Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical and Computer Engineering

Proposed Syllabus
(16-07-2016)

Undergraduate Program

Semester-wise distribution of credits

Sl.	Year/ Semester	Theory		Sessional		Total Credits
		No of Course	Credits	No of Course	Credits	
1	1st/Odd	5	15	5	5.25	20.25
2	1st/Even	5	15	4	4.50	19.50
3	2nd/Odd	5	15	5	4.50	19.50
4	2nd /Even	5	15	4	4.50	19.50
5	3rd/Odd	5	15	4	4.50	19.50
6	3rd/Even	5	15	5	4.50	19.50
7	4th/Odd	5	15	6	6.25	21.25
8	4th/Even	5	15	4	6.00	21.00
	Total	**40**	**120**	**37**	**40.00**	**160.00**

% Distribution of Undergraduate Courses

Course type	% of Credit	Credits
Mathematics and Basic Sciences	**12.18**	**19.50**
(a) Mathematics	7.50	12
(b) Physics	2.34	3.75
(c) Chemistry	2.34	3.75
Humanities	**6.09**	**9.75**
(a) Economics, Government & Sociology	1.88	3.00
(b) Industrial Management & Accountancy	1.88	3.00
(c) English with Sessional	2.34	3.75
Basic and Major Engineering	**81.72**	**130.75**
(i) Core Electrical Engineering with Sessional	37.03	59.25
(ii) Core Computer Engineering with Sessional	40.78	65.25
(iii) Industrial training, Seminar, Project and Thesis	3.91	6.25
Total	**100.00**	**160.00**

Semester-wise Course Distribution:

Department will offer the courses to its students, in general, as per the following arrangement.

1st Year Odd Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 1101	Circuits and Systems – I	3	3			3.00
2	ECE 1102	Circuits and Systems -I Sessional			3	1.5	1.50
3	ECE 1103	Computer Programming	3	3			3.00
4	ECE 1104	Computer Programming Sessional			3	1.5	1.50
5	Math 1117	Calculus and Co-ordinate Geometry	3	3			3.00
6	Phy 1117	Optics and Modern Physics	3	3			3.00
7	Phy 1118	Optics and Modern Physics Sessional			3/2	0.75	0.75
8	Hum 1117	Technical English	3	3			3.00
9	Hum 1118	Technical English Sessional			3/2	0.75	0.75
10	ECE 1100	Introduction to Computer System			3/2	0.75	0.75
		Total	15	15	9	5.25	20.25

1st Year Even Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 1201	Circuits and Systems -II	3	3			3.00
2	ECE 1202	Circuits and Systems -II Sessional			3/2	0.75	0.75
3	ECE 1203	Object Oriented Programming	3	3			3.00
4	ECE 1204	Object Oriented Programming Sessional			3	1.5	1.50
5	ECE 1205	Analog Electronic Circuits-I	3	3			3.00
6	ECE 1206	Analog Electronic Circuits-I Sessional			3/2	0.75	0.75
7	Math 1217	Differential Equations	3	3			3.00
8	Hum 1217	Economics, Government & Sociology	3	3			3.00
9	ECE 1200	Electrical Shop Practice			3	1.50	1.50
		Total	15	15	9	4.5	19.50

2nd Year Odd Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 2103	Data Structure& Algorithms	3	3			3.00
2	ECE 2104	Data Structure& Algorithms Sessional			3	1.50	1.50
3	ECE 2107	Electrical Machines-I	3	3			3.00
4	ECE 2108	Electrical Machines-I Sessional			3/2	0.75	0.75
5	ECE 2111	Digital Techniques	3	3			3.00
6	ECE 2112	Digital Techniques Sessional			3/2	0.75	0.75
7	Math 2117	Vector Analysis & Linear Algebra	3	3			3.00
8	Chem 2117	Inorganic and Physical Chemistry	3	3			3.00
9	Chem 2118	Inorganic and Physical Chemistry Sessional			3/2	0.75	0.75
10	ECE 2100	Software Development Project- I			3/2	0.75	0.75
		Total	15			4.50	19.50

2nd Year Even Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 2205	Analog Electronic Circuits-II	3	3			3.00
2	ECE 2206	Analog Electronic Circuits-II Sessional			3/2	0.75	0.75
3	ECE 2213	Numerical Methods	3	3			3.00
4	ECE 2214	Numerical Methods Sessional			3	1.50	1.50
5	ECE 2215	Data Base Systems	3	3			3.00
6	ECE 2216	Data Base Systems Sessional			3	1.50	1.50
7	Math 2217	Complex Variable, Statistics & Transform Methods	3	3			3.00
8	Hum 2217	Industrial Management & Accountancy	3	3			3.00
9	ECE 2200	Software Development Project -II			3/2	0.75	0.75
		Total		15		4.5	19.50

3rd Year Odd Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 3107	Electrical Machines -II	3	3			3.00
2	ECE 3108	Electrical Machines -II Sessional			3/2	0.75	0.75
3	ECE 3109	Power System	3	3			3.00
4	ECE 3111	Microprocessors & Assembly Language	3	3			3.00
5	ECE 3112	Microprocessors & Assembly Language Sessional			3	1.50	1.50
6	ECE 3117	Software Engineering & Information System Design	3	3			3.00
7	ECE 3118	Software Engineering & Information System Design Sessional			3/2	0.75	0.75
8	ECE 3119	Computer Architecture and Design	3	3			3.00
9	ECE 3100	Electronic Shop Practice			3	1.50	1.50
		Total		15.00		4.50	19.50

3rd Year Even Semester

Sl. No	Course No.	Course Title	Theory Contact Hrs/week	Theory Credits	Sessional Contact Hrs/week	Sessional Credits	Total Credits
1	ECE 3205	Industrial Electronics	3	3			3.00
2	ECE 3206	Industrial Electronics Sessional			3/2	0.75	0.75
3	ECE 3211	Peripheral and Interfacings	3	3			3.00
4	ECE 3212	Peripheral and Interfacings Sessional			3/2	0.75	0.75
5	ECE 3221	Operating System	3	3			3.00
6	ECE 3222	Operating System Sessional			3/2	0.75	0.75
7	ECE 3207	Communication Engineering	3	3			3.00
8	ECE 3208	Communication Engineering Sessional				3	1.50
9	ECE 3219	Computer Aided Instrumentations	3	3			3.00
10	ECE 3220	Computer Aided Instrumentations Sessional			3/2	0.75	0.75
		Total		15.00		4.50	19.50

4th Year Odd Semester

Sl. No	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 4109	Power Station, Switchgear & Protection	3	3			3.00
2	ECE 4123	Digital Signal Processing	3	3			3.00
3	ECE 4124	Digital Signal Processing Sessional			3	1.50	1.50
4	ECE 4121	Electromagnetic Fields & Waves	3	3			3.00
5	ECE 41**	Optional I	3	3			3.00
6	ECE 41**	Optional I Sessional			3/2	0.75	0.75
7	ECE 41**	Optional II	3	3			3.00
8	ECE 41**	Optional II Sessional			3/2	0.75	0.75
9	ECE 4100	Industrial Training			2	1.00	1.00
10	ECE 4122	Seminar			3/2	0.75	0.75
11	ECE 4000	Thesis/ Project-I			3	1.50	1.50
		Total		15.00		6.25	21.25

Industrial Training: Students will be attached with the industries/service agencies for two weeks after completing their Third year first semester (before starting Third year second semester/during any vacation in Third year second semester) to gain practical knowledge.

** Optional Courses for 4th year Odd Semester:

Two optional courses with Sessional (Optional I –Optional II) will be offered to the students according to the following list:

Optional I	Optional II
• Computer Aided Power System Design • Renewable Energy • Microwave Engineering • Power System Operation & Control • High Voltage Engineering • System Simulation & Modeling	• Computer Networks • Network Planning • Wireless Networks • Artificial Intelligence • Human Computer Interaction

4th Year Even Semester

Sl. No	Course No.	Course Title	Theory		Sessional		Total Credits
			Contact Hrs/week	Credits	Contact Hrs/week	Credits	
1	ECE 4211	VLSI Design	3	3			3.00
2	ECE 4223	Digital Image Processing	3	3			3.00
3	ECE 4224	Digital Image Processing Sessional			3/2	0.75	1.50
4	ECE 4217	Control Systems	3	3			3.00
5	ECE 4218	Control Systems Sessional			3/2	0.75	0.75
6	ECE 42***	Optional III	3	3			3.00
7	ECE 42***	Optional III Sessional			3/2	0.75	0.75
8	ECE 42***	Optional IV	3	3			3.00
9	ECE 42***	Optional IV Sessional			3/2	0.75	0.75
10	ECE 4000	Thesis/ Project -II			6.0	3.00	3.00
		Total		15		6.00	21.00

***Optional Courses for 4th year Even Semester:**

Two optional courses with sessional (Optional III –Optional IV) will be offered to the students according to the following list:

Optional III	Optional IV
• Unix Programming • Network Security • Parallel & Distributed Processing • Computer Graphics & Animations • Computer Vision • Data Mining • Neural Networks & Fuzzy Systems	• Digital Communication • Antennas & Propagations • Radar and Satellite Communication • Fiber optic Communication • Bio-medical Engineering • Radio and TV Engineering

Course details: 1st Year Odd Semester

ECE 1101   Circuits and Systems-I   Credits : 3

DC analysis: Introduction of electrical power sources, ideal and practical sources, linear circuit elements. DC analysis of series, parallel and series-parallel circuits. Kirchhoff's Voltage and current laws, voltage, current, power and energy.

Sinusoidal wave: Average and effective values, form factor, peak factor, phase relation and phasors. Steady state AC analysis of series, parallel and series parallel circuits, phase relation between voltage and current, concept of impedance, power, power factor, phasor diagram.

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, substitution theorem and reciprocity theorem. Frequency response of ac circuits, resonance phenomena. periodic signals in time and frequency domains. Circuit analysis using proper simulation tools.

Magnetic circuit and concepts: flux, fields, permeability reluctance, analysis of series, parallel and series- parallel magnetic circuit.

ECE 1102   Circuits and Systems- I   Sessional   Credits : 1.5
Sessional based on the theory of course ECE 1101.

ECE 1103   Computer Programming   Credits : 3

Introduction to computer programming: Algorithm, Writing, debugging and running programs using C/C++ compiler.

C/C++ Basics: Different Data types and their range, Operator and operands and its precedence, input/output, conditional operators, loops nested structure, error handling, built-in functions.

Functions and Arrays: Writing & calling of User – defined functions, Recursive functions, scope of variables, introduction to one-dimensional arrays, multi-dimensional arrays and array manipulation.

Pointers and Strings: Introduction to pointers, pointers and array, pointers and functions, String I/O, String-based built-in functions, String operations, pointer and string.

Files: Introduction to files in C/C++, opening, closing and updating binary and sequential files.

Advanced topics: Operations on bits, register variable, Pre-processors and graphics in C/C++.

ECE 1104   Computer Programming Sessional   **Credits : 1.5**

Sessional based on the theory of course ECE 1103.

Math 1117   Calculus & Coordinate Geometry   **Credits : 3**

Differential Calculus: Review of differentiation of various types of functions. Rolle's theorem, Mean value theorem. Taylor's and Maclaurin's theorems in finite and infinite forms. Divergency and Convergency of series. Partial differentiation, Euler's theorem. Tangent, normal and curvature. Determination of maximum and minimum values of functions and their application.
Integral Calculus: Review of indefinite and definite integration of various types of functions. Use of definite integration in summing series. Walli's formulae. Improper integrals. Beta function and Gamma functions. Area under a plane curve and area of a region enclosed by two curves in cartesian and polar coordinates. Volume and surface areas of solids of revolution.

Co-ordinate Geometry: Co-ordinate geometry of three dimension- System of co-ordinates, transformation of co-ordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

Phy 1117   Optics and Modern Physics   **Credits : 3**

Optics: Theories of light: Huygens's principle and construction. Interference of light. Young's double slit experiment, Fresnel bi-prism, Newton's ring, Interferometers. Diffraction of light: Fresnel and fraunhofer diffraction, Diffraction by single and double slit, diffraction gratings. Polarization: Production and analysis of polarized light, Optical activity, Optics of crystals. Waves and Oscillations: Oscillations: Simple Harmonic Motion,. Transverse and Longitudinal nature of waves: Travelling and Standing waves. Intensity of a wave, energy calculation of progressive and Stationary waves. Phase velocity, Group velocity. Sound waves: Velocity of longitude wave in a gaseous medium, Doppler effect. Architectural acoustics: Sabine's formula, requisites of a good auditorium.

Modern Physics: Atom models: Thomson model, Rutherford atom model, Electron orbits, Bohr atom model, Energy levels and spectra, Particle properties of waves: Photoelectric effect, Einstein's photoelectric equation, Laws of photoelectric emission, Compton Effect, Quantum effect: de Broglie waves, Group velocity, phase velocity, Michelson Morley's experiment. Galilean transformation. Spectral theory of relativity. Lorentz Transformation. relative velocity, length contraction, time dilation, relativity of mass. Mass-energy relation.

Phy 1118   Optics and Modern Physics Sessional   **Credits : 0.75**
Sessional based on the theory of course Phy -1117.

Hum 1117   Technical English   **Credits : 3.00**

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures,wh& yes/no questions, conditional sentences.
Vocabulary: Technical & scientific vocabulary, defining terms.

Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.
Reading: Comprehension of technical & non-technical materials-skimming, scanning, inferring & responding to context.

Technical Writing: Paragraph & composition writing on scientific & other themes, report writing, research paper writing, library references.
Professional communication: Business letter, job application, memos, quotations, tender notice.

Hum 1118   Technical English Sessional   **Credits : 0.75**
Sessional based on the theory of course Hum-1117

ECE 1100   Introduction to Computer Systems   **Credits : 0.75**

Computer Fundamentals: Introduction to computer basics, types and generation of computers; basic organization and functional units.

Hardware: Basic units of computer hardware; Processors; input, output and memory devices; keyboard; mouse; OMR; OCR; MICR; CD-ROM; printers; CRT; LCD; LED; microfilm; floppy.

Software: Types of software; system software: familiarization with various operating systems (Windows, DOS, UNIX, Android, IOS etc.); application software: text processing (MS-WORD, etc); Spread sheet (MS-EXCEL etc).

Computer Ethics: Computers in the workplace; computer crime; rules of communications; privacy; intellectual property; impact on employment; professional responsibility; globalization.

Course details: 1st Year Even Semester

ECE 1201   Circuits and Systems II   Credits : 3

Poly phase system: balanced and unbalanced three phase circuit analysis.

Two-port network analysis. Coupled circuit. Analogous system, Response to non-sinusoidal voltage.

 Linear system: Transform methods, Purpose and nature of transform, Fourier and Laplace transforms. Impulse function. Convolution integral and their application to network and system analysis.

Filter: Introduction to filter, Filter equations, Modern filters.

ECE 1202   Circuits and Systems II Sessional   Credits : 0.75
Sessional based on the theory of course ECE 1201.

ECE 1203   Object Oriented Programming   Credits : 3

Fundamentals of OOP: Introduction to Object Oriented Programming, Principles of Object Oriented Design, Encapsulation and Information-hiding, Inheritance, Polymorphism, Data binding, Static and Dynamic binding.

Classes and Objects: Structure of Class, Access Modifiers, Nested Classes, Abstract Classes, Arrays of Objects, Pointer to Objects, Friend function, Data abstraction.

Constructors and Destructors: Default constructor, Copy constructor, Dynamic constructor, Constructor function for derived class and their order of execution, Destructor.

Inheritance: Single inheritance vs. multiple inheritance, Mode of inheritance, Virtual inheritance.

Polymorphism: Operator and Function overloading, Run-time and Compile time Polymorphism, Virtual function, Errors and Exception Handling.

Advanced Topics: Persistent Objects, Objects and Portable Data, UML Basics, Design Patterns, Multithreading.

ECE 1204   Object Oriented Programming Sessional   Credits : 1.5
Sessional based on the theory of course ECE-1203.

ECE 1205   Analog Electronic Circuits -I   Credits : 3
Signal: Signals, their origin and processing in electronic system. Development of electronic processing devices; Vacuum tubes and semiconductor devices; P-N junction semiconductor diodes; Application of diode as rectifier, Zener diode and its application.

BJT, FET, MOSFET : Characteristics, Biasing techniques, Stabilization factors, Compensation. Equivalent circuits, single stage amplifiers at midband frequencies. Power amplifiers and Heat sink.

ECE 1206   Analog Electronic Circuits-I   Sessional   **Credits : 0.75**

Sessional based on the theory of course ECE-1205.

Math 1217   Differential Equations   Credits : 3

Ordinary Differential Equation: Degree and order of ordinary differential equations. Formation of differential equations. Solutions of first order differential equations by various methods, Solutions of general linear differential equations of second and higher orders with constant coefficients, Solution of homogeneous linear differential equations. Solution of higher order differential equations when the dependent of independent variables are absent. Solution of differential equation with constant coefficients by operator method. Differential equations with variable coefficients.

Partial differential equations: Four rules for solving simultaneous equations of the form $P = Q = r$; Lagrange's method of solving PDE of order one, Integral surfaces passing through a given curve, Non linear PDE of order one (Complete, Particular, Singular and general integrals), Charpit's method, Second order PDE; Its nomenclature and classifications to canonical (Standard) parabolic, elliptic, hyperbolic, Solution by separations of variables, Linear PDE with constants coefficients.

Series solution: Solution of differential equations in series by the method of Frobenius, Bessel's functions, Legendre's Polynomials and their properties.

Hum 1217   Economics, Government & Sociology   Credits : 3

Economics: Nature of the economics theory applicability of economic theory to the problems of developing countries, Some basic concepts supply, demand and their elasticity. Economics and technology. Producer's equilibrium-isoquant. Production - factors of production, production possibility curve-equilibrium of a firm, fixed cost and variable cost, laws of returns ,internal and external economics and dis-economics, Input output analysis. Economic growth and economic development and planning basic concept-saving, investment, GNP, NNP, per-capita income, growth rate, Fiscal policy, monetary policy and trade policy and their relative applicability in Bangladesh, Planning- Five year plans of Bangladesh, development problems related to agriculture. Industry and population of Bangladesh.

Government: Basic concepts of government and politics. Functions, Organs and forms of modern state and Government, Socialism. Capitalism, UNO, government and politics of Bangladesh, Some major administrative systems of developed counties. Local self - government. Central government, Public opinion.

Sociology: Scope, Culture and civilization Relationship, Social structure of Bangladesh. Industrial revolution, Urbanization and industrialization, Urban Ecology, Cyber crime and delinquency, Sociology of Education. Relationship-Sociology and cyber crime. Causes and remedies of cyber crime.

ECE 1200   Electrical Shop Practice   Credits : 1.50

Electrician's tools, splices, soldering, code practices. Electrical and electronic symbols, Safety rules, electricity rules and electricity codes. Electrical wiring system design drawing and estimation for residential and commercial house wiring and Industrial installation wiring. Use of meggers, Insulation test, Grounding earth resistance measurement using earth resistance tester. Battery charging.

Course details: 2nd Year Odd Semester

ECE 2103   Data Structure & Algorithms   **Credits : 3**

Data Structure

Introduction: Concepts and Examples of Elementary Data Objects, Necessity of Structured Data, Types of Data Structure, Ideas on Linear and Nonlinear Data Structure.

Linear Array: Linear Array & its representation in memory, Traversing LA, Insertion & Deletion in LA, Bubble Sort, Linear Search & binary Search, Multidimensional Array & its representation in memory, Algebra of matrices, Sparse matrices.

Stack and Queue: Stack representation & applications; PUSH and POP operation on stack; Queue representation, Insertion & deletion in Queue, Priority Queues.

Linked List: Linked list & its representation in memory, Traversing, Searching, Insertion & Deletion operation on Linked list, Circular List, Header linked lists, Two way lists.

Tree: Tree terminology, representation of binary trees in memory, Traversing binary tree, Binary search tree, Insertion & deletion on binary search tree, B trees, General tree.

Algorithm

Complexity: Algorithm and flow chart, Complexity analysis of algorithms, worst case, best case and average case, Rate of growth, Big-O notation, Complexity of Linear Search & Binary search.

Sorting Algorithms: Insertion sort, selection sort, quick sort, merge sort, Searching & data modification, Hash function, collision resolution, Chaining.

Shortest Path: Dijkstra‟s Algorithm, Bellman-Ford Algorithm.

Searching algorithms: Binary search trees, balanced binary search trees, B-trees, skip lists, hashing. Priority queues, heaps.

Graph algorithms: Representation of Graphs, Breadth First Search, Depth First Search, Minimum Spanning Tree..

Recurrences & Backtracking: Recurrences, NP-Hard and NP-Complete Problems, Backtracking, n-Queen Problem.

ECE 2104   Data Structure & Algorithms Sessional   **Credits : 1.50**

Sessional based on the theory of course ECE 2103.

ECE 2107   Electrical Machines I   **Credits : 3**

Transformer: Ideal transformer- transformation ratio, no-load and load vector diagrams; actual transformer-equivalent circuit, regulation, short circuit and open circuit tests. Three phase transformer and its connections; Vector group of three phase transformers; Phase conversion.
Three Phase Induction Motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance and reactance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, starting and braking and speed control; Induction generator.
Single Phase Induction Motor: Theory of operation, equivalent circuit and starting.

ECE 2108   Electrical Machines I Sessional   **Credits : 0.75**

Sessional based on the theory of course ECE 2107.

ECE 2111   Digital Techniques   Credits : 3

Information and digital Systems: Introduction to digital systems, Number Systems, weighted and non-weighted codes, error detection code, Binary addition and subtraction, 2's compliment methods.

Boolean Algebra and Combinational Logic Circuits: Digital logic, Boolean algebra, Boolean function, Canonical forms, Karnaugh Maps, Minimization of Boolean functions, Logic gates and their truth tables, Design methodologies, Combinational logic circuit design, Arithmetic and data handling logic circuits. Decoders, Encoders, Multiplexer, Demultiplexer.

Flip Flop and Sequential Logic Circuits: Transistor Latch, NAND gate latch, NOR gate latch, D latch. Clock signals and Clocked FFs: Clocked SR, JK and D Flip-Flops, Master/Slave JK FF, timing diagram of different FFs, Edge-triggered and level-triggered timing diagrams. , Counters, registers, memory devices and their applications.

Technology parameters: Fan in, Fan out, Propagation delay, Power dissipation and noise immunity.

Others: Diode logic gates, transistor gates, MOS gates, Logic Families: TTL and CMOS logic with operation details.

ECE 2112   Digital Techniques Sessional   Credits : 0.75

Sessional based on the theory of course ECE 2111.

Math 2117   Vector Analysis & Linear Algebra   Credits : 3

Vector Analysis: Vectors, Differentiation and integration, Line, surface and volume integrals, Gradient of a function, Divergence and curl of vector and their applications, Physical significance of gradient, divergence and curl, Vector identities, Integral forms of gradient, divergence and curl, Green's theorem, Stock's theorem, Gauss's Divergence theorem.

Matrix: Definition of matrices, Equality of two matrices, Addition, Subtraction and Multiplication of matrices, Equivalence of Matrices, Positive and Negative Matrices, Adjoint of matrices, Transpose and inverse of matrices, Rank and normal form of matrices, System of Linear Equations, Solution of Homogeneous and non-homogeneous systems, Determination of Eigen values and Eigen vectors, Solutions of matrix differential equations.

Linear Algebra: Vector Space, Subspace, Sum and Direct sum, Hilbert space, Normed linear space, Branch space, Basis and Dimension. Linear transformation: Range, Kernel, Nullity, Singular and Non-singular transformation. Linear operations: Matrix representation of a linear operator. Change of basis, Similarity and linear mapping.

Chem 2117   Inorganic and Physical Chemistry   Credits : 3

Inorganic chemistry
Atomic structure- general concept of fundamental particles, Boh'r model, spectrum, quantum number, and electronic configuration.
Periodic table and periodic properties- periodic law, features of modern periodic table, classification of elements, merits and demerits, periodicity, atomic size, ionization potential, electron affinity, and electronegativity.
Chemical bonding- different types of chemical bonds and their properties. Acid and bases- modern concepts of acid and bases, pH and buffer solution. Titration.

Physical chemistry

Solution- Types and composition of solution, Henry's law, solution of gas in liquid, solid in liquid, colligative properties of dilute solution lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmosis and osmotic pressure.

Chemical kinetics- rate of reaction, order, molecularity, different types of rate expressions, effect of temperature on reaction rate, collision theory.

Chemical equilibrium- reversesible reaction, law of mass action, evaluation and characteristics of equilibrium constant of reaction, the Lechatelier's principle.

Thermochemistry- laws of thermochemistry, heat of reaction, heat of solution, heat of neutralization, heat of formation, heat of combustion, experimental determination of thermal changes during chemical reactions.

Electrochemistry- electrolytes, mechanism of electrolyte conduction and different types of cells.

Chem 2118   Inorganic and Physical Chemistry Sessional   Credits : 0.75

Sessional based on the theory of course Chem 2117.

ECE 2100   Software Development Project I   Credits : 0.75

Students will develop one or more programs / projects on some practical problems with sound software engineering practices as assigned by teacher.

Course details: 2nd Year Even Semester

ECE 2205   Analog Electronic Circuits II   Credits : 3

BJT, FET, MOSFET multistage amplifier circuits. Frequency response of single stage and multistage amplifiers. Introduction to CMOS and its applications.

Feedback concept, Improvement of amplifier characteristics by negative feedback. Classification, analysis of feedback amplifiers. Op-amps and its applications, integrator and differentiator, Frequency response, bandwidth and other practical limitations of op-amps, compensation techniques.

Oscillators and multivibrators. Active filters. Negative impedance converters. Times 555 and its applications.

ECE 2206   Analog Electronic Circuits II   Sessional   Credits : 0.75

Sessional based on the theory of course   ECE 2205.

ECE 2213   Numerical Methods   Credits : 3

Modeling, Computers and Error Analysis: Mathematical modeling and engineering problem solving, Programming and software, Approximations and round-off errors, Truncation errors and the Taylor series.

Roots of Equations: Bracketing Methods, Open Methods, Roots of polynomials. Linear Algebraic Equations: Gauss elimination, LU Decomposition and Matrix Inversion, Gauss-Seidel.

Curve Fitting: Least-square Regression. Interpolation: Interpolation with one and two independent variables, Formation of different difference table, Newton's forward and backward difference, Langrange's interpolation.

Numerical Differentiation and Integration: Newton-Cotes Integration formulas, Integration of equations.

Optimization: One-dimensional Unconstrained optimization.

Numerical differentiation. Ordinary Differential Equations: Runge-Kutta Methods, Boundary-Value and Eigenvalue problems, Numerical solution of partial differential equations

ECE 2214   Numerical Techniques Sessional   Credits : 1.5

Sessional based on the theory of course ECE 2213.

ECE 2215   Database Systems   Credits : 3

Concepts of database systems: Files and Databases, Database Management Systems; Transaction management, Structure of a DBMS, Applications.

Entity-Relationship concepts: Entity types, Entity set, Attribute and key, Relationships, Relation types, Entity relationship, ER modeling, ER diagrams, Database design using ER diagrams, Enhanced Entity-Relationship (EER) model.

Normalization: Normal forms, Normalized Relations and Database performance; De-normalization.

Relational model: Structure of relational databases, Relational algebra, Relational algebra operations, Modification of the database, Introduction to views, Pitfalls in relational database design.

SQL: Data Definition Language, Data Manipulation Language, Basics of SQL, Query designing in SQL using aggregate functions and nested queries, Embedded SQL, Triggers, Procedures; Indexes; Declarative Constrains and Database Triggers.

Concurrency control: Lock based protocols, Timestamp based protocols, Validation based protocols, Deadlock.

Recovery system: Failure classification, Storage structure, Recovery and atomicity, Log-based recovery, Recovery with concurrent transactions, Advanced recovery techniques, RAID model.

Advanced database management systems: No SQL Systems, distributed systems, object-oriented System, Temporal, Database Security, Data Warehousing and Data Mining, Database Administration and Tuning.

ECE 2216   Database Systems Sessional   Credits :1.50

Sessional based on the theory of course ECE 2215.

Math 2217   Complex Variable, Statistics & Transform Methods   Credits : 3

Complex Variable : Complex number systems, analyticity, singularity, limits of continuity of a function and related theorems, Complex differentiation and the Cauchy-Riemenn equations, mapping by elementary functions, Infinite series, Convergence, Line integration, Cauchy integral theorem, Cauchy integral formula, Liouville's theorem, Taylor's and Laurent's theorems, Singular points, Residue, Cauchy's residue theorem, Contour integration.

Statistics: Frequency distribution, mean, median, mode, and other measures of central tendency; standard deviation and other measures of dispersion; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distributions- binomial, poisson, negative binomial, continuous probability distributions- exponential and normal distribution, characteristics, elementary sampling theory, estimation, hypothesis testing and regression analysis.

Harmonic Analysis and Laplace Transform: Periodicity**,** Fourier series, Dirichlet's conditions, odd and even functions, Fourier transforms and Fourier integral and their applications to solve boundary value problems. Laplace transforms, Inverse Laplace transforms, Solution of differential equation by Laplace transforms.\

Hum 2217   Industrial Management & Accountancy   **Credits : 3**

Industrial Management: Management: Principle of Management, Management functions, Management skills, Authority& Responsibility, Span of control, Management by objective, Consultative management, Participative management, Decision Making, Manpower motivation. Human Resources Management: Manpower planning, Recruitment & Selection, Employee training & Development, Performance appraisal, Wages & Salary administration. Production Management: Plant layout: Definition, Basic layout types, Problem solving, Problem solving, Linear Programming.EOQ, Lead time, Safety stock, re-order point.

Accountancy: Basic accounting principles, Objectives of Accounting, Transaction, Double Entry systems, Accounts and it's classification, Journals Cash book, Ledger, Trial Balance, Financial statement. Cost Accounts & objectives; Costs; Classification, Preparation of cost sheet, Cost volume profit (CVP) analysis, Standard costing, Process costing

ECE 2200   Software Development Project II   **Credits : 0.75**

Students will work in groups or individually to develop web based applications and design a web site by adding client side and server side scripting and interfacing the web applications to a database.

Course details: 3rd Year Year Odd Semester

ECE 3107   Electrical Machines II   **Credits : 3**

DC Generators: Types, no-load voltage characteristics, build up of a self excited shunt generator, load-voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation, armature reaction.
DC Motor: Operating principle, counter emf, torque, speed, torque-speed characteristics, starting, braking, and speed control.
Synchronous Generator: Windings, excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance methods of predicting voltage regulation and its limitations. Parallel operation: necessary conditions, synchronizing, circulating current and vector diagram.
Synchronous Motor: Operation, loading effect, effect of changing excitation, V-curves, and starting methods.

Special machines: Stepper motor, Hysteresis motor, Servo motor, Repulsion Motor, Magnetic levitation.

ECE 3108   Electrical Machines II   Sessional   **Credits : 0.75**

Sessional based on the theory of course ECE 3107.

ECE 3109   Power System   **Credits : 3.00**

Inductance and Capacitance of overhead power lines, Line representation- equivalent circuit of short, medium and long line. Network representation: single line and reactance diagram of power system and per unit representation. Load flow studies : Gauss – Seidel and Newton-Raphson method. Control of voltage, real and reactive power, reactive power compensation. Fault analysis: Symmetrical fault calculation, symmetrical components, sequence impedance and sequence networks, different unsymmetrical fault calculation, stability analysis.

ECE 3111   Microprocessors & Assembly Language   **Credits: 3**

Microcomputer System: Introduction to different types of microprocessors and its applications, organization of Intel 8086/8088 Microprocessor, the component of microcomputer system, I/O device, Interrupt Structures, I/O interfacing, DMA, Co-processors, RISC processors, Power PC processor, CISC processor, Direct video RAM accessing, Memory module.

Introduction of Assembly Language: Program structure and it components, few basic instruction, input/output instruction.

Flag Register and Flow Control: The flag register, flow control instructions, conditional and unconditional jumps, branching and looping structures.
Logic and Arithmetic Operation: Logic, Shift and Rotate Instruction, multiplication and division Instructions.

Arrays and Data Structure: Arrays and related addressing modes, DUP operator, register indirect modes, Based and Indexed addressing modes, basic stack operations, procedures declaration, communication between procedures, calling a procedure.

String Manipulation: The string instructions, director flag, moving a string, storing a string, Loading a string, scanning a string, comparing strings, substring operation.

ECE 3112   Microprocessors & Assembly Language   Sessional   Credits : 1.5

Sessional based on the theory of course ECE 3111.

ECE 3117   Software Engineering & Information System Design   Credits : 3.00

Software Engineering

Introduction: Introduction to Software and its Nature, Software Engineering Methods, Different Types of Software Process Model.

Software Requirement Analysis and design: Software Requirements Analysis and their Applications, Software Prototyping.

Design of Software: Software Design and its Different Techniques, Software Configuration Managements. System Structuring, Control Models

Software Testing: Verification and Validation Planning, Software's Testing Strategies and Different Type of Testing Techniques,

Software Quality Assurance: Management and its Quality Assurance, Concepts of Software Reengineering.

Information System Design

Application Development Policy and Strategies: Planning of Information System, Policy in Information System Development, Strategies for Achieving Information System Goals.

Application System Development Life Cycle: Phases in Application System Development, Interrelationship among Each Phase. Feasibility Assessment: Problems and Needs in Information System Development.

Feasibility Assessment: Economic, Technical, Operational and Schedule Feasibility.

Information Requirements Determination: Strategies for Obtaining Information Requirements, Methods for Providing Assurance that Requirement are Correct and Complete.

Structured Systems Analysis: Steps in Structured Systems Analysis, Activity Diagrams and Related Documentation, Problem Analysis.

ECE 3118   Software Engineering & Information System Design   Sessional   Credits : 0.75

Sessional based on the theory of course ECE 3117.

ECE 3119   Computer Architecture and Design   **Credit: 3.00**

Introduction to computer Architecture: Internal structure of processor/CPU – registers, PC, ALU, CU, etc. Bus architecture and processor interaction with memory and peripherals, Memory hierarchy in terms of cache memory, main memory, secondary storage, Memory organization into bytes and words; big-endian and little-endian organization, Computer Peripherals, Introduction to Von Neumann SISD organization, RISC and CISC machines.

Review: Representation of strings, Binary and hex integer representations and conversions, Signed and unsigned formats; 2's complement, Computer integer arithmetic, Fixed-point arithmetic, IEEE floating point representation and arithmetic.

Process and Control: Fetch-Execute cycle, Encoding and decoding of MIPS machine instructions, The MIPS CPU instruction set syntax and semantics, Addressing modes, MIPS assembly language programming, Register usage conventions, Use of stack and stack-frame for supporting function calling with parameters, Operating system calls and I/O operations. CPU and It`s Instruction Sets Design.

Application HDL and FPGA for microcomputer design: Introduction to FPGA and HDL/VHDL for digital design implementation.

ECE 3100   Electronic Shop Practice   **Credits : 1.50**

Introduction to formal procedures of preventive maintenance. Circuit tracing, trouble shooting, fault repairing, soldering and de-soldering of electronic circuits. Design of PCB layout, etching.
Radio receivers: Principles of operations, circuit tracing, fault finding by signal injection alignment. TV camera, B/W TV, color TV. CD and VCD player.

Course details: 3rd Year Even Semester

ECE 3205 Industrial Electronics   **Credits : 3.00**

Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT and DIAC. Rectifiers: Uncontrolled and controlled single phase and three phase. Regulated power supplies: Linear-series and shunt, switching buck, buckboost, boost and cuk regulators. AC voltage controllers, single and three phase. Choppers. DC motor control. Single phase cycloconverter. Inverters: single phase and three phase current and voltage source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

ECE 3206 Industrial Electronics   Sessional   **Credits : 0.75**

Sessional based on the theory of course ECE 3205.

ECE 3211 Peripherals & Interfacings   **Credits: 3**

Microprocessor Based System Design: Hardware and software interfacing in microcomputer system design, hardware and I/O design, building, debugging, testing and linking program modules, programming EPROM.

Interfacing Components: 8284A programmable timer, bus architecture, bus timing, 8286 transceiver device, 8282 latches, 8288 bus controller, characteristics of memory and I/O interface, synchronous and asynchronous communication, serial I/O interface, 8251A communication interface, 8255A Programmable peripheral Interface.

Interrupt System: Sources of interrupt, types of interrupt, handling interrupt request, interrupt vector and table, 8259A priority interrupt controller, daisy chain.

I/O Controller and Peripheral Components: Interfacing ICs of I/O Devices, I/O ports, Programmable peripheral interface, DMA controller i.e. 8237A DMA Controller, interrupt controller, communication interface, interval timer, etc.

Memory Device: Memory Terminology, CPU-Memory Connections, ROM Architectures and Time Diagram, Different type of ROM, Flash Memory, RAM Architectures and Time Diagram, Different type o RAM and Read/Write Cycle, Programmable Logic Device Architectures.

Multi-processor configurations: co-processor configurations, Numeric data processor, I/O Processors.

Analog and Digital Interface: Sensors, Transducers, D/A interface, A/D interface, AD and DA converters related chips, High power devices.

ECE 3212   Peripherals & Interfacings Sessional   Credit: 0.75

Sessional based on the theory of course ECE 3211.

ECE 3221   Operating Systems   Credit: 3

Introduction to operating system: Operating system concepts, its role in computer systems, computer system structure, fundamental of different types of computer system, operating system structure and operation, protection and security.

Process management: Process concept, model and implementation, process state, process scheduling, inter-process communication (IPC), multiprocessing and timesharing, interaction between process and operating system; CPU scheduling: Scheduling concepts, scheduling criteria, scheduling algorithms (SJF, FIFO, round robin, etc.).

Memory Management: Memory portioning, with and without swapping, virtual memory – paging and segmentation, demand paging, page replacement algorithms, implementation.

File systems: FS services, disk space management, directory and data structures.

Deadlocks and Case study: Modeling, detection and recovery, prevention and avoidance; Case study of some operating systems.

Others: Introduction to the different smart device Operating system and their usage.

ECE 3222   Operating Systems Sessional   Credit: 0.75

Sessional based on the theory of course ECE 3221.

ECE 3207   Communication Engineering   Credits : 3.00

Overview of communication system: Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity. Noise: Source, characteristics of various types of noise and signal to noise ratio. Communication systems: Analog and digital.

Continuous wave modulation: Amplitude, Angle Modulations & Demodulations, Sampling and Pulse Modulations-PAM, PWM, PPM, PCM, DM; line coding- formats and bandwidths. Binary Modulated Bandpass Signaling: OOK, BPSK, DPSK, FSK, MSK bandwidth requirements, detection and noise performance, Multilevel Modulated Bandpass Signaling, Multiplexing: TDM- principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; FDM- principle, de-multiplexing; wavelength-division multiplexing multiple-access network- time-division multiple-access, frequency-division multiple access, code-division multiple-access - spread spectrum multiplexing, coding techniques and constraints of CDMA. Communication system design: design parameters, channel selection criteria and performance simulation.

ECE 3208   Communication Engineering Sessional   Credits : 1.50

Sessional based on the theory of course ECE 3207.

ECE 3219   Computer Aided Instrumentations   Credits: 3.00

Introduction : Methods of measurement. Statistical method applied to field of measurement and error analysis and calibration.

Resistance, Inductance and Capacitance measurements: Different methods of measuring high, medium and low resistances. Methods of measuring self and mutual inductance and capacitance measurement. A.C. and DC bridge methods, Measurement of insulation and earth resistances. Localization of cable fault.

Magnetic measurement: Flux meter, Flux and Flux density measurement. Determination of iron losses and their separation.

Measuring instruments : Classification of measuring instruments. Ammeter, Voltmeter, wattmeter, AVO meter, Energy meter, Ampere-hour meter and Maximum demand meter for measuring AC and DC quantities. Speed, frequency and phase difference measurements. Illumination measurement.
Electronic measuring instruments: Digital instruments, VTVM, Q-meter and CRO.

Instrumentation : Extension of instrument range. Use of C.T. and P.T and calculation of their burden, Instrumentation of substation.

Measurement of non-electrical quantities: Transducer. Measurement of temperature, pressure, displacement, velocity, acceleration. Strain gauge and their applications.

ECE 3220   Computer Aided Instrumentations   Sessional   Credits: 0.75

Sessional based on the theory of course ECE 3219.

Course details: 4ᵗʰ Year Odd Semester

ECE 4109   Power Station, Switchgear and Protection   Credits: 3

Introduction to various power plants- steam, hydro, gas, combined cycle, and nuclear power plants. Plant factor, load factor, diversity factor, load curve, chronological load curve, load duration curve. Base load and peak load, selection of units. Power plant economy.

Introduction to switchgear and protection.
Circuit breakers, principle of arc extinction in DC and AC circuit breakers. Recovery voltage, rate of rise of recovery voltage and other transient phenomena. Switching surges. Disconnection of unloaded transformer and transmission line. Speed of circuit breaker. Construction, operation, rating and testing of bulk oil and minimum oil breaker, SF_6 circuit breaker, ABCB, ACB, and VCB. Selection of circuit breaker. Travelling wave in transmission line. Surge absorber, lightning arrester, horn gap, its rating and testing.

Protective relaying: Relay voltage rating, high, medium and low. Basic protective zone. Relaying Scheme. Electromechanical Relays: Principal, general equation. overcurrent, balanced current, overvoltage, distance, directional, positive sequence, negative sequence and differential relays and their applications.

Static relays: Introduction to solid state device in the construction of static relays. Different type of static relays. Generator protection. Transformer protection, Bucholz's relay. Protection of bus bar, transmission line, feeder etc. Relay testing.

ECE 4123   Digital Signal Processing   **Credits: 3**

Introduction: signals, systems and signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.

Discrete time signals and systems: Discrete time signals, discrete time systems, analysis of discrete time linear time invariant systems. Discrete time systems described by difference equations, implementation of discrete time systems, correlation and convolution of discrete time signals.

The z-transform: Introduction, definition of the z-transform, z-transform and ROC of infinite duration sequence, properties of z-transform inversion of the z-transform, the one-sided z-transform.

Frequency analysis of signals and systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain characteristics of linear time invariant system, linear time invariant systems as frequency selective filters, Inverse systems and deconvolution.

Discrete Fourier Transform (DFT): Discrete Fourier Series (DFS), Properties of DFS, Discrete Fourier Transformation (DFT), Properties and application of DFT.

Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.

Digital Filter Design Techniques: Differential and difference equations, Digital Transfer Functions, frequency response, Digital filter realization scheme, Finite Impulse response (FIR) Infinite Impulse Response (IIR) filter design.

Application of DSP: Speech processing, analysis and coding, Matlab application to DSP.

ECE 4124   Digital Signal Processing Sessional   **Credits: 1.5**

Sessional based on the theory of course ECE 4123.

ECE 4121   Electromagnetic Fields & Waves   **Credits:3**

>   Contact hours/week: 3

Electrostatics and Magnetostatics using vector methods. Fields in dielectrics and conductors. Boundary conditions of Electric and Magnetic fields. Time Varying Fields; Maxwell's equation and poynting vector. Uniform plane wave and its transmission and reflection. Skin effect and Surface resistance. Wave guides. Introduction to radiation system.

ECE 4100   Industrial Training   **Credits: 1.00**

Students will be attached with the industries/service agencies for two weeks after completing their Third year odd semester (before starting Third year even semester/during any vacation in Third year even semester) to gain practical knowledge.

ECE 4000 Thesis/ Project-I   **Credits: 1.50**

A project/thesis course will be assigned to the students in 4th year odd semester class and it will continue till 4th year even semester. The objective is to provide an opportunity to the students to develop initiative, creative ability,

confidence and engineering judgment. The results of the work should be submitted in the form of a dissertation, which should include appropriate drawings, charts, tables, references etc. A grade X shall be awarded for this course in 4th year odd semester. Final assessment on this course will be done in 4th year even semester.

ECE 4122 Seminar   Credits: 0.75

Students will works in groups or individually to prepare review papers on topics assigned by the teachers and will present before audience.

Optional Course Details for the 4th year Odd Semester

Optional I:

ECE 4111 Computer Aided Power System Design   Credit: 3.00

Computer algorithm Mathematical modeling of physical systems. Iterative Techniques, Solution of simultaneous equations, Interpolation, Curve fitting, Solution of Differential Equations. Numerical solution of Integration. Application of the above techniques in Electrical & Electronic Engineering through computer program.

ECE 4112 Computer Aided Power System Design Sessional Contact hours/week: 3/2 Credits: 0.75

Sessional based on the theory of course ECE 4111

ECE 4115   Renewable Energy   Credits: 3.00

Importance of renewable energy, sources. Statistics regarding solar radiation and wind speed. Insulation: geographical distribution, atmospheric factors, measurements. Solar cell: principle of operation, spectral response, factors affecting conversion efficiency, I-V characteristics, maximum power output. PV modules and arrays: stationary and tracking. PV systems: stand alone, battery storage, inverter interfaces with grid. Wind turbine generators: types, operational characteristics, cut-in and cut-out speed, control, grid interfacings, AC-DC-AC link. Wind and Tidal energy conversion.

ECE 4117 Microwave Engineering   Credit: 3.00

UHF Transmission Lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, smith chart, impedance matching and lossy transmission lines. Microwave Components: Cavities, Slow wave structures, Waveguide Tees, Directional Couplers, Circulators and Isolators, S-parameter. Microwave tubes: Klystron amplifier, multicavity klystron amplifier, Reflex Klystron oscillator, magnetron, TWT amplifier, BWO. Semiconductor microwave devices: Tunnel diodes, Gunn-Effect diodes, IMPATT diodes. Microwave measurements.

ECE 4118   Microwave Engineering Sessional   Contact hours/week: 3/2   Credits: 0.75

Sessional based on the theory of course EEE 4117.

ECE 4141   Power System Operation & Control   Credits: 3.00

Design and constructional features of overhead power transmission lines and underground cables. DC and AC power distribution. Stability: Swing equation, power angle equation, equal area criterion, multi-machine system, step-by-step solution of swing equation, factors affecting transient stability. Flexible AC transmission system. High

voltage DC transmission system. Power system harmonics.

Principles of power system operation : SCADA, convention and competitive environment. Unit commitment, static security analysis, state estimation, optimal power flow, automatic generation control and dynamic security analysis.

ECE 4142 Power System Operation & Control Sessional   Credits: 0.75

Sessional based on the theory of course EEE 4141.

ECE 4143 High Voltage Engineering   Credits: 3

Ionization and decay process: Townsend's first and second ionization coefficient. Electric breakdown in gases. Townsend's criterion for spark breakdown. Sparking potential. Penning effect. Corona discharges, power loss calculation. Breakdown of solid and liquid dielectrics.

Generation of high voltage: Alternating voltage, transformer cascade. Series resonant circuit for high voltage ac testing. Test of dc and ac cable.

Transient Voltage: Impulse wave shape. Impulse voltage generator and its mathematical analysis. Design consideration of impulse generators. Triggering of impulse generators.

DC voltage doubler and cascade circuits. Electrostatic generator, voltage stabilization. Measurement of high voltage. Electrostatic voltmeter, sphere gap. Potential divider. High Voltage testing of power system equipment. Oil testing. Design consideration of transmission line based on direct stroke. High voltage transient in transmission line. High voltage lightning arrester. Insulation co-ordination.

ECE 4144 High Voltage Engineering Sessional   Credits: 0.75
Sessional based on ECE 4143

ECE 4125 System Simulation and Modeling   Credit: 3

Simulation modeling basics: systems, models and simulation; Classification of simulation models; Steps in a simulation study.

Concepts in discrete-event simulation: event-scheduling vs. process-interaction approaches, time-advance mechanism, organization of a discrete-event simulation model; Continuous simulation models; Combined discreet-continuous models; Monte Carlo simulation; Simulation of queuing systems.

Building valid and credible simulation models: validation principles and techniques, statistical procedures for comparing real-world observations and simulated outputs, input modeling; Generating random numbers and random variates; Output analysis. Simulation languages; Analysis and modeling of some practical systems.

ECE 4126 System Simulation and Modeling Sessional   Contact hours/week: 3/2

Sessional based on ECE 4125   Credits: 0.75

Optional II

ECE 4127 Computer Networks   Credits: 3

Introduction: Definition, uses of computer networks, network topology, network media, network devices, different types of network: LAN, MAN, WAN etc.

IP addressing: Classification of IP addressing, subnet mask, CIDR, private IP Address, public IP address, sub netting, VLSM etc.

Network Model: OSI Reference Model, TCP/IT Reference Model, ATM Reference Model, functions of the layers of different models, Network Protocols working at different layers.

Data Link Layer Design Issues and Framing: Character count, byte stuffing, bit stuffing, error detection: cyclic redundancy check, parity bit checking and correction: Hamming code, windowing protocols: go back N ARQ, selective repeat ARQ, elementary data link protocols, high-level data link control, point to point protocol, the medium access control sub-layer.

Multiple Access: Random Access; ALOHA, CSMA, CSMA/CD, CSMA/CA, channelized access, CDMA, TDMA, FDMA, controlled access, reservation, poling, token passing, Ethernet, wireless LANs and Bluetooth.

Switching: Circuit switching, packet switching, message switching, routing algorithms, virtual circuit and datagram, congestion control algorithms, quality of service, internetworking, internetworking devices etc.

Network Layer Protocols: Address resolution protocol, internet protocol, internet control, message protocol, ipv6, routing information protocol, open shortest path first, border gateway protocol, user datagram protocol, transmission control protocol.

Network Security: Cryptography, substitution cipher, transposition cipher, one time pads, public key cryptography, encryption and decryption, authentication protocol 1.0 to 5.0, digital signature, key distribution center, different symmetric key algorithm, certificate authority, DNS, electronic mail, world wide web.

Other: HTTP and recent advances in internet protocols, Web server performance, proxy servers, load balancing in web servers, IP security, Queuing models for networks and protocols, Real time protocols such as RTP, RTCP and RTSP, Voice over IP, Cloud computing.

ECE 4128   Computer Network Sessional   Credits: 0.75

Sessional based on the theory of course ECE 4127.

ECE 4129 Network Planning   Credits: 3

Introduction: Network components, Theoretical network, Real world networks.

Network Architectural Design: Designing the LAN, Configuring the network server and client, Network administration, Remote access, Expanding the network, Wide area network troubleshooting, Major protocol suites.

Network Simulation: Network simulation and optimization, Network operations, control and maintenance, Network administration, Network management database and tools, Capacity planning.

Network Optimization: Network security and integrity, Linear programming and network algorithms for planning, Reliability theory and network planning.

ECE 4130   Network Planning Sessional   Credit: 0.75

Sessional based on the theory of course ECE 4129

ECE 4131 Wireless Networks   Credits: 3

Introduction to wireless networks: wireless access networks – wireless mesh networks, personal area networks (wireless sensor networks, body area networks, LowPan, and Bluetooth), wireless and mobile ad hoc networks, challenged networks (DTNs, VANETs).

Wireless MAC protocols: IEEE 802.11, IEEE 802.11e, IEEE 802.11n, IEEE 802.11s, IEEE 802.15.4, S-MAC, B-MAC, IEEE 802.22/20, IEEE 802.16d/e.

Wireless routing: routing matrix – ETX, ETT, WCETT, Air Time Metric, routing protocols – AODV, DSR, DSDV, HWMP, sensor network routing, VANET routing etc.

Others: Wireless Transport protocols; Wireless TCP and its variants, Hop by Hop Congestion Control, Rate based Congestion Control etc. Quality of Service in Wireless Networks.

ECE 4132 Wireless Networks Sessional   Credits:0.75
Contact hours/week: 3/2
Sessional based on the theory of course ECE 4131

ECE 4133   Artificial Intelligence   Credits: 3
Contact hours/week: 3

Fundamental: Definition of Al, historical development of Al, application of Al.

Production systems: Introduction of product system, production rules, the working memory, the control unit interpretation, conflict resolution strategies, alternative approach for conflict resolution, types of production systems, forward versus backward production systems, knowledge base optimization in a production system.

General Problem Solving Approaches: Breadth first search, depth first search, iterative deepening search, hill climbing, simulated annealing, heuristic search, A* algorithm, adversary search, the minimax algorithm, constraint satisfaction problems.

Logic and Structural Knowledge Representation: Propositional logic, first-order logic, resolution principle, frames, semantic-nets, petri nets, relational data model.

Reasoning under Uncertainty: Bayesian reasoning, fuzzy knowledge, probability theory, Dempster-shafer theory, fuzzy set theory, expert systems.

Machine Learning and Natural language processing: Naive Bayes algorithm, syntactic semantics and pragmatic, top-down passing, bottom-up pursing, lexicon.

Programming Languages for Al Research: Historical overview, features of Al programming languages, major Al programming languages LISP, PROLOG, Implementation of AI algorithms through PROLOG.

ECE 4134   Artificial Intelligence Sessional   Contact hours/week: 3/2
Sessional based on the theory of course ECE 4133   Credits: 0.75

ECE 4135   Contact hours/week: 3
Human Computer Interaction   Credits: 3

Process and Model: Introduction to Human-computer interaction (HCI), human information processing systems, Models of interaction, Approaches to HCI, User interface, HCI in software process, Cognitive models.

Issues and Requirements: Socio-organizational Issues and stakeholders Requirements, Communication and collaboration models, Task Analysis, Dialog notation and design, Groupware, CSCW and social issues.

User system interaction: analysis and design, User interface design, Interface technique and technology, case studies.

ECE 4136 Human Computer Interaction Sessional   Contact hours/week: 3/2
Sessional based on the theory of course ECE 4135   Credits: 0.75

Course details: 4th Year Even Semester

ECE 4211   VLSI Design   **Credits: 3**

VLSI design methodology: top-down design approach, technology trends.

MOS technology: Introduction to Microelectronics and MOS Technology, Basic Electrical Properties and Circuit Design Processes of MOS and Bi CMOS Circuits,, MOS, NMOS, CMOS inverters, pass transistor and pass gates, DC and transient characteristics.

Overview of fabrication process: NMOS, PMOS, CMOS, Bi-CMOS process.

NMOS and CMOS layout: Color plate Stick diagram, and design rules.

CMOS circuit characteristics: Resistance and capacitance, rise and fall time, power estimation.

Introduction to Bi-CMOS circuits: Shifter, an ALU Sub-System, adder, counter, multipliers, multiplexer. Data Path and memory structures, Buffer circuit design, DCVS Logic.

Design and Test-Ability: Circuit partitioning, Floor planning and placement, Routing, Practical Aspects of Design Tools and Test-Ability MOS Design, Behavioral Description, Structural Description, Physical Description and Design Verification

ECE 4223   Digital Image Processing   **Credits: 3**

Digital Image Fundamentals: Different types of digital images, sampling and quantization, imaging geometry, image acquisition systems.

Bilevel Image Processing: Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.

Binarization of Grey level images: Histogram of grey level images, optimal thresholding using Bayesian classification, multilevel thresholding.

Detection of edges : First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.

Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.

Image Segmentation: Segmentation of grey level images, Water shade algorithm for segmenting grey level image. Image representation and description, recognition and interpretation.

Image compression: Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

ECE 4224   Digital Image Processing Sessional   **Credits: 0.75**

Sessional based on the theory of course ECE 4223.

ECE 4217   Control Systems   **Credits: 3.00**

Introductory Concepts: Open loop versus closed loop feedback system. Input output relationship. Transfer function.

DC machine dynamics, performance criteria, sensitivity and accuracy. Analysis of control systems time and frequency domain error constants.

Stability of control system : Routh-Hurwitz criterion, bode plot, polar plot. Nyquist method. Root locus techniques. Frequency response analysis. Nicholes chart, compensation. Introduction to non-linear control system. State variable characterization of systems, transition matrix, canonical forms. Controllability and observability.

ECE 4218   Control Systems Sessional   Credits: 0.75

Sessional based on the theory of course ECE 4217.

Optional Course Details for the 4th year Even Semester

Optional III

ECE 4221   Contact hours/week: 3
Unix Programming   Credit: 3

Introduction: Introduction to Unix Programming.

Unix Environment: command line, globbing, I/O redirection, piping, Basic commands, Memory layout.

Debugging: GDB, valgrind, essential x86, Fork, exec, wait, Process status, bit manipulation, sending signals Unix I/O Implementing I/O redirection, piping Directories and files. Walking a directory tree, exploring attributes. Implementing ls -l. Permissions, file owner / group, time-stamps. Signals and signal handling Design / implementation of sleep Process Relationships Backgrounding. Popen / pclose Midterm Terminal handling Review midterm Networking Client / Server. I/O multiplexing.

Multi-threading: basics, mutual exclusion Multi-threading: bounded buffers, condition variables Multi-threading: deadlocks Non-blocking I/O. Regular expressions. Sys V IPC. Semaphores and shared memory. Shell scripting.

ECE 4222   Unix Programming   Contact hours/week: 3/2
Sessional based on the theory of course ECE 4221   **Credits: 0.75**

ECE 4227   Contact hours/week: 3
Network Security   Credits: 3

Introduction: Network security policies, strategies and guidelines; Network security assessments and matrices;

Different attacks: Denial of Service attack (DoS), Distributed Denial of Service (DDoS) attack, Eavesdropping, IP spoofing, Sybil attack, Blackhole attack, Grayhole attack, Man-in-the-middle attack, Passwords-based offline attacks;

Network security threats and attackers: Intruders, Malicious software, Viruses and Spy-ware; Security standards: DES, RSA, DHA, Digital Signature Algorithm (DSA), SHA, AES; Security at Transport layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS);

Security on Network layer: IPSec; Network security applications: AAA standards, e-mail securities, PGP, S/MIME; PKI smart cards; Sandboxing; Firewalls and Proxy server;

Security for wireless network protocols: WEP, WPA, TKIP, EAP, LEAP; Security protocols for Ad-hoc network; Security protocols for Sensor network; Security for communication protocols; Security for operating system and

mobile agents; Security for e-commerce; Security for LAN and WAN; Switching and routing security; Other state-of-the-art related topics.

ECE 4228   Network Security
Sessional based on the theory of course ECE 4227

Contact hours/week: 3/2
Credits: 0.75

ECE 4237
Parallel and Distributed Processing

Contact Hours/week: 3
Credits:3

Multithreaded computing: Basic concepts: processes, threads, scheduling, Multithreaded programming, Thread synchronization: semaphores, locks, monitors , Concurrency issues: deadlock, starvation , Multi-core computers.

Networked computers: Basic concepts: client-server, connections, datagrams, Application protocol design , Client-side socket programming ,Server-side socket programming, Datagram programming.

Network protocols and security: Physical/data link/network/transport/application layers, Network security.

Distributed systems: Architectures: Two-tier, multi-tier, peer-to-peer, many-to-many, Middleware: distributed objects, web services.

Parallel computing: Architectures: SMP, cluster, hybrid, grid, GPGPU ,Middleware: OpenMP, MPI, grid middleware.

ECE 4238   Parallel and Distributed Processing Sessional
Sessional based on the theory of course ECE 4237

Contact hours/week: 3/2
Credits: 0.75

ECE 4239
Computer Graphics and Animations

Contact hours/week: 3
Credits: 3

Introduction: History, Application of Computer Graphics (Computer Aided Design Animation), A Survey of Graphics I/O Devices and Types.

Graphics Software Design: Survey of Desired Function, Toward a Universal Graphic Language. Display Files, Databases for Pictorial Applications.

Graphics Techniques: Point-Plotting Techniques, Line Drawing, Geometric Transformations, Windowing and Clipping, Raster Graphics.

Hardware for Computer Graphics: Typical Small and Large System, Graphic Terminals, Plotters, Graphic Display Processors, Device Independent Graphics Systems.

Graphics Software: A Simple Graphic Package, Segmented Display Files, Geometric Models, Picture Structure.

Interactive Graphics: Input Techniques, Event Handling, Three-Dimensional Graphics, Curves and Surfaces, 3-D Transformation.

Hidden Surface Problem: Back Face Removal, Hidden-Line Removal Curved Surfaces, Describing Points, Lines And Polygons, Some Hints For Building Polygonal Models, Color Perception, RGBA and Color Index Mode, Dithering, Blending, 3-D Blending With The Depth Buffer, Antialiasing, Fog, Fog Equations, The OpenGL ARB.

API Specifies: Data Types, Function Naming Conventions, Platform Independence, Drawing Shapes With OpenGL, Animation With OpenGL And GLUT.

Drawing in Space: Lines, Points and Polygons.

Co-ordinate Transformations: Understanding Transformations, Matrix Munching Projections, Matrix Manipulation Color Lighting and Materials, Texture Mapping.

ECE 4240 Computer Graphics and Animations	**Contact hours/week: 3/2**

Sessional based on the theory of course ECE 4239   Credits: 0.75

ECE 4241	**Contact hours/week: 3**
Computer Vision	**Credits: 3**

Introduction: Introduction to Computer Vision, Case study-Face Recognition, Linear Algebra/Probability Review.

Image Structure: Linear Filters, Finding Lines-From Detection to Model Fitting, Clustering and Segmentation.

Camera Models: Camera Models, Camera Calibration, Epipolar Geometry, Stereo & Multi-view Reconstruction.

Recognition (Building blocks): Detectors and Descriptors, SIFT & Single Object Recognition, Optical Flow & Tracking.

Recognition (Objects, Scenes, and Activities): Introduction to Object Recognition and Bag-of-Words Models, Object classification and detection- a part-based generative model (Constellation model), Object Classification and

Detection: a Part-based Discriminative Model (Latent SVM), Human Motion Recognition.

Computer Vision: State-of-the-art and the Future.

ECE 4242 Computer Vision Sessional	**Contact hours/week: 3/2**

Sessional based on the theory of course ECE 4241   **Credits: 0.75**

ECE 4243	**Contact hours/week: 3**
Data Mining	**Credits: 3**

Data Mining and Applications: Relational Databases, Data Warehouses, Transactional Databases, Advanced Data and Information Systems, Characterization and Discrimination, Mining Frequent Patterns, Associations, and Correlations, Classification and Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis.

Data Preprocessing: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Classification, Clustering and Prediction: Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Clustering by Partitioning/ Hierarchical/ Density-based/ Grid-based/ Model-based methods, Clustering High-Dimensional Data, Outlier analysis, Prediction, Linear Regression, Nonlinear Regression, Other Regression-Based Methods of prediction, Evaluating the Accuracy and error measures of a Classifier or Predictor.

Web Mining: Anatomy of a search engine, Crawling the web, Web Graph Analysis, Extracting structured data from the web, Classification and vertical search, Web Log Analysis.

Advanced Analysis: Mining Stream, Time-Series, and Sequence Data, Graph Mining, Social Network Analysis, and Multi-relational data mining, Mining Object, Spatial, Multimedia, and Text Data.

ECE 4244 Data Mining	**Contact hours/week: 3/2**

Sessional based on the theory of course ECE 4243   **Credits: 0.75**

ECE 4245　　　　　　　　　　　　　　　　　　　　**Contact hours/week: 3**
Neural Networks & Fuzzy Systems　　　　　　　　　　**Credits: 3**

Introductory Concept: Introduction Human Brain Mechanism, Neural Machine Intelligence.

Fundamental concept of Neural Network: Basic models of artificial neuron, activation function, network architecture, neural network viewed as directed graph, Basic learning rules, overview of perceptrons, Single layer of perceptrons, mathematical model of single layer perceptrons, perceptrons learning algorithm, Delta learning rule, Multi-layer perceptrons, Back propagation learning algorithm, mathematical model of MLP network.

Function Approximation: Basis function network, Radial Basis function networks (RBF), MLP vs. RBF networks, Support vector machine (SVM).

Competitive Network and Associative memory network: Adaptive Resonance Theory (ART), ART-1 architecture and algorithm, Kohonen Self-organizing Maps (SOMs), Linear Feed-forward Associative memory network, Recurrent associative memory network, Bidirectional Associative memory network (BAM), Hopfield networks.

Fuzzy System: Introduction to Fuzzy system, Fuzzy relations, fuzzy numbers, Linguistic description and their analytical form, fuzzy control.

Defuzzification: Defuzzification Methods, Centroid Method, Center of Sum Method, Mean of Maxima Defuzzification, Applications, Equilibrium of Learning System, Concept of Neuro-Fuzzy and Neuro-GA Network.

Genetic Algorithm: Basic Concepts, Offspring, Encoding, Reproduction, Crossover, Mutation Operator, Application of GA.

ECE 4246 Neural Networks & Fuzzy Systems Sessional　　　　**Contact hours/week: 3/2**
Sessional based on the theory of course ECE 4245　　　　　　　　**Credits: 0.75**

Optional IV

ECE 4249　　Digital Communication　　　　　　Contact hours/week: 3　　　Credits: 3

Introduction: Communication channels, mathematical model and characteristics. Probability and stochastic process. Source coding: Mathematical models of information, entropy, Huffman code and linear predictive coding. Digital transmission system: Base band digital transmission, inter-symbol interference, bandwidth, power efficiency, modulation and coding trade-off. Receiver for AWGN channels: Correlation demodulator and maximum likehood receiver. Channel capacity and coding: Channel models and capacities and random selection of codes. Block codes and conventional codes: Linear block codes, convolution codes and coded modulation. Spread spectrum signals and system.

ECE 4250　　Digital Communication Sessional

Contact hours/week: 3/2　　Credits: 0.75, Sessional based on the theory of course EEE 4249.

ECE 4251　　Antennas and Propagation

Contact hours/week: 3　　Credits: 3

Fundamental of Antennas: Vector Potential Functions, Electric and Magnetic Fields for Electric and Magnetic Current Sources, Solution of Vector Potential Wave Equation.

Antenna Arrays: Two-Element Array, N-element Linear Arrays: Broad-side, End-fire, Phased, Binomial, Dolph-Tchebyschef and Super-directive Arrays, Determination of Array Factor and Patterns, Planar and Circular Arrays.

Travelling-Wave and Broad-band Antennas: Long wire, V, Rhombic and Helical Antennas, Yagi, Uda array, Frequency Independent and Log-periodic Antennas.

perture, Reflector and Lens Antennas: Huygens's Principle, Rectangular and Circular Apertures, Microstrip Antennas.

Babinet's Principle, Sectoral, Pyramidal and Conical Horns, Parabolic and Cassegrain Reflector Antennas, Lens Antennas.

Antenna Measurement: Antenna ranges, Radiation Pattern, Gain and Directivity, Polarization. Radio wave propagation: Ground wave propagation, Ionospheric propagation, Propagation losses.

ECE 4252   Antennas and Propagation Sessional

Contact hours/week: 3/2 Credits:0.75 Sessional based on the theory of course EEE 4251.

ECE 4253   Radar and Satellite Communication   Contact hours/week: 3   Credits: 3

Radar: Introduction to Radar, Radar Equation CZ, Operating Principle of Radar with Block Diagram, CW and FM Radar, Tracking Radar, Antennas for Radar, Radar Receivers, Radar Transmitting System, Duplexer, Usable Frequencies for Radar, Radar Applications.

Satellite Communication: Overview of Satellite System Engineering. Spacecraft, Introduction, to Spacecraft Subsystem. (AOCS), Telemetry, Tracking and command (TT&C). Spacecraft Antennas, Basic Antenna Types and Relationships Spacecraft, Antennas in Practice, Frequency Reuse Equipment Reliability and Space Qualification, Reliability redundancy. Multiple Access. Earth station Technology : Earth Station Design, Earth Station Design for Low System Noise Temperature, Large Earth Station Antennas. Satellite Television Broadcasting Networks, VSAT technology.

ECE 4255   Fiber Optic Communication   Contact hours/week: 3   Credits: 3

Introduction : Historical perspective, basic system, nature of light, advantages and applications of fiber optic. Optics review : Ray theory and applications, lenses, imaging, numerical aperture, diffraction. Light wave fundamentals : Electro magnetive waves, Dispersion, polarization, resonant cavities, reflection at plane boundary, critical angle. Integrated optic waveguides : Slab waveguide, Modes in symmetric and asymmetric waveguide, coupling, Dispersion and distortion, Integrated optic components.

Optic fiber waveguide : Step index fiber, graded index fiber, attenuation, pulse distortion and information rate, construction of optic fiber, optic fiber cables. Light sources : LED, LD, distributed feedback LD, optical amplifiers, fiber laser, vertical cavity surface emitting laser diode. Light detectors : Photo detection, photo multiplier, semiconductor photodiode, PIN photodiode, avalanche photodiode. Couplers and connectors : Connector principle, end preparation, splices, connectors, source coupling.

Network distribution and fiber components: Directional couplers, star couplers, switches, isolator, wave-length division multiplexing, fiber bragg grating. Modulation: LED modulation, LD modulation, Analogue and digital modulation, modulation formats, optic heterodyne receivers. Noise and detection : Thermal shot and noise, SNR, error rates, receiver circuit design. System design: Analogue and digital system design, few real life problems and examples.

ECE 4257   Biomedical Engineering   Contact hours/week: 3   Credits: 3

Medical terminology, cell physiology, membrane potential, action potential, Rhythmic excitation of heart. Transducers used in medical diagnostics.

Biomedical Instrumentation: Normal Electrocardiograph, ECG simulator, Watch filter, ECG amplifier, pulse beat monitor, pace maker, galvanic skin resistance detector, respiratory and suction apparatus. Electronic stethoscope. Electronic clinical thermometer, blood flow and pressure monitoring recorders, metabolic rate measurement.

Special topics: Bio-telemetry, application of ultrasonic and laser in biology and medicine. Clinical X- ray equipment. Fluoroscopy. Infrared heating.

ECE 4258   Biomedical Engineering Sessional   Contact hours/week: 3/2   Credits: 0.75

Sessional based on the theory of course **ECE 4257**.

ECE 4259   Radio and TV Engineering   Contact hours/week: 3/2   Credits: 0.75

Introduction to radio communication, History, Frequency management. Design of radio transmitter and receiver circuits using scattering-parameter methods. Circuits include oscillators, radio frequency amplifiers and matching networks, mixers and detectors. Design of amplitude, frequency, and pulse-modulated communication systems, including modulators, detectors, and the effects of noise.

Television: Introduction, principle of operation, transmitter and receiver, Receiving and transmitting antenna. Camera tube, Picture tube, Electron beam scanning, T-lines, balun, duplexer, Vestigial side-band filters. Introduction to color TV, VCR, CCTV, CATV, MATV, TV Booster.

ECE 4260   Radio and TV Engineering Sessional   Contact hours/week: 3/2   Credits: 0.75

Sessional based on the theory of course EEE 4259.