Undergraduate Course Descriptions for students of Computer Engineering

1710103 Introduction to Electrical Engineering 1 Cr.

Basic introduction to some aspects of electrical engineering in different fields.

1730103 Introduction to Computer Engineering 1 Cr.

Basic introduction to some aspects of computer engineering in different fields.

1730155 Computer Programming Fundamentals 3 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, File Input and output, Introduction to Class.
Prerequisite: -

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.

1730115 Fundamentals of 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:** -

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. **Prerequisites:** Differential Equations, Physics II

1710203 Electric 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

1710201 Electrical Circuits Lab.

1 Cr.

Practicing the concepts of Electric Circuits I and Electric Circuits II. **Prerequisites:** Electric Circuits I, Electric Circuits II

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 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. **Prerequisites:** Electronics Principles, Electrical Circuits Lab.

1712432 Principles of Biomedical Engineering

3 Cr.

Introduction to the origin of biopotentials, biomedical signal processing, biopotential amplifiers, bipotential electrodes, medical imaging and brain computer interface (BCI).

1714304 Electric Machine Lab. I — 1 Cr.

Practicing concepts of courses Electric Machines I and Electric Machines II. **Prerequisites:** Electric Machines I and Electric machines II

1714303 Electrical 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

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 pacts 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. **Prerequisites:** Electric Circuits II, Signals and Systems Analysis, Engineering Mathematics

1716401 Linear Control Systems Lab. — 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

1716405 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, Multi layer networks and Backpropagation algorithm, Unsupervised Hebbian learning rule, RBF Networks, Competitive Networks, Grossberg Network, Adaptive Resonance Theory, Hopfield Network. **Prerequisite:** (Linear Control Systems)

1712436 Special Topics in Electronics 3 Cr.

Designing high frequency circuits using Altium Designer. Prerequisite:**Prerequisite:** Electronics Principles

1730499 Special Topics in Computer 3 Cr.

Students are expected to learn the basics of Game Theory: 1. Introduction and Examples: Games in normal form, Strategy (pure and mixed), Cost and payoff, Zero-sum and general-sum games. 2. Analyzing Games: Pareto optimality, Best response, Nash equilibrium, Finding Equilibria, Maxmin and Minmax strategies, Indifference principle. 3. Extensions: Correlated Nash Equilibria, Evolutionary Nash Equilibria. 4. Cooperative Games: Strong Nash equilibria, With and without transferable payoff, Coalitional games, Shapley value, Nash bargaining model. 5. Games in Extensive form: Khun's tree, Information sets, Subgame Perfect Equilibria, Behavioral strategy. 6. Other types of Games: Games with Imperfect Information, Bayesian Games, Repeated and Stochastic Games, Congestion games and selfish routing. 7. (Further Topics) Mechanism Design, Social choice, Price of Anarchy, Graphical games and Online mechanisms. **Prerequisites:** General Mathematics II

1730465 Modern Topics in Computer 3 Cr.

Students are expected to learn the basics of Graph Theory: properties of standard graphs, Eulerian graphs, Hamiltonian graphs, Chordal graphs, Distances in graphs, Planar graphs, graph connectivity and Coloring of graphs.

1710204 Electrical Safety Principles Workshop 0 Cr.

Safely use test equipment and power tools commonly found in industry.

1714297 Electric Machines I 2 Cr.

Magnetic Circuits, magnetic field energy, force and torque in electromagnetic system, DC machines, machine Construction, review and determination of emf, armature winding, armature reaction, compensating windings, types of machines excitations, load characteristics of motor and generators, control of DC motors, loss and efficiency, parallel connection of DC generators, various application of DC machines. **Prerequisites:** Electric Circuits II, (Electromagnetics)

1714396 Electric Machines II 2 Cr.

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. **Prerequisite:** Electric Machines I

1716320 Advanced Control Systems 3 Cr.

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

1716413 Digital Control Systems Lab. 1 Cr.

Practicing concepts of course Digital Control Systems. **Prerequisite:** Digital 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

1716440 Industrial Automation Lab. 1 Cr.

Practicing concepts of course Industrial Automation. **Prerequisite:** Industrial Automation

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

1716444 Industrial Automation Lab. 1 Cr.

Practicing concepts of course Industrial Processes Control. **Prerequisite:** Industrial Processes Control

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

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 circuit, displacement current, Maxwell's Equations, Transmission lines. **Prerequisites:** General Mathematics II, 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. **Prerequisites:** Electromagnetics, Engineering Mathematics

1718204 Signals and 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)

1718414 Microwave and Antenna 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, 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, S- parameter definition and properties, Cavity resonators, waveguide and cavity excitations, passive microwave components, directional couplers, microstrip lines and coplanar waveguides, propagation of waves In ferrites, ferrite components, microwave tubes, klystrons, magnetrons, TWT. **Prerequisite:** Fields and Waves

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

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. **Prerequisites:** Engineering Probability, Signals and Systems Analysis

1718449 Hardware and Circuits Description Languages (FPGA) 3 Cr.

This course explores FPGA architectures, HDL synthesis, place and route, FPGA configuration, Hardware validation and embedded MCU solutions, The course curriculum consists of modules that teach a broad range of FPGA topics, while hands on laboratory experiments exercise lecture content. The course is designed to provide students material to gain a working understanding of FPGA architectures, design methodologies, FPGÅ development tools, prototyping hardware, FPGA synthesis, place and route and FPGA image generation. **Prerequisite:** Digital Systems Design I

1718402 FPGA Lab. 1 Cr.

Practicing concepts of course Hardware and Circuits Description Languages (FPGA). **Prerequisite:** Hardware and Circuits Description Languages (FPGA)

1718448 Digital Communications Systems 3 Cr.

This course gives students deep knowledge in modern digital communication systems at the theoretical and practical level. This course introduces the most advanced standards and outlines the future of digital wireless communication systems and networks and will focus on the modulation and demodulation concepts, Noise in communication systems, Random signal theory and Coding algorithms and will therefore supply students with essential skills to work in the communication industry in particular. **Prerequisite:** Communication Systems Principles

1718406 Digital Communications Systems Lab. 1 Cr.

Practicing concepts of course Digital Communication systems (Modulation/Demodulation and Coding). **Prerequisite:** Digital Communications Systems

1740320 Computer Networks 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.

1718450 Digital Signals Processing 3 Cr.

Discrete time signals, Discrete Convolution and Correlation, Z-transform, Fourier Series, Fourier Transform, Frequency Response of LTI Systems, Sampling and Reconstruction of Signals, Discrete and Fast Fourier Transform, Design of FIR and IIR Digital Filters. **Prerequisite:** Signals and Systems Analysis

1730217 Discrete 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:** Fundamentals of Computer Programming and Lab.

1718452 Digital Signals Processing Lab. 1 Cr.

Practicing concepts of course Digital Signals Processing (Speech recognition and Speech processing, Audio signal processing). **Prerequisite:** Digital Signals Processing

1734102 Advanced 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, 10 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:** Fundamentals of Computer Programming and Lab.

1734212 Data Structures 3 Cr.

Analyzing the efficiency of algorithm, recursion Data abstractions, elementary data structures such as array and 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). **Prerequisites:** Advanced Programming and Lab., Discrete Structures

1732208 Computer Architecture and Organization 3 Cr.

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

1732207 Fundamentals of Electrical and Electronics Circuits 3 Cr.

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:** Physics II, Differential Equation

1732401 Microprocessor Lab. 1 Cr.

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, Digital Systems Design Lab. I

1734425 Algorithms Design 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

1740403 Guidelines for Research and Oral Presentation 2 Cr.

1. Study of principles of oral and written presentations. 2. Basic concepts of authenticity and plagiarism. Department of Electrical and Computer Engineering Isfahan University of Technology Page 9 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). **Prerequisites:** Especial English for Computer Science, Engineering Mathematics

1734320 Operating Systems I 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

1734325 Theory of Formal Languages and Automata 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

1734304 Operating Systems Lab. 1 Cr.

Practicing concepts of course Operating Systems I. **Prerequisite:** Operating Systems I

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. **Prerequisites:** Computer Networks, Engineering Mathematics

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

1720101 Physiology 2 Cr.

Introduction to Physiology, membrane physiology of nerve and muscle cells, heart, neural system and brain.

1734303 Databases 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 Databases 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:** Databases I

1734452 Database 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:** Databases 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:** Fundamentals of 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. **Prerequisite:** Software Engineering I

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

1732312 Microprocessor 3 Cr.

Internal organization of computers, memory organization, memory types and address decoding, CPU architecture, microcontroller versus general purpose microprocessor, microcontroller and em-

bedded 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, Fundamentals of Electrical and Electronics Circuits

1734333 Compiler 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 and Automata

1736310 Computer Networks II 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

1740312 Technical and Scientific Topics Presentation 2 Cr.

1. Study of principles of oral and written presentations. 2. Basic concepts of authenticity and plagiarism. Department of Electrical and Computer Engineering Isfahan University of Technology Page 9 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). **Prerequisites:** Especial English for Computer Science, Engineering Mathematics

1740417 Computer Networks 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.

1732203 Digital Systems Design I 3 Cr.

Number systems, Boolean algebra, logic functions and their reduction, logic gates and logic families (RTL, TTL, CMOS, etc.), combinational circuits (comparators, coders, etc.), sequential circuits (Flip-Flops, Shift Registers, etc.), study of various types of codes. **Prerequisite:** (Electronics Principles)

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. **Prerequisite:** Digital Systems Design I

1732204 Digital Systems Design Lab. I 1 Cr.

Practicing concepts of course Digital Systems Design I. **Prerequisite:** Digital Systems Design I

1732308 Digital Systems Design Lab. II 1 Cr.

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. **Prerequisites:** Digital Systems Design II, Digital Systems Design Lab. I

1740404 Computer Networks 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 Networks

1730401 Fundamentals Cryptography 3 Cr.

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, Totient 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, Digital signatures. **Prerequisite:** -

1730151 Fundamentals of Computer Programming Workshop 0 Cr.

Practicing concepts of course Fundamentals of Computer Programming and Lab.

1730400 Fundamentals of Computer Security 3 Cr.

Introduction to fundamentals of computer security. Topics discussed: 1. Basic Cryptography: DES, AES, Asymmetric Cryptography, RSA, SHA-1, HMAC, 2. Key Management: Needham — Schroeder Protocol, Otway — Rees Protocol, PKI, CRL, OCSP, 3. Access Control: DAC, IBAC, MAC, ORCON, BLP, Biba, PACLs, 4. Authentication, Auditing

1730402 Secure Software Development 3 Cr.

Concepts of Software Security, Vulnerabilities in C/C++ programs, Vulnerabilities in Web applications, Vulnerability Mitigation Methods, Secure Software Development Practices, Introduction to Dynamic and Static Program Analysis, Fuzzing, Hybrid Approaches in Program Analysis

1730403 Fundamentals of Computational Intelligence 3 Cr.

Machine Learning, Supervised Learning, Linear Regression, Classification, Gradient Descent, Feature Scaling, Logistic Regression, Regularization, Neural Networks: Back Propagation, Mini-Batch and Batch Gradient Descent, Data Augmentation, K-fold Cross Validation, Softmax, Hyper Parameters Tuning, RMSProp, Momentum, Adam, Convolutional Neural Network, Transfer Learning, Precision/Recall/F1 Score, SVM, Unsupervised Learning, K-means, Fuzzy Systems, Genetic Algorithms. **Prerequisite:** Advanced Programming and Lab., Artificial Intelligence

1730460 Fundamentals of Computer Vision 3 Cr.

Introduction to image types, How to save images, Basic Watermarking, Visual Quality Assessment, Methods of Resizing images, Nearest Neighbor Interpolation, Bilinear Interpolation,

Bicubic Interpolation, Image Histogram, Image Enhancement, Content-Based Image Retrieval, Image Filtering, What are Kernels, Image Padding, Low Pass Filters, High Pass Filters, Mean Filter, Gaussian Filter, Image Denoising, Template Matching, Edge Detection, Sharpening Images, Feature Extraction, Histogram of Oriented Gradient, Local Binary Patterns, Image Segmentation, Mathematical Morphology, Erosion, Dilation, Opening, Closing, Region Growing. Prerequisite: Signals and Systems Analysis

1730220 Fundamentals of Data Mining 3 Cr.

What is Data Mining, CRISP-DM, Fallacies of Data Mining, What is Data, Attribute Values, Discrete and Continues Attributes, Asymmetric Attributes, Important Characteristics of Data, Data Matrix, Document Data, Transaction Data, Graph Data, Ordered Data, Data Quality, Outliers, Missing Values, Duplicate Data, Data Preprocessing, Categorical Features, Numeric Features, Data Binning, Data Normalization, Exploratory Data Analysis, Contingency Tables, Data Partitioning, Balancing Data, Clustering, Modeling, Classification, Regression, Decision Trees, Random Forests, Naive Bayes Classification, Neural Networks, Logistic Regression, Model Evaluation, Dimension Reduction, Association Rules, Sequence Mining. **Prerequisites:** Advanced Programming and Lab., Artificial Intelligence

1730420 Principles of Robotics 3 Cr.

What is Robotics, History of Robotics, Types of Robots, Introduction to Robot Components, Geometric Transformations, Kinematics of Arm Robots, Direct Kinematics, Inverse Kinematics, Jacobins, Linear and angular Velocity, Rotational Velocity, Introduction to Mobile Robots, Perception in Robots, Introduction to Sensors, Introduction to Working with webots, Trajectory. **Prerequisite:** Signals and Systems Analysis

1730430 Fundamentals of Internet of Things 3 Cr.

An overview of IOT and its evolution, IOT application domains, IOT architecture, Devices, edge and cloud, Embedded systems and processors, Sensors and actuators, Energy consumption models, General concepts in wireless communication, Short-range wireless networks, Long-range wireless communication, Protocol stacks, IETF 6LowPAN, Application layer standards, ARM embed IOT hardware programming Platform, Arduino, Raspberry Pi, Vendors' devices, 10T Platforms (AWS, Google cloud IOT core, Kaa, Thingspeack, ...). **Prerequisites:** Microprocessor, Computer Networks

1732316 Embedded Systems 3 Cr.

Introduction and basic concepts, System modeling, Hardware components of the embedded system, Software components of the embedded system, Real-time scheduling methods, System performance analysis, Testing and certification methods. **Prerequisite:** Microprocessor

logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, techniques of integration, indeterminate forms, improper integrals, Taylor's formulae, infinite series. **Prerequisite:** -

1914107 General Mathematics II

3 Cr.

Study of several variable calculus: Euclidean geometry matrices, linear transformation, elementary topology of n R, limits, derivative as linear operator, directional and partial derivatives, extreme function values, Lagrange multiplier, multivariable and iterated integrals, change of variable theorem, parametric curves and surfaces, line integral, surface integral, vector analysis, green stokes and divergence theorem. **Prerequisite:** General Mathematics I

1914239 Applied Linear Algebra

3 Cr.

Vector spaces. Basis, dimensions. Gram-Schmidt process, projections, linear transformations, isomorphism, change of basis. Eigen values and Eigen vectors, Diagonalizations, Jordon canonical forms, Hermitian matrices, Exponential of a matrix. **Prerequisite:** General Mathematics II

1914251 Differential Equation

3 Cr.

Methods of solving especial classes of ordinary differential equation including linear, Bernoulli, separable and exact first order equation, reduction of order, variation of parameter, undetermined coefficients, power series methods, and Laplace transform methods in second order linear equation and autonomous system of linear differential equations. Systems of first order differential equations, exponential matrix. **Prerequisites:** General Mathematics I, (General Mathematics II)

1914252 Engineering Mathematics

3 Cr.

Engineering Applications of mathematical methods. Topics include ordinary differential equations, linear algebra, calculus, Fourier analysis, Laplace transform and partial differential equations. **Prerequisites:** Differential Equation, General Mathematics II

1912296 Engineering Probability

3 Cr.

Probability models, axioms, theorems and interpretations related to probability functions, counting techniques, conditional probability, Bayes' formula, independent events, random variables, C.D.F. Discrete case, mathematical expectations, standard discrete distributions, and sum of two independent random variables. **Prerequisite:** General Mathematics II

1730120 Fundamentals of Information Technology 3 Cr.

Fundamentals of Networking, Web Systems, Blockchain, Database, HCI and Ethics in Information Technology.

1730435 Fundamentals of Machine Learning 3 Cr.

Machine Learning, Supervised Learning, Linear Regression, Classification, Gradient Descent, Feature Scaling, Logistic Regression, Regularization, Neural Networks: Back Propagation, Mini-Batch and Batch Gradient Descent, Data Augmentation, K-fold Cross Validation, Softmax, Hyper Parameters Tuning, RMSProp, Momentum, Adam, Convolutional Neural Network, Transfer Learning, Precision/Recall/F1 Score, SVM, Unsupervised Learning, K-means, Fuzzy Systems, Genetic Algorithms. **Prerequisite:** Advanced Programming and Lab., Artificial Intelligence

1736407 Information Technology Project Management and Control 3 Cr.

Introduce the field of project management, History of Project Management, Network Diagram, Understanding Organizations, Factors Influencing IT Project Management, Organizational Structures, Phases of the Project Life Cycle, Work Breakdown Structure, Scope Verification, Scope Control, Activity Definition, Milestones, Activity Sequencing, Precedence Diagramming Method, Gantt Charts, Critical Path Method, Introducing effective factors in project success, Scope management, Time management, Cost management, Net Present Value Analysis, Cost Estimating, Cost Budgeting, Earned Value Management, Rate of Performance. **Prerequisite:** Software Engineering I

1310426 Economics and Industrial Management 2 Cr.

Project evaluation and planning, Real and Effective interest rate calculation, Return On Investment (ROI) calculation, Profit calculation.

1312354 Management Principles and Organization Theory 2 Cr.

Definition and objectives of management, the historical development of management, the main responsibility of managers (planning, organization, motivation, coordination and control), planning concept, different kinds of planning and models. The organizational concept, different organizations, departmentalization of organization, management and human factors (motivations, communications, coordination and leadership) the control concept, the control process and usual procedure of control, knowing the management work in different departments.

1914106 General Mathematics I 3 Cr.

Study of single variable calculus, numerical sequences, limits, continuity differentiation, extreme function values, the definite integrals, applications of the definite integrals, Inverse functions,

1912291 Engineering Statistics and Probability 3 Cr.

Descriptive statistics, counting rules, introducing concepts of probability, conditional probability, Bayes theorem, random variables with emphasis on discrete cases, probability function and distribution function, conditional probability function, standard discrete distributions, sum of two independent random variables.

1914271 Numerical Analysis 2 Cr.

Error analysis, solving nonlinear equations, solving systems of linear and nonlinear equations, interpolation, numerical differentiation and integrations, solving ordinary differential equations. **Prerequisite:** General Mathematics II, (Differential Equation)

1740350 Project I 3 Cr.

Bachelor's Capstone Project.

1740450 Project II 3 Cr.

Optional (Elective) Project for Bachelor's study.

1740357 Internship 1 Cr.

3 months of practical internship in a company or laboratory.

1734400 Software Testing 3 Cr.

Introduction to Software Testing, Model-driven Testing, Agile Testing, Testing Levels, Testing Stages, Automation Testing, Criteria-based testing, Coverage Criteria, Input Space Partitioning, Graph Coverage, Black-Box Testing, White-Box Testing

1914363 Game Theory 3 Cr.

1. Introduction and Examples: Games in normal form, Strategy (pure and mixed), Cost and payoff, Zero-sum and general-sum games. 2. Analyzing Games: Pareto optimality, Best response, Nash equilibrium, Finding Equilibria, Maxmin and Minmax strategies, Indifference principle. 3. Extensions: Correlated Nash Equilibria, Evolutionary Nash Equilibria. 4. Cooperative Games: Strong Nash equilibria, With and without transferable payoff, Coalitional games, Shapley value, Nash bargaining model. 5. Games in Extensive form: Khun's tree, Information sets, Subgame Perfect Equilibria, Behavioral strategy. 6. Other types of Games: Games with Imperfect Information, Bayesian Games, Repeated and Stochastic Games, Congestion games and selfish routing. 7.

(Further Topics) Mechanism Design, Social choice, Price of Anarchy, Graphical games and Online mechanisms. **Prerequisites:** General Mathematics II

2010115 Physics I 3 Cr.

Vectors, motion in one and two dimensions, work and energy, conservation of linear momentum, rotational dynamics, heat and the first law of thermodynamics, entropy and the second law of thermodynamics. **Prerequisite:** -

2010125 Physics II 3 Cr.

Coulomb's law, electric field, Gauss law, electric potentials, capacitors, electromotive force and circuits, magnetic fields, Ampere's law, Faraday's law and induction, electromagnetic waves. **Prerequisite:** Physics I

2010116 Physics Lab. I 1 Cr.

Implementing theoretical principles of mechanical physics and thermal physics. **Prerequisite:** (Physics I)

2010126 Physics Lab. Electricity 1 Cr.

Implementing theoretical principles of electricity and electromagnetics. **Prerequisite:** (Physics II)

2410171 Electrical Workshop 1 Cr.

Fully practical course, which includes basic information about electrical wiring of the apartments, demonstrating the concepts of control circuits for industrial uses and working with industrial motors.

2510111 General English for Engineering 3 Cr.

Review on the English grammar, English vocabulary and Reading skills.

2510317 Specialized English for Electrical Engineering 2 Cr.

Making students familiar with the basic terminology used in the English-speaking professional Electrical texts, preparing students to understand the professional publications in Electrical in

the English Language and Self-formulation of Electrical texts in this language. **Prerequisite:** General English for Engineering

2510318 Especial English for Computer Science 2 Cr.

Making students familiar with the basic terminology used in the English-speaking professional Computer Engineering texts, preparing students to understand the professional publications in Computer Engineering in the English Language. **Prerequisite:** General English for Engineering

2610011 Islamic Thoughts I 2 Cr.

A review on the lives of the prophets and Islam's Imams.

2610012 Islamic Thoughts II 2 Cr.

A review on the lives of the prophets and Islam's Imams.

2610014 Social and Political Rights in Islam 2 Cr.

A review on the content of holy Quran and Islam about Social and Political Rights.

2610043 History of Imamate 2 Cr.

A review of history of Imamate.

2610042 Analytical History of Early Islam 2 Cr.

A review of history of early Islam.

2610041 History of Islamic Culture and Civilization 2 Cr.

A review of history on Islamic culture and civilization.

2610022 Islamic Ethics 2 Cr.

A review on the doctrine and content of holy Quran about lifestyle.

2610023 Lifestyle (Ways to Living) 2 Cr.

A review on the doctrine and content of holy Quran about lifestyle.

2610013 Man in Islam 2 Cr.

A review on human's responsibilities in Islam.

2610033 Political Thoughts of Imam Khomeini 2 Cr.

A review on the Islamic thoughts, beliefs and values of Imam Khomeini.

2610031 Islamic Revolution of Iran 2 Cr.

A review on events leading to Islamic revolution of Iran.

2610051 Thematic Interpretation of Quran 2 Cr.

Practice of Quran.

2610052 Subjective Interpretation of Nahjolbalagheh 2 Cr.

Practice of Nahj al-Balagha

2610032 Introduction to Constitution of the Islamic Republic of Iran 2 Cr.

A brief Introduction to Constitution of the Islamic Republic of Iran.

2610252 Persian Literature 3 Cr.

Persian poetry, Persian novels, history of Persian literature, figure of speech.

2710130 Physical Education I 1 Cr.

Body Training.

2710134 Sport I (Physical Education II) 1 Cr.

Professional training in a specific sport.

8010021 Basic skills of Life I 0 Cr.

Teaching basic skills of life.

8010022 Basic skills of Life II 0 Cr.

Teaching basic skills of life.