



University Electives Course Requirements

University Electives Course Requirements

II. Faculty Requirements: 27 Credit Hours Compulsory Requirements: 27 Credit Hours

1	0102200	Engineering Drawing	2 CH	PREREQ:	None
			0	3	

Introduction to engineering drawing sketching, type of lines, scales, engineering construction and geometry, theory of orthographic projection, pictorial drawing, isometrics and oblique, drawing sections, working drawing, dimensioning and introduction to computer Aided Drafting (AutoCAD). AutoCAD fundamentals create and save an AutoCAD drawing template, create new drawings, modifying commands, layers, text and dimensions.

2	102460	Engineering Economics	2 CH	PREREQ:	0903101
			2	0	

Introduction to the concepts in the determination of the economic feasibility of engineering undertakings, time value of money, interest rates, depreciation, replacement, economic life, present value, rate of return, payback period, supply and demand, private and social cost estimations, secondary and intangible benefits and costs, benefit-cost models, economic risk analysis, economic optimization.

3	0104100	Engineering Workshops	1 CH	PREREQ:	None
			0	3	

Development of basic skills in fields of hand filing, turning, welding, piping and plumbing, carpentry, sand casting, glass works, sheet metal fabrication, metal forming, household electric circuits.

4	0104400	Topics in Engineering Profession	2 CH	PREREQ:	0900130
			2	0	

Professional Ethics: safety and responsibility, professional responsibility to customers and to employers, codes of ethics and honor, standard ethics theories, case studies.
 Technical Writing: basic technical writing concepts and techniques including report writing, numbering systems, order of arrangements of results and recommendations, preparing an undetailed proposal on any technical and scientific work.



5	0903101	Calculus (1)	3	0	PREREQ:	None
<p>Functions, algebraic and transcendental, graphs and the effects of translations and scaling, limits (with intuitive approach) and continuity, the derivative various meanings, main rules and applications, approximation and graph sketching, definite and indefinite integration, the substitution rule and the fundamental theorem of calculus.</p>						
6	0903102	Calculus (2)	3	0	PREREQ:	0903101
<p>Some applications of the definite integral, volumes and surface area of certain solids, arc-length of some curves, methods of integration, integration by parts, integration of rational functions, partial fractions, trigonometric substitution, improper integrals, infinite sequences and series, convergence tests, power series and Taylor series and their applications, parametric equations, polar coordinates, graphing and areas and arc-length in polar coordinates.</p>						
7	0904101	General Physics (1)	3	0	PREREQ:	None
<p>An introductory calculus-based physics course, primarily serving students majoring in engineering or the physical sciences, covers vectors, motion in one dimension, motion in two dimensions, Newton's laws, work and energy, conservation of angular momentum, collisions, rotational motion and equilibrium.</p>						
8	0904102	General Physics (2)	3	0	PREREQ:	0904101
<p>A continuation of general physics (1) (0904101) including electricity, electric charge, force, field, potential, Gauss's law, electromotive force, capacitors, direct current circuits, and magnetism, magnetic fields, Amperes law and Faradays law, inductance and AC circuits.</p>						
9	0904107	General Physics Lab. (1)	0	3	PREREQ:	Pre/Co-requisite: 0904101
<p>It includes experiments on topics covered by general physics (1).</p>						
10	0904108	General Physics Lab. (2)	0	3	PREREQ:	Pre/Co-requisite: 0904102
<p>It includes experiments on topics covered by general physics (2).</p>						



11	0401222	Introduction to C++ programming	3 CH	PREREQ:	None
			3	0	

This course provides basic skills in problem solving and program development using C++. Topics include: data types, expressions and statements, declarations and prototypes, program flow control structures (selection and repetition), functions and modularity, pointers and arrays, and exception handling, elements of object-oriented programming are introduced.

12	0903381	Numerical Analysis	3 CH	PREREQ:	0903102
			3	0	

Numerical differentiation, forward, backward, central; numerical integration methods, rectangular, trapezoidal, Simpson's rules, 2D, 3D Gauss Quadrature; numerical interpolation, Lagrange's, Newton's, Least Square; numerical solution of non-linear equations, Bisection, Secant, Newton-Raphson's; numerical solution of linear equations, Gauss Elimination, Gauss Siedel, LU decomposition; numerical solution of the Eigen problem, numerical solution of differential equations.

**III. Department Requirements: 107 Credit Hours****A. Compulsory Requirements: 77 Credit Hours**

1	0103212	Electric Circuits (1)	3 CH	PREREQ:	0904102
			3	0	

Circuit variables and elements, Kirchhoff's laws, simple resistive circuit analysis, voltage and current dividers, Delta to Wye and Pi to Tee equivalent circuits, circuit analysis techniques (mesh and nodal analysis), Thevenin's and Norton's equivalent circuits, basics of active circuit elements, transient analysis of RL, RC and RLC circuits

2	0103213	Electric Circuits (2)	3 CH	PREREQ:	0103212+ 0103250
			3	0	

Sinusoidal steady-state analysis and power calculations, and balanced three phase circuits. It also covers the complex frequency and its use in circuit analysis, the frequency response, and two-port networks.

3	0103214	Electric Circuits Lab	1 CH	PREREQ:	0103213
			0	3	

DC circuit: Kirchhoff's laws and mesh analysis, Thevenin's and Norton's theorems, superposition theorem, Wheatstone bridge. Transient response: RL, RC, and RLC circuits. AC circuits: impedance concept, frequency response, three-phase circuits. Y Δ transformation. Maximum power transfer. Two-port networks.

4	0103215	Electromagnetics (1)	3 CH	PREREQ:	0903202+ 0904102
			3	0	

Review of coordinate systems and vector calculus. Electrostatic fields, electric fields in material space, magneto static fields, magnetic fields in material space, Maxwell's equations.

5	0103220	Electronics (1)	3 CH	PREREQ:	0103212
			3	0	

Basic semiconductor concepts, diodes: DC and AC analysis, special type diodes, theory of Bipolar Junction Transistors (BJT): biasing techniques, BJT amplifier analysis, Field Effect Transistors (FET): biasing techniques, FET amplifier, simple applications of BJTs and FETs.



5	0103221	Electronics Lab. (1)	0	3	1 CH	PREREQ:	Pre/Co-requisite: 0103220
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An introduction to electronics laboratory course. Experiments include diode and transistor characteristics, voltage rectification, biasing, single and multistage amplifiers, h-parameters. Computer-aided electronic circuit analysis and design are used.

6	0103240	Digital Logic Design	0	3	3 CH	PREREQ:	None
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Numbering systems, basic gates and logic functions, Boolean algebra, Boolean expressions, logic minimization techniques. Combinational logic building blocks: decoders, encoders, multiplexers, demultiplexers and magnitude comparators. Digital arithmetic: adders and subtractors. Basics of sequential circuits: latches and flip-flops. Timing diagrams, counters and shift registers, basic PLDs, CPLDs, FPGAs. State machines. System design with state machines using VHDL. Memory devices and systems: RAM, ROM, FIFO, LIFO, DRAM.

7	0103241	Digital Logic Design Lab.	0	3	1 CH	PREREQ:	0103240
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Building combinational circuits using gates, parallel adder, decoders, multiplexers, ROM, RAM, register, counters. This lab starts with the basic logic components, and continues with an FPGA development kit. A simple design project may be assigned during this lab.

8	0103250	Simulation Tools	0	3	2 CH	PREREQ:	0401222
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Introduction to simulation concepts solving mathematical models through simulation models using the following software tools: MATLAB, PSPICE, and Multisim. Constructing and analyzing electrical circuits and signals. Time domain and frequency domain analysis of systems. Introduction to digital sources and signals.

9	0103311	Electrical Machines (1)	3	0	3 CH	PREREQ:	0103215
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Transformers: construction, principles and operation, ideal and practical, performance characteristics, three-phase, auto transformers. DC machines: construction, classifications, performance equations of generators and motors, Synchronous machines: construction, generator and motor operations. Three-phase induction motors: construction, operation, performance calculations, starting and speed control.



10	0103312	Measurements and Instrumentation	3	0	3 CH	PREREQ:	0103220
<p>Measurements and error, systems of units, standards of measurements, potentiometers, DC and AC bridges, DC and AC indicating instruments, Galvanometers, electro-dynamometers, ammeters, voltmeters, Wattmeters, Watthourmeters, power factor meters, loading effects, Ohmmeters, Meggers, frequency counters, instrument transformers, oscilloscopes, spectrum analyzers.</p>							
11	0103320	Electronics (2)	3	0	3 CH	PREREQ:	0103220
<p>Operational amplifiers: basic theory, characteristics and applications. Differential and multistage amplifiers, frequency response of single and multistage amplifiers. Negative feedback analysis: feedback topology, properties and stability analysis.</p>							
12	0103321	Electronics Lab. (2)	0	3	1 CH	PREREQ:	Pre/Co-requisite: 0103320 Prerequisite: 0103221
<p>MOSFET characteristics and amplifiers, operational amplifier characteristics and use, functional circuits, power supply design. Computer-aided electronic circuit analysis and design are used.</p>							
13	0103325	Digital Electronics	3	0	3 CH	PREREQ:	0103320
<p>Dynamic operation of the BJT switch, early form of the digital circuit, study of DTL and TTL circuits, characteristics of the standard TTL circuit, TTL families with improved performance, Emitter-Coupled Logic (ECL) circuits, design and performance evaluation of CMOS logic circuits. Types of the CMOS logic circuits: pass transistor, dynamic logic. Latches, flip-flop, architecture of memories (SRAM, DRAM, ROM), logic gate based multivibrator circuits, BiCMOS and GaAs logic circuits, interface of various logic gates, sampling circuit, D/A and A/D conversion techniques.</p>							
14	0103326	Digital Electronics Lab.	0	3	1 CH	PREREQ:	0103321+ 0103325
<p>Basic TTL circuits, TTL characteristics, basic MOS logic circuits, MOS characteristics, logic gate based oscillators, interfacing techniques, sampling circuits, A/D and D/A converters.</p>							



15	0103340	Microprocessors and Assembly Language	3	0	3 CH	PREREQ:	0103240
<p>Assembly language instruction set, addressing modes, arithmetic instructions, logical and bit manipulating instruction, I/O instructions, microprocessor pin out and timing diagram, address decoding circuits, memory interfacing, input/output interfacing, serial and parallel communications, counter and timers, interrupts, DMA controllers.</p>							
16	0103350	Signals and Systems	3	0	3 CH	PREREQ:	0103213
<p>Signal classifications and system properties: discrete and continuous time systems. Application of Fourier transform to linear systems, Z-transform, system function, frequency response and simulation in the frequency domain.</p>							
17	0103410	Control Systems	3	0	3 CH	PREREQ:	0103350
<p>Transfer functions: block diagrams and signal flow graphs. Mathematical modelling of physical systems, state space representations, control systems characteristics, time response of systems and closed loop performance of second order systems, stability and Routh-Hurwitz stability criterion, root locus analysis, frequency domain analysis, design of control systems.</p>							
18	0103411	Power Systems (1)	3	0	3 CH	PREREQ:	0103311
<p>Basic concepts and introduction to power system: components, generation, transmission, distribution, symmetrical components, P.U. system, and single-line diagram. Load flow analysis using Gauss-Seidel method. Transmission line: classification, parameters' calculations, R, L and C. ABCD representation. Fault analysis: balanced and unbalanced.</p>							
19	0103412	Electrical Machines and Power Lab.	0	3	1 CH	PREREQ:	0103411
<p>Single-phase transformers and simulation, three-phase transformers. DC machines: motors and generators. Synchronous Machines: motors and generators. Special motors: induction and stepping. Simulated three-phase transmission lines, three-phase reactive power compensation, power factor improvement. Protection relays: over-current, over-voltage, under-voltage, directional.</p>							
20	0103413	Control Lab.	0	3	1 CH	PREREQ:	0103410
<p>Analog simulation, first and second order systems, transient and steady state for step, ramp, and parabolic inputs, time and frequency response of second order systems, DC motor control, application of PID controllers, phase lead, and phase lag controllers, applications of MATLAB control toolbox and Simulink, level control, PLC control.</p>							



			3 CH	PREREQ:	0103410+ 0102310
21	0103415	Introduction to Robotics	3	0	

Introduction to robotics involving concepts from the fields of electrical engineering, mechanical engineering and computer science. Topics covered include: sensor performance and integration, electric and pneumatic actuators, power transmission, materials and static force analysis, controls and programmable embedded computer systems, system integration and robotic applications.

			3 CH	PREREQ:	0103320+ 0103450
22	0103420	Communications Electronics	3	0	

Power amplifiers: classification of output stage. Class A, B, C, and AB, efficiency analysis of power amplifiers and basic techniques in heat sink design. Tuned amplifier: theory and design. Oscillators: op-amp oscillators, LC and crystal oscillators. Waveform generation and shaping. Linear and nonlinear waveforms, modulation and demodulation circuits. Phase Locked Loop (PLL): theory and design. Active and passive filters.

			1 CH	PREREQ:	0103420+ 0103321
23	0103421	Communications Electronics Lab.	0	3	

Power amplifiers, oscillators, waveform generation. Multivibrators: astable and monostable circuits. 555 timers, modulation and demodulation circuits, Phase Locked Loop (PLL) circuits, active filters.

			3 CH	PREREQ:	0103340
24	0103441	Embedded Systems	3	0	

Embedded system characteristics, microprocessors versus microcontrollers, microcontrollers' characteristics, general purpose microcontrollers, examples of microcontroller architectures, interrupts, counters/timers, input/output ports, microcontroller programming, instruction set, program development and use of assemblers, memory maps and addressing modes, digital to analog and analog to digital conversion in microcontrollers, data acquisition and distribution, serial and parallel communications, real time systems and its constraints, interfacing to external devices, power consumption consideration, applications.

			1 CH	PREREQ:	0103441
25	0103442	Microprocessor and Embedded Systems Lab.	0	3	

Software development using PC assembly language, implementation of simple I/O interfacing circuits, keyboard and 7-segment displays scanning, a simple interfacing circuit project. Introduction to PIC, MPLAB, IDE. Interfacing switches and LED displays, use of mechanical and solid state relays, interrupts and counters, A/D conversion, temperature measurement, waveform generation, PWM techniques.



26	0103450	Analog Communications	3 CH		PREREQ:	0103350
			3	0		

Spectral densities, correlation function, power-bandwidth product, distortion and distortionless channels. Analog modulation: DSB-SC, DSB-AM, SSB. Vestigial AM, modulator and demodulator: coherent, non-coherent. Angle modulation: FM, PM, modulator, demodulator. Baseband modulation: sampling theorem, PAM, PWM, PPM. Noise in analog communications: noise types, signal to noise ratio, the additive white Gaussian noise, signal interference.

27	0103451	Digital Communications	3 CH		PREREQ:	0103450+ 0903281
			3	0		

Baseband digital modulation techniques: PCM, DM, D-Σ, and DPCM. Line coding. Intersymbol interference: M-ary signaling, bandwidth, data rate. Multiplexing: FDM, TDM, CDM. Passband digital modulation and demodulation techniques: ASK, FSK, PSK, DPSK, M-ary, coherent and non-coherent detection. Bit error rate performance. Channel coding theory: convolution coding, block codes. Error performance using coding.

28	0103457	Analog Communications Lab.	1 CH		PREREQ:	Pre/Co-requisite: 0103450
			0	3		

RF amplifiers, noise, oscillators, frequency conversion, AM generation and reception, phase-locked loops, angle modulation, frequency modulations.

29	0103458	Digital Communications Lab.	1 CH		PREREQ:	Pre/Co-requisite: 0103451 Prerequisite: 0103457
			0	3		

Variety of modulations schemes and encoding formats, such as pulse code modulation (PCM), frequency shift keying (FSK), and phase shift keying (PSK). PCM line codes including RZ, NRZ, and Manchester.



30	0103490	Electrical Engineering Training	3 CH	PREREQ:	Completion of 99 Cr. Hr.
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As part of their graduation requirements, undergraduate students should undergo training in a professional capacity at an engineering organization in Jordan or abroad. Such training is an integral part of the program and is typically done during the Summer Semester after the fourth year of studies. This experience consists of an eight-week internship in an engineering project with a professional organization that provides opportunities for training and exposure to the real engineering practice. Typical venues for such experiences have to be approved by the department and include local, regional, and international engineering organizations. In order to demonstrate attaining their practical experience, students are required to submit at the end of their training a written report describing their experience.

31	0103522	Power Electronics	3 CH	PREREQ:	0103411+ 0103320
			3	0	

Switching operation, and commutation. Thyristors: static and dynamic characteristics, turn-on, DI, DV turn-off, and specification sheets. Single-phase and three-phase controlled rectifiers, AC voltage controllers. DC choppers: buck, boost, buck-boost and full bridge converters. Thermal consideration in design and use of specification sheets and energy graphs.

32	0103550	Communication Systems	3 CH	PREREQ:	0103451
			3	0	

Elements of cellular radio systems: specifications, cell coverage for signal traffic, cell site, mobile antenna, frequency management and channel assignment. GSM network systems, introduction to the latest developments.

33	0103591	Graduation Project (1)	1 CH	PREREQ:	Completion of 120 Cr. Hr.
			1	0	

Each student will work with his graduation project advisor, and should meet with him/her at least once a week to present and discuss the project progress. The project scope will be developed, tasks will be laid out and a schedule to complete the two parts of the Graduation Project: (1) and (2) will be set. Data, specifications, engineering drawings and other needed information should be gathered. Analysis and design of major elements of the project should be carried out. A report for Graduation Project (1) should be submitted by the student and evaluated by his advisor.



34	0103592	Graduation Project (2)	2 CH	PREREQ:	0103591
			2	0	

Graduation Project (2), a continuation for Graduation Project (1), builds on and integrates the engineering concepts developed in prior course work towards a complete document, ready to execute, of a practical electrical engineering project. Analysis and design of major and minor elements, accompanied with all required details, of the project should be completed. A comprehensive professional engineering report that includes all required documentations; description, specifications, literature review, data, theoretical background, calculations, engineering plans, results and conclusions should be submitted. The course requires a written and an oral presentation of the completed project documents conducted by the student and evaluated by a three-member jury.

**B. Elective Requirements: 12 Credit Hours**

1	0103416	Power Transmission and Distribution	3 CH	PREREQ:	0103411
			3	0	

Components of Transmission and Distribution systems (TD), planning of TD, overhead lines, cables, bulk power transmission, TD grid, losses, HVDC, FACT, substation. Distribution networks: radial, interconnected. Cost of electrical power TD, electricity market of TD, control and reliability of TD.

2	0103444	Database Systems	3 CH	PREREQ:	0103443
			3	0	

Basic concepts of databases, DBMS components, transaction managements, data modeling, entity relationships diagrams, relational databases, database integrity constraints, relational algebra, query languages, dependencies, schema designs normalization, redundancy elimination.

3	0103445	Computer Organization	3 CH	PREREQ:	0103240
			3	0	

Register transfer and micro-operations, basic computer organization and design, design of arithmetic logic unit, design of accumulator, central processing unit, hardwired control, micro programmed control, execution of instructions, pipelining, introduction to memory hierarchy.

4	0103455	Digital Signal Processing	3 CH	PREREQ:	0103450
			3	0	

Discrete-time signals and systems, frequency analysis of discrete-time signals and systems, sampling and quantization, Discrete Fourier Transform, windowing effect, z-transform, FIR and IIR digital filter design, digital filter realization, Fast Fourier Transform.

5	0103512	Power Systems (2)	3 CH	PREREQ:	0103411
			3	0	

Power system component modeling, power system protection against overcurrent and earthing faults, load flow analysis, transient stability of power systems, economic operation of power systems.

6	0103515	Electrical Machines (2)	3 CH	PREREQ:	0103311
			3	0	

Transformers, special transformer connections. Three-phase synchronous motors: starting, pull out torque and conditions for maximum power, applications. DC machines: starting and speed control. Three-phase induction motors: starting, speed control, deep-bar double cage rotor, circuit diagram, induction generator. Fractional HP machines. Single phase induction motor: principle of operation, torque/speed characteristics, equivalent circuit, analysis and performance evaluation. Single-phase 2-winding motors: starting methods, performance evaluation. Stepper motors, brushless DC motors.



7	0103517	Special Topics in Power Engineering	3	0	3 CH	PREREQ:	Department Approval
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The objective of this course is to introduce advanced and new topics in one of the areas of power engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

8	0103525	Special Topics in Electronics Engineering	3	0	3 CH	PREREQ:	Department Approval
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The objective of this course is to introduce advanced and new topics in one of the areas of electronics engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

9	0103544	Special Topics in Computer Engineering	3	0	3 CH	PREREQ:	Department Approval
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The objective of this course is to introduce advanced and new topics in one of the areas of computer engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.

10	0103545	Computer Architecture	3	0	3 CH	PREREQ:	0103445
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Computer evolution and performance, system buses and memory, input/output, computer arithmetic, CPU structure and function, multimedia instruction set, Reduced Instruction Set Computers (RISCs), instruction-level parallelism and superscalar processors, control unit operation, parallel processing, SMPs, clusters, NUMA systems.

11	0103552	Wireless Communications	3	0	3 CH	PREREQ:	0103451
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Elements of cellular radio systems: specifications, cell coverage for signal traffic, cell site, mobile antenna, frequency management and channel assignment. GSM network systems, introduction to the latest developments.

12	0103558	Special Topics in Communications Engineering	3	0	3 CH	PREREQ:	Department Approval
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The objective of this course is to introduce advanced and new topics in one of the areas of communications engineering. The topics can be changed from one year to another depending on the instructor's area of specialty.



C. Ancillary Requirements: 18 Credit Hours

1	0102310	Engineering Mechanics	3 CH	PREREQ:	0903101
			3	0	

Force vectors and resultant, Free-Body-Diagram (FBD), forces, supports, equilibrium of particles, moment of a force about a point and about an axis, equilibrium of planar rigid bodies, analysis of simple trusses, internal axial and shear forces and bending moment in beams, shear force and bending moment diagrams in beams, stresses and strains, Hook's law, torsional stresses, axial deformation, introduction to kinematics and kinetics of particles and of planar rigid bodies.

2	0903201	Applied Math for Engineers (1)	3 CH	PREREQ:	0903102
			3	0	

Present ordinary differential equations along with necessary linear algebra topics like matrices, operation, determinants and eigenvalues and eigenvectors, solving linear systems by Gauss elimination and Cramer's rule.

3	0903202	Calculus (3)	3 CH	PREREQ:	0903102
			3	0	

Vectors in a plane and in space, plane and space curves, functions of several variables, partial differentiation and derivatives, gradient, extreme values, Lagrange multipliers, double integrals in cartesian and polar coordinates, triple integrals in cartesian, cylindrical and spherical coordinates.

4	0903301	Applied Math for Engineers (2)	3 CH	PREREQ:	0903201
			3	0	

Vector calculus, line and surface integrals, Green's theorem, Stokes' theorem, divergence theorem, Fourier Series, integrals, transforms, partial differential equations solutions using Fourier Series and Transforms.

5	0903281	Statistics and Probability	3 CH	PREREQ:	None
			3	0	

Foundations of probability, sample spaces, probabilities and distributions, discrete and continuous random variables, expectation, joint probabilities and independence, limit theorems, law of large numbers, central limit theorem, basic statistics, mean, variance, covariance, correlation, regression, linear models, least squares estimation, hypothesis testing, null hypothesis, test statistics, type I and II errors, t-tests, computational methods, simulation, bootstrapping.



Old Courses:

			3 CH	PREREQ:	103417+ 401222
15	103443	Data Structure - No Longer Offered	3	0	

Basics of algorithm design and analysis. Searching and sorting algorithms. Recursion. Data abstraction and review of object oriented concepts. Basic data structures. Sequential and linked representation of data structures. Lists, ordered lists, sets, stacks, queues, trees, binary trees, graphs and networks.