreading essentials, exception handling, object oriented programming principles, comparing C++ with other languages (C# , java , ...) , Debugging and testing of programs, Function calling conventions, Dynamic memory coding. Introduction to functional programming. Developing dynamic-link-libraries. Using OpenCv library as an example (Loading image, matrix manipulation…).

Prerequisite: Computer Programming and Lab

1734441 Programming Languages 3 Cr.

History of programming Language , programming environments , virtual computers and binding times, campiled languages, interpreted languages , data types (elementary , structured, abstract data type, encapsulation, inheritance) ,sequence control (sequential and nonsequential control) ,subprograms (call- return , recursive , coroutines, schedulers , tasks, exception handlers),data access (local and nolocal environment) ,storage management prerequisite: compiler design.

Prerequisite: Compiler Design

1732409 Introduction to Robotics and Automation 3 Cr.

This course is mainly about introducing robot manipulators and Automation in industry. The robotics part discusses about history of robotics, robot configurations, transformations, forward and inverse kinematics, and path planning. In the automation part PLCs are introducted.

Prerequisite: Calculus II, Microprocessor

1730101 Computer Workshop 1 Cr.

This course familiarizes students with the basics of using a computer. The course begins by introducing operating systems, and then Farsi and English typing is taught. Later working with a word-processor, spreadsheet, slide presentation, database is introduced. The course concludes with the ways of keeping computers safe, and agronomy of using computers.

1730425 Data Communications and Computer Networks 3 Cr.

- A short introduction on communication systems and reviewing layer concept in network.
- Data transmission concepts: Analog and digital data transmission, Transmission impairments, Channel capacity, Introduction to Fourier series and Fourier transform, Bandwidth of signals.
- Signal encoding techniques: digital line coding techniques (NRZ, RZ, Manchester, AMI, Scrambling techniques), analog and digital modulation techniques (AM, FM, PM, ASK, FSK, PSK), Sampling theorem (PCM, DM)
- Digital data communication techniques: Asynchronous and synchronous transmission, Error types, Error detection, Error correction
- Multiplexing techniques: FDM, TDM, WDM, CDM.

Prerequisite: Signals & Systems Analysis.

1734433 Database Management Systems I 3 Cr.

A presentation of the fundamental concepts used in data modeling and database implementation. The data modeling process, basic relational concepts, and the process of normalization, relational algebra, SQL, and guidelines for mapping a data model into a relational database will be covered. Student will model a multimedia and or text – only problem and implement it on a single machine with a commercially available DBMS including Microsoft SQL server or Oracle. Prerequisite : Data Structures

1734308 Database Management Systems II 3 Cr.

Advanced concepts used in database design and implementation. Transaction processing, XML data exchange support by DBMS, spatial databases and location-dependent queries, as well as an overview of data analysis techniques are among the topics discussed in this course. Student will conduct practical projects in

applying the concepts on MS-SQL server, Oracle, PostgreSQL, MySQL and DB2. Prerequisite: Database Management Systems I

1734452 Database Management Systems Lab 1 Cr.

This lab covers a wide range of practical sections on installing a DBMS like MS SQL Server, configuration of its engine and enterprise management environment, the SQL language, inner and outer join operations, aggregate functions, subqueries and common type expressions, handling null values, triggers, stored procedures and user defined functions and indexing methods. Prerequisite : Database Management Systems I

1734312 Software Engineering I 3 Cr.

Process models, agile processes, system engineering, requirement engineering, analysis engineering, design engineering, architectural design, computer level design, user interface design, software testing, quality management, software engineering with emphasis on UML modeling and design patterns. Prerequisite: Computer Programming
and Lab

1734449 Software Engineering II 3 Cr.

Advanced software engineering techniques using state-of-the-art tools and techniques and software reuse, component-based design, distributed software design, service-oriented architectures and aspect-oriented software development are discussed. Students perform practical team projects focusing on software design skills. Software project management, project scheduling and risk management based on holistic methods like the Rational Unified Process is also presented to enhance their software project management skills. Prerequisit: Software Engineering I

1736401 Electronic Commerce 3 Cr.

In this course, we will attempt to understand the phenomena, both technological, economic and social, behind these rapid changes, and how organizations successfully conduct Internet-based activities. We will also study some of the technology of the Internet, as described below. This course provides an overview of e-commerce from both technological and managerial perspectives. It introduces e-commerce frameworks, and technological foundations; and examines basic concepts such as strategic formulation for e-commerce enterprises, management of their capital structures and public policy. This course is designed to familiarize students with current and emerging electronic commerce technologies using the Internet. Topics include Internet technology for business advantage, revenue models, auction design, managing electronic commerce funds transfer, reinventing the future of business through electronic commerce, business opportunities in electronic commerce, electronic commerce Web site design, social, political and ethical issues associated with electronic commerce, and business plans for technology ventures. It is particularly important that the student place a great deal of emphasis in understanding the different EC system design principles. Prerequisite : Database Management Systems I.

1734425 Design and Analysis of Algorithms 3 Cr.

This course in intended for undergraduate students of Software Engineering and it provides basic concepts and methods for designing and analyzing algorithms. Students are supposed to have already passed Discrete Structures and Data Structures and Algorithms courses. In particular, after a quick review of growth of functions and asymptotic nations, four general paradigms of Divide and Conquer, Dynamic Programming, Greedy, Backtracking, and Branch and Bound are introduced using basic examples including basic graph problems.
Prerequisite : Data Structures.

1734307 Software Engineering Lab 1 Cr.

This lab. is intended for undergraduate students of Software Engineering as a companion to the Software Engineering I course. In particular, students practice requirements engineering and the concepts of objected oriented design using UML diagrams such as use-case, sequence and class diagrams through a real project. Students also become familiar with up-to-date tools such as Visual Paradigm, .
Prerequisite : Software Engineering I.

1740312 Technical Writing and Presentation 2 Cr.

1. Study of principles of oral and written presentations.
2. Basic concepts of authenticity and plagiarism.

3. General concepts of technical publication and its structure, including: (Title, abstract, keywords, introduction, main body, conclusions, references, appendices, etc.), structure of reports (lab reports, term papers, thesis, etc.).
4. Oral presentations (preparation, sets and tools).

Prerequisite : Technical English for Computer Majors, Engineering Mathematics.

1736426 Multimedia Systems 3 Cr.

1. Introduction to multimedia history, applications, and tools.
2. Basics of image processing: point and mask processing.
3. Frequency domain image processing.
4. Color images.
5. Basics of audio, human auditory system, and audio signal processing.
6. Basics of video processing and compression.
7. Image reconstruction methods.

Prerequisite : Computer Networks I, Engineering Mathematics.

1732420 VLSI Circuit Design 3 Cr.

This course provides an introduction to the design and implementation of VLSI circuits for complex digital systems. The focus is on CMOS technology. Issues to be covered include basics of semiconductor fabrication, basics of layout design, clocking, power dissipation, CAD tools and algorithms, simulation, verification, testing, and design methodology. The course includes a project for which students try to design and layout a small 4-bit microprocessor.
Prerequisite: Digital Electronics

1734417 Computer Simulation 3 Cr.

The purpose of this course is study the key issues in simulation and modelling techniques of the discrete event systems. The course covers the event scheduling algorithms and includes an overview of simulation languages. Emphasis is placed on the design of simulation experiments, simulation programming in OPNET, correct interpretation of the associated statistical results in introduction level. Special topics such as design of experiments and variance reduction techniques will be discussed.
Prerequisite: Engineering Probability, Advanced Computer Programming and Lab

1730103 Introduction to Computer Engineering 1Cr.

This undergraduate course provides a broad review of important challenges in computer science and computer engineering. The course is given to the computer and IT engineering students in the first semester. Students would be able to understand differences between different fields of computer sciences and engineering. They learn the main topics of computer and IT engineering courses, which would be delivered at the IUT. They also learn about department and faculties. There are many topics, including but not limited to Software Engineering, Hardware Engineering, Networking, Algorithm, Machine Learning, AI, Database, Networking, … Prerequisite: ---

1740320 Computer Networks I 3 Cr.

This undergraduate course provides an overview on networking and Internet. The course covers the following topics: Introduction (Protocol, Access Net, Physical Media, Packet/Circuit Switching, Internet Structure, Performance: Loss, Delay, Throughput, Introduction to Network Security, Protocol Layers), Application layer (Principles of Network Applications, Web and HTTP, FTP, SMTP, POP3, DNS, TCP and UDP Sockets), Transport Layer (Transport-layer services, Multiplexing and demultiplexing, Connectionless transport: UDP, Principles of reliable data transfer (Rdt protocol, Stop and Wait, Go-back-N, Selective repeat), Connection-oriented transport: TCP (Segment structure, Reliable data transfer, Flow control), Connection management (Principles of congestion control, TCP Congestion Control), Network Layer (Virtual circuit and datagram networks, Inside a router, Internet Protocol, DHCP, NAT, ICMP, IPv6 Addressing), Link layer and LANs (Framing, Flow control, Half-duplex and full-duplex, Error detection and correction, Multiple access protocols) Prerequisite: 75 Cr. and Computer Architecture

1736310 Computer Networks 2 3 Cr.

This is an advance networking course which covers: Internet network Architecture, Transport Layer (Congestion Control, Fairness, Scheduling), Routing Algorithms (Link State, DV, Hierarchical), Routing in the internet (RIP, OSPF, BGP), Multicast Routing, Link layer Protocol (Framing, Error Detection and Correction, Multiple Access, Addressing, VLAN, PPP Protocol, Link Layer Switch), ATM Network, MPLS, Queuing Theory, Physical Layer, Prerequisite: Computer Networks 1

1736318 Information Technology Engineering 3 Cr.

This undergraduate course provides an advanced topics in networking and distributed computing. The course covers the following topics: Introduction to IT Engineering, Wireless and Mobile Networks (Wifi, CSMA, and 802.11, Cellular Architecture, GSM, GPRS, UMTS, Mobile IP), Backbone Network (Hub, Switch, Router, Gateway, VLANs, Backbone Performance), Multimedia Networking (MM Applications, Streaming Audi and Video, QoS Guarantees and Multiple Class of Services, RTP, RTCP, RTSP, RSVP, SIP and H323), Security and Privacy (Principles of cryptography, Message integrity, Securing e-mail, Securing TCP connections: SSL, Network layer security: IpSec, Securing wireless LANs, Operational security: firewalls and IDS, Privacy enhancing technology), Network Management (MIB, SMI, SNMP, Security and Admission, ASN.1), Distributed Systems (Introduction to Grid and Cload Computing), Network Simulation (Ns-2), Search Engines, (Google Page Rank Algorithm), Network Programming (CGI, ASP, PHP, …) Prerequisite: Computer Network 1

1736208 Ethics in Information Technology 3 Cr.

This undergraduate course provides a broad overview ethics in Information Technology. The following topics are addressed in this course: An Overview of Ethics, Ethics for IT Workers and IT Users, Computer and Internet Crime, Privacy, Freedom of Expression, Intellectual Property, Software Development, The Impact of Information Technology on Productivity and Quality of Life, Social Networking Ethics, Ethics of IT Organizations. Prerequisite: Foundations of IT Engineering or Computer Networks 1

1732312 Microprocessors I 3 Cr.
Internal organization of computers, memory organization, memory types and address decoding, CPU architecture, microcontroller versus general purpose microprocessor, microcontroller and embedded processors, history and features of AVR microcontroller, AVR architecture and assembly language programming, AVR port programming, AVR advanced assembly language programming, AVR programming in C, AVR hardware connections, timers programming, and interrupt programming, AVR Serial port programming, LCD and keyboard interfacing, ADC , DAC, and Sensor interfacing, relay and stepper motor Interfacing, PWM programming and DC motor control.
Prerequisite: Computer Architecture, Electric and Electronic Circuits.

1732417 Digital Electronics 3 Cr.
Basics of Logic families, BJT switch, RDL, RTL, and DTL Logic family structure, TTL characteristics and logic family structure, ECL family structure, NMOS, CMOS, BiCMOS, Dynamic CMOS family structure, Schmitt triggers, multivibrators, D/A and A/D converters structure and basic, Flip-Flops, registers, RAM, ROM.
Prerequisite: Digital Systems Design, Electric and Electronic Circuits.

1732207 Electric and Electronic Circuits I 3Cr.
Circuit abstraction, Ideal and practical two-terminal elements, Kirchhoff's laws, analysis of resistive networks, network and superposition theorems, analysis of nonlinear circuits, digital abstraction, BJT switch, MOSFET switch, energy storage elements, analysis of RC, RL circuits, state and state variables, digital memory, operational amplifier and applications, 555 timer and applications.
Prerequisite: General Physics II, Differential Equations.

-------- **Electric and Electronic Circuits II** 3Cr.
Energy and power in digital circuits, BJT biasing, amplifier and small signal model, MOSFET amplifier and small signal model, analysis of RLC circuits, sinusoidal steady state: Impedance and frequency response, Time domain versus frequency domain analysis, sinusoidal steady state: resonance, filters, and diodes.
Prerequisite: Electric and Electronic Circuits I.

1730115 Computer Programming and Lab 4 Cr.

Introduction to Computers, History of Computers, Introduction to computer parts and environments (hardware. Software). Numerical Systems (2's Complement, IEEE Floating point), Constants, Variables, Input and output consoles, Introduction to algorithms implementation, Introduction to structural languages (e.g. C), arithmetic and logical operators. Bitwise operators, flow control and loops (IF, while, do…), Casting, Search and sort algorithms, Overloading functions, introduction to Debugging, pointers, File Input and output, Introduction to Class and Data Abstraction

Prerequisite: --.

1732401 Microprocessor Lab 1Cr.

Introducing to AVR microcontrollers, Programming of I/O ports, LCD, Keyboard, Timers, ADC/DAC, PWM, and RS232. Familiarizing with the use of relay, DC motors, and Dot matrix. And also an interesting tutorial on "codevision" programming.

Prerequisite: Microprocessor I, Digital Systems Design I Lab.

1732316 Embedded system Design 3Cr.

Introduction to embedded systems design(Common characteristics), SPECIFICATIONS AND MODELING(Model of computation, Early design phases, Communicating finite state machines, Timed automata, Statecharts), EMBEDDED SYSTEM HARDWARE (Sensors, Sample-and-hold circuits, A/D-converters, Processing unit, Thumb Instruction Set , Code Compression , DSP Processors , Floating point vs. fixed Point , Streaming SIMD, Extensions, reconfigurable Logic, Memories, Communication, CAN,D/A-converters, Sampling theorem), SYSTEM SOFTWARE (Embedded Operating Systems, RTOS, Scheduling in real-time systems, Middleware, MPI), IMPLEMENTING EMBEDDED SYSTEMS HARDWARE/SOFTWARE CODESIGN (High-level optimizations, Compilers for embedded systems, Power Management and Thermal Management)

Prerequisite: Microprocessor I.

1736407 IT project Management and Control 3Cr.

phases of Project Management Process, Categorizing projects, Types of information systems (IS) projects, Setting objectives , Problems with software project , Product description (PD) , Product breakdown structure (PBS) , Product flow diagram (DFD) , Gantt charts , Generic process model, Programme management and project evaluation, Programme management, Benefits management, Quantifying benefits, Cost benefit analysis (CBA), Net profit, Payback period, Return on investment (ROI), Net present value, Discount factor, Internal Rate of Return (IRR), Risk evaluation, Functional organization, Matrix structure, Generic project organization

Development Strategy: Waterfall, B, V, Prototyping, Incremental delivery, agile methods, Dynamic System Development Method (DSDM), XP

Estimation Methods: Bottom-up, parametric algorithmic (COCOMO), Analogy, Delphi

Scheduling: Work breakdown structure (WBS), Product breakdown structure (PBS), PERT, CPM

Risk management, Resource Allocation, Monitoring & Control (Slip chart, Ball chart, Earn value analysis ...)

Managing Contracts (Fixed price contracts, Time and materials contracts, Fixed price per delivered unit, …) MOA**… ,**

Managing People and Organizing Teams: Hawthorne effect, McGregor Theory, Innate characteristics, Maslow's hierarchy of needs, Herzberg, Vroom, Oldham-Hackman Job Characteristics, Delphi approach, Leadership styles, PMI body of knowledge

Prerequisite: Software Engineering I.

1740404 Computer Network Lab 1 Cr.

- Network setting in windows and Linux
- Virtual machine
- Linux firewall
- Analysis some appellation protocols (WEB, DNS, ICMP)
- Switching basics [Basic configuring of switches]
- VLAN Configuration
- Routing Basics [Basic configuring of routers]
- Static routing in CISCO router
- RIP Routing
- OSPF routing
- VLAN Configuration
- Case study (Design a network)

Prerequisite: Computer Network I.

1736432 Information Security 3 Cr.

- Introduction and Motivating examples
  - Basic concepts: confidentiality, integrity, availability, security policies,

security mechanisms, assurance

- Cryptography
  - Historical background
  - Transposition/Substitution, Caesar Cipher
  - Introduction to Symmetric crypto primitives, Asymmetric crypto

primitives, and Hash functions

- Secret Key Cryptography
  - Applications
  - Data Encryption Standard (DES)
  - Encrypting large messages (ECB, CBC, OFB, CFB, CTR)
  - Multiple Encryption DES (EDE)

- Message Digests
  - Applications
  - Strong and weak collision resistance
  - The Birthday Paradox
  - MD5, SHA-1

- Public Key Cryptography
  - Applications
  - Theory: Euclidean algorithm, Euler Theorem, Fermat Theorem, Totent functions, multiplicative and additive inverse
  - RSA, Selection of public and private keys

- Authentication
  - Security Handshake pitfalls
  - Online vs. offline password guessing
  - Reflection attacks
  - Per-session keys and authentication tickets
  - Key distribution centers and certificate authorities

- Trusted Intermediaries
  - Public Key infrastructures
  - Certification authorities and key distribution centers
  - Kerberos

- Real-time Communication Security
  - Introduction to TCP/IP protocol stack
  - Implementation layers for security protocols and implications
  - IPsec: AH and ESP
  - IPsec: IKE
  - SSL/TLS

- Electronic Mail Security
  - Distribution lists
  - Establishing keys
  - Privacy, source authentication, message integrity, non-repudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity
  - Pretty Good Privacy (PGP)

- Firewalls and Web Security
  - Packet filters
  - Application level gateways
  - Encrypted tunnels

- Cookies
- Web security problems

Prerequisite: Computer Network II.

1734320 Operating System 3 Cr.

- Overview of operating systems, functionalities and characteristics of OS.
- Hardware concepts related to OS, CPU states, I/O channels, memory hierarchy, microprogramming
- The concept of a process, operations on processes, process states, concurrent processes, process control block, process context.
- UNIX process control and management, PCB, signals, forks and pipes.
- Interrupt processing, operating system organization, OS kernel FLIH, dispatcher.
- Job and processor scheduling, scheduling algorithms, process hierarchies.
- Problems of concurrent processes, critical sections, mutual exclusion, synchronization, deadlock.
- Mutual exclusion, process co-operation, producer and consumer processes.
- Semaphores: definition, init, wait, signal operations.
- Use of semaphores to implement mutex, process synchronization etc., implementation of semaphores.
- Critical regions, Conditional Critical Regions, Monitors, Ada Tasks.
- Interposes Communication (IPC), Message Passing, Direct and Indirect
- Deadlock: prevention, detection, avoidance, banker's algorithm.
- Memory organization and management, storage allocation.
- Virtual memory concepts, paging and segmentation, address mapping.
- Virtual storage management, page replacement strategies.

Prerequisite: Data Structures, Digital Systems Design II.

1730120 Foundations of Information Technology 3 Cr.

- Information Technology: Principles, Practices, and Opportunities
- Essentials of Computing
- Essentials of the Internet and World Wide Web
- The Central Processor and Memory
- Storage and Input/Output Devices
- Personal and PC Databases
- Enterprise Databases and Data Warehouses
- Enterprise and Personal Communications Networks
- Electronic Commerce and Electronic Business
- Launching Information Technology Applications Projects
- Creating Enterprise Applications
- Creating Web-Enabled Applications
- Information Systems in the Enterprise
- Other Issues in Information Technology

Prerequisite: ----.

1736438 Information Technology Strategic Management 3 Cr**.**

- Information Systems & Information Technology
- Management Information Systems (MIS)
- IT Strategic Planning
- Enterprise Architecture (including EA Frameworks like Zacheman, TOGAF, FEAF)
- IT Service Management & ITIL
- IT Governance (including Governance frameworks like COBIT)

Prerequisite: IT project Management and Control.

1734325 Theory of Formal Languages 3 Cr.

Finite state automata and regular expressions. Pushdown Automata and context free grammars, linear bounded Automata and context sensitive grammars, Turing machines and unrestricted grammars, relations between machines and grammars. **Prerequisite** : Data Structures

1734333 Compiler Design I 3 Cr.

lexical analysis, regular expressions and finite automata, syntax analysis, context free grammars, (SLR, LALR, CLR), semantics analysis and intermediate code generation (syntax directed translation method), code generation and runtime storage management. **Prerequisite** : Theory of Formal Languages.

1734420 Artificial Intelligence 3 Cr.

A survey of the problems and techniques involved in producing or modeling intelligence in computers. Particular emphasis is placed on representation of knowledge and basic paradigms of problem solving topics include game playing theorem proving natural language and learning systems. Rule base inference (forward and backward chaining). Search techniques and dealing with uncertainty using probability and fuzzy logic.

Prerequisite : Data Structures.

1734436 Computer Graphics 3 Cr.

An introduction to the field of computer generated and/or displayed graphics data, covering the topics of graphics applications, graphics hardware, transformations, projections, chipping, modeling 2D and 3D curves, modeling objects, color and shaping, and familiarity with one of graphics libraries. **Prerequisite**: Data Structures, Engineering Mathematics.

1730217 Discrete Mathematical Structures 3 Cr.

Preliminaries: Logic and Reasoning, Propositional, Predicate, and Fuzzy Logic, Methods of Proof, Set Theory, Functions, Combinatorial Analysis: Basics of Counting The Pigeonhole Principle, Permutations and Combinations, Recurrence Relations, Generating Functions and Counting, Relations and Ordered Sets, Relations and Their Properties, Representing Relations, Closures of Relations, Equivalence Relations, Partial Ordering ,Partially-ordered sets, Totally-ordered sets, Hasse diagrams, and Lattices, Graphs, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity and Euler and Hamiltonian Paths ,Shortest Path Problems, Planar Graphs, Trees , Introduction to Trees and Their Applications, Tree Traversal, Spanning Trees, Fundamentals of Computing , Languages and Grammars, Finite-State Machines, Turing Machines and Computability, Miscellaneous and Review **Prerequisite** : Computer Programming and Lab.

1734212 Data Structures 3 Cr.

Analyzing the efficiency of algorithm, recursion Data abstractions, elementary data structures such as array & records and way of representation. stacks, queues, limited lists, trees, graphs, sorting (bubble, selection, linear insertion, tree sort heap, quick, merge), searching (binary, bst, AVL, b-trees, digital search). **Prerequisite** : Advanced Computer Programming and Lab, Discrete Mathematical Structures

1732208 Computer Organization and Architecture 3 Cr.

Principles of an assembly language programming, introduction to computer architecture, internal representation of data and instruction, memory organization, microprogramming multi-level machines, Control memory, common bus organization, stack organization and RISC and CICS structures, pipeline and basics of parallel machines. **Prerequisite** : Digital System Design.

1732303 Digital Systems Design II 3 Cr.

Computer Abstractions and Technology, Instructions: Language of the Computer, The Processor: Datapath and Control, Enhancing Performance with Pipelining, The AVR Microcontroller: History and Features, AVR Architecture and Assembly Language Programming, Branch, Call, and Time Delay Loop, AVR I/O Port Programming, Arithmetic, Logic Instructions, and Programs, AVR Advanced Assembly Language Programming, AVR Programming in C, AVR Timer Programming in Assembly and C, AVR Interrupt Programming in Assembly and C, AVR Serial Port Programming in Assembly and C, LCD and Keyboard Interfacing, ADC, DAC, and Sensor Interfacing,PWM Programming and DC Motor Control in AVR.