SEMESTER I

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	M101	ENGINEERING MATHEMATICS - I	3	1	0	4	4
2	CH(ECE)101	ENGINEERING CHEMISTRY	3	1	0	4	4
3	HU101	PROFESSIONAL COMMUNICATION	1	1	0	2	2
4	ME101	ENGINEERING MECHANICS	3	1	0	4	4
5	EE101/ EC101	ELEMENTS OF ELECTRICAL ENGINEERING/ ELEMENTS OF ELECTRONICS ENGINEERING	3	1	0	4	4
6	ME191	ENGINEERING GRAPHICS	1	0	3	4	3
7	CH191	CHEMISTRY LABORATATORY	0	0	3	3	2
8	EE191/ EC191	ELEMENTS OF ELECTRICAL ENGINEERING LAB/ ELEMENTS OF ELECTRONICS ENGINEERING LAB	0	0	3	3	2
9	HU181	LANGUAGE LABORATORY	0	0	2	2	1
10	ME181	WORKSHOP	1	0	2	3	2
11	HU182	NSS/NCC	0	0	2	2	1
			Total			35	29

SEMESTER II

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	M201	ENGINEERING MATHEMATICS – II	3	1	0	4	4
2	PH201	PHYSICS	3	1	0	4	4
3	CS201	COMPUTER PROGRAMMING	3	1	0	4	4
4	ME201	ELEMENTS OF MECHNICAL ENGINEERING	3	1	0	4	4
5	EE201/ EC201	ELEMENTS OF ELECTRICAL ENGINEERING/ ELEMENTS OF ELECTRONICS ENGINEERING	3	1	0	4	4
6	PH291	PHYSICS LABORATATORY	0	0	3	3	2
7	CS291	COMPUTER PROGRAMMING LAB	0	0	3	3	2
8	EE291/ EC291	ELEMENTS OF ELECTRICAL ENGINEERING LAB/ ELEMENTS OF ELECTRONICS ENGINEERING LAB	0	0	3	3	2
			Total			29	26

SEMESTER III

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	M(ECE) -301	ENGINEERING MATHEMATICS-III	3	1	0	4	4
2	CH301	ENVIRONMENTAL STUDIES	3	1	0	4	4
3	EC301	DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE	3	1	0	4	4
4	EC302	SIGNALS AND SYSTEMS	3	0	0	3	3
5	EC303	SOLID STATE DEVICES	3	0	0	3	3
6	EC304	CIRCUIT THEORY AND NETWORKS	3	1	0	4	4
7	EC391	DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE LAB	0	0	3	3	2
8	EC392	LINEAR CIRCUITS AND SIGNALS LAB	0	0	3	3	2
9	EC381	SEMINAR	0	0	2	2	1
			Total			30	27

SEMESTER IV

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	PH401	PHYSICS-II	3	0	0	3	3
2	CS401	DATA STRUCTURES AND C++	3	0	0	3	3
3	EC401	ANALOG ELECTRONICS	3	0	0	3	3
4	EC402	MICROPROCESSOR & MICROCONTROLLER	3	0	0	3	3
5	EC403	ANALOG COMMUNICATION	3	0	0	3	3
6	EC491	ANALOG ELECTRONICS LAB	0	0	3	3	2
7	EC492	MICROPROCESSOR & MICROCONTROLLER LAB	0	0	3	3	2
8	CS481	DATA STRUCTURES AND C++ LAB	0	0	3	3	2
9	PH491	PHYSICS-II LAB	0	0	3	3	2
10	HU481	TECHNICAL REPORT WRITING & LANGUAGE LABORATORY	1	0	2	3	2
			Total			30	25

SEMESTER V

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	HU501	FINANCIAL MANAGEMENT & ACCOUNTING	3	0	0	3	3
2	EC501	DIGITAL COMMUNICATIONS	3	0	0	3	3
3	EC502	ELECTROMAGNETIC THEORY AND TRNSMISSION LINES	3	0	0	3	3
4	EC503	CONTROL SYSTEMS	3	1	0	4	4
5	EC504	ANTENNAS AND PROPAGATION	3	0	0	3	3
6	EC505	TELECOMMUNICATION SYSTEMS	3	0	0	3	3
7	EC591	COMMUNICATIONS SYSTEMS LAB	0	0	3	3	2
8	EC592	ELECTROMAGNETIC THEORY AND TRNSMISSION LINES LAB	0	0	3	3	2
9	EC593	CONTROL SYSTEMS LAB	0	0	3	3	2
			Total			28	25

SEMESTER VI

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	HU601	MANAGEMENT THEORY AND PRACTICE	3	0	0	3	3
2	EC601	RF & MICROWAVE ENGINEERING	3	0	0	3	3
3	EC602	VLSI CIRCUITS AND SYSTEMS	3	0	0	3	3
4	EC603	DIGITAL SIGNAL PROCESSING	3	0	0	3	3
5	EC604	COMPUTER COMMUNICATION AND NETWORKS	3	0	0	3	3
6	EC605	ELECTRICAL AND ELECTRONIC INSTRUMENTATION	3	0	0	3	3
7	EC691	RF & MICROWAVE ENGINEERING LAB	0	0	3	3	2
8	EC692	VLSI CIRCUITS AND SYSTEMS LAB	0	0	3	3	2
9	EC693	DIGITAL SIGNAL PROCESSING LAB	0	0	3	3	2
			Total			27	24

Summer training at Industry after sixth semester examination

SEMESTER VII

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC701	INFORMATION THEORY AND CODING	3	1	0	4	4
2	EC702	ELECTIVE-I (PE)	3	0	0	3	3
3	EC703	ELECTIVE-II (IE)	3	0	0	3	3
4	EC781	PROJECT-I	0	0	6	6	3
5	EC782	GROUP DISCUSSION	0	0	3	3	2
			Total			19	15

ELECTIVE-I (PE)

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC702A	Embedded Systems	3	0	0	3	3
2	EC702B	High Speed Communication Circuits	3	0	0	3	3
3	EC702C	Optical Communication & N/W	3	0	0	3	3
4	EC702D	Radar Engineering	3	0	0	3	3
5	EC702E	Power Electronics	3	0	0	3	3
6	EC702F	Designing digital systems with VHDL	3	0	0	3	3

ELECTIVE-II (IE)

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC703A	Biomedical instrumentation	3	0	0	3	3
2	EC703B	Advanced Microcontroller	3	0	0	3	3
3	EC703C	Advance Biomedical Control System and Simulation Technique	3	0	0	3	3
4	EC703D	Database Management System	3	0	0	3	3
5	EC703E	Artificial Intelligence	3	0	0	3	3

SEMESTER VIII

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC801	MOBILE COMMUNICATION	3	1	0	4	4
2	EC802	ELECTIVE-III (PE)	3	0	0	3	3
3	EC803	ELECTIVE-IV (IE)	3	0	0	3	3
4	EC881	PROJECT-II	0	0	6	6	3
5	EC882	VIVA VOCE					4
			Total			16	17

ELECTIVE-III (PE)

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC802A	FPGA & Reconfigurable Computing	3	0	0	3	3
2	EC802B	Digital Image Processing	3	0	0	3	3
3	EC802C	Satellite Communication & Remote Sensing	3	0	0	3	3
4	EC802D	Smart Antenna	3	0	0	3	3
5	EC802E	Wireless communication and networks	3	0	0	3	3
6	EC802F	Electronic measurement and instrumentation	3	0	0	3	3

ELECTIVE-IV (IE)

Sl. No.	Field	Subject	Contact Hours/ Week				
			L	T	P	Total	Credit points
1	EC803A	Advance Bio-Signal Processing and Human Machine Interaction	3	0	0	3	3
2	EC803B	Renewable Energy	3	0	0	3	3
3	EC803C	Material Sc. & Engg	3	0	0	3	3
4	EC803D	Computer Architecture	3	0	0	3	3
5	EC803E	Robotics	3	0	0	3	3

M101 ENGINEERING MATHEMATICS – I

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School mathematics that includes Algebra, Calculus, Scalar and Vector.

Course Objective: This course is aimed at enhance the students' ability to solve engineering mathematical problems. This can enrich the problem solving ability of the students.

Module-1
Matrix: Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, orthogonal matrix and its properties, Trace of a matrix. Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Eigen values and eigen vectors of a square matrix (of order 2 or 3), Eigen values of APTP, kA, AP-1P, Caley-Hamilton theorem and its applications. (5L)

Module-2
Successive differentiation: Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders. Mean Value Theorems & Expansion of Functions: Rolle's theorem and its application, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions being an integer or a fraction. Reduction formula: Reduction formulae both for indefinite and definite integrals. (10L)

Module-3
Calculus of Functions of Several Variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives and related problems, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems, Concept of line integrals, Double and triple integrals. (5L)

Module-4
Infinite Series: Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test and Raabe's test (statements and related problems on these tests), Alternating series, Leibnitz's Test (statement, definition) illustrated by simple example, Absolute convergence and Conditional convergence. (10L)

Module-5

Vector Algebra and Vector Calculus: Scalar and vector fields – definition and terminologies, dot and cross products, scalar and vector triple products and related problems, Equation of straight line, plane and sphere, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics: Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications). (10L)

Text Books:

1. Advanced Engineering Mathematics 8e by Erwin Kreyszig is published by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
3. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
4. Mathematics Handbook: for Science and Engineering, L. Rade and B. Westergren (5PthP edition, 1PstP Indian Edition 2009, Springer)
5. Calculus: M. J. Strauss, G. L. Bradley and K. L. Smith (3PrdP Edition, 1PstP Indian Edition 2007, Pearson Education)
6. Engineering Mathematics: S. S. Sastry (PHI, 4PthP Edition, 2008)
7. Advanced Engineering Mathematics, 3E: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.

Course Outcome: After this course students can have the knowledge

- **to solve difficult engineering problems;**
- **to analyze and interpret different physical phenomena mathematically**;

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
M101	√		√									

CH101 Engineering Chemistry

Contacts: 3L + 1T = 4
Credits: 4
Prerequisites: Knowledge in High School Chemistry that includes Physical Chemistry, Inorganic Chemistry and Organic Chemistry

Course Objective: This course is aimed at to enrich the knowledge of the students in Engineering Chemistry. Students can have the ability to learn material properties.

Module 1

Chemical Thermodynamics

Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Physical significance, Enthalpy: Definition, Characteristics, Physical significance, Heat Capacity: Definition, Classification of Heat Capacity (Cp and

CV) Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process. 3L

Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff's Equation. 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Evaluation of entropy: characteristics and expression, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. 3L

Work function and free energy: Definition, characteristics, physical significance, mathematical expression of ΔA and ΔG for ideal gas. Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature. 2L

Module 2

Electrochemistry:

Conductance Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Ionic mobilities, Experimental measurement of ionic mobility and transport number. 2L

Electrochemical cell:

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), Application of EMF measurement on a) Ascertain the change in thermodynamic function (ΔG, ΔH, ΔS) b) ascertain the equilibrium constant of a reversible chemical reaction c) ascertain the valency of an ion. 1L

Single electrode potential, types of electrodes. Reference electrodes- hydrogen half cell, quinhydrone half cell, calomel half cell, glass electrodes (construction, representation, cell reaction, expression of potential, Discussion, Application) 2L

Battery, commercial electrochemical cell and battery: dry cell, lead acid storage cell, lead accumulator battery, Alkaline storage cell, Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application). 3L

Module 3

Solid:

Solid state Chemistry Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Conduction in Metal, Semiconductor-n type and p type, Effect of temperature on conductivity, p-n junction, rectifiers, transistors.

Photovoltaic cell, Fabrication of integrated circuits.

Role of silicon and germanium in the field of semiconductor. 4L

Module 4

Polymers and Nanomaterials:

Introduction, classification, Hydrocarbon Molecules, Thermoplastic, Thermosetting Polymers. Basic Concepts Molecular Weight, Polymer Crystallinity. Crystallization, Melting & Glass Transition Phenomena Polymerization mechanism, (addition and condensation polymerization), degree of polymerization, Poly dispersity index (PDI). 3L

Preparation, properties, engineering applications of: polyethylene, PVC, Bakelite, nylon, PTFE, PS, natural rubber, vulcanization. elastomers – Buna-s, Butyl rubber. 2L

Electronic polymers- synthesis, classification, application. 2L

Nanomaterials- Basic principle of nanoscience and technology, preparation, properties and applications of nano meterials (metal, ceramic, polymeric, carbon based). 3L

Module 5

Corrosion:

Introduction, Cause and Effect of Corrosion Types and Mechanism of corrosion of corrosion-Chemical and Electrochemical corrosion, Comparison between them. 3L

Types of Electrochemical corrosion- Underground corrosion, Microbiological corrosion, Other forms of corrosion. 2L

Passivation, Factors influencing corrosion. Protective measures against corrosion. 3L

Course Outcome: After this course students are able

- **to achieve knowledge in material science, chemical properties of materials used in industry;**
- **to identify chemical reactions of different elements present in the atmosphere;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CH101	√		√						√			

Reference Books:

1. Sashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co.Pvt. Ltd.
2. Engineering Chemistry, P. C. Jain, Dhanpat Rai Publication
3. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).
4. P. Ghosh, Polymer Science and Technology of Plastics and Rubbers, Tata McGraw Hill Publishing Company Limited.
5. F.W.Billmeyer : Textbook of Polymer Science is published by Wiley India (is now an Indian Imprint.)
6. Joel R. Fried, Polymer Science and Technology, Pearson Education (2nd Edition).
7. I. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc.
8. Physical Chemistry, Atkins, 6th Edition, Oxford Publishers.
9. Organic Chemistry, Mark Loudon, 4th Edition, Oxford Publishers.
10. Concise Inorganic Chemistry, J. D. Lee, Black Well Science

HU101 PROFESSIONAL COMMUNICATION

Contact: 2P
Credits: 2
Prerequisites: Knowledge in English language, Parts of Speech and Grammar

Course Objective: The main objective of the course is to grasp the ability to read, write and speak in English fluently by the students and improve their personality and technical skill.

Fundamentals of Technical Communication : process of communication, language as a tool of communication, levels of communication , flow of communication, barriers to communication, communication across cultures; Technical Communication: meaning, significance, characteristics, difference between technical and general communication.4L
Elements of Written Communication: words and phrases, word formation, synonyms and antonyms, homophones, one word substitution, sentence construction, paragraph construction,tense,preposition,voice change .8L
Forms of Technical Communication: business letters, job application letter and resume, business letters: sales & credit letters, letters of enquiry, letters of quotation, order, claim and adjustment letters, official letters: D.O. letters, government letters, letters to authorities, etc. ,
Technical Reports: general format of a report, formal and informal reports, memo report, progress report, status report, survey report, trip report, trouble report, laboratory report, research papers, dissertations and theses. Technical Proposals: purpose, characteristics, types, structure. 8L
Presentation Strategies: defining the subject, scope and purpose, analysing audience & locale, collecting materials, preparing outlines, organising the contents, visual aids, nuances of delivery, extemporaneous, manuscripts, impromptu, memorization and non- verbal strategies.6L
Value-based Text Reading: 4L
(A) Study of the following essays from the text book with emphasis on writing skills:
1. The Thief by Ruskin Bond
2. The Open Window by Saki
3. Marriage is a private Affair by Chinua Achebe
4. The Moon in the Earthen Pot by Gopini Karunakar

BOOKS -- RECOMMENDED:
1. Board of Editors: Contemporary Communicative English
for Technical Communication
Pearson Longman,2010
2. Dr. D. Sudharani: Manual for English Language Laboratory
Pearson Education (W.B. edition), 2010
3. Technical Communication Principles and Practice by Meenakshi Raman, Sangeeta Sharma(Oxford
Higher Education)
4. Effective Technical Communication by Barun K.Mitra(Oxford Higher Education)
5. V. Sashikumar (ed.): Fantasy- A Collection of Short Stories
Orient Black swan (Reprint 2006)

Course Outcome: After this course students

- **Conceive the expertise to communicate with outside world with their technical skill;**
- **Improve their personality to interact with the outside world;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU101							√	√				√

ME101 ENGINEERING MECHANICS

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics that includes Newton's Law of Motion, Gravitation, Vectors, Friction etc.

Course Objective: The main objective of the course is to enhance the knowledge of the students to excel in mechanical design used in the industry.

Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector). Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications. Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces. Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium. Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction. Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadralateral, composite areas consisting of above figures. Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone. Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of

motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion). Kinetics of particles: Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency.

TEXT BOOKS:

1. Engineering Mechanics [Vol-I & II]by Meriam & Kraige, 5th ed. – Wiley India
2. Engineering Mechanics: Statics & Dynamics by I.H.Shames, 4th ed. – PHI
3. Engineering Mechanics by Timoshenko , Young and Rao, Revised 4th ed. – TMH
4. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P
5. Fundamentals of Engineering Mechanics by Debabrata Nag & Abhijit Chanda– Chhaya Prakashani
6. Engineering Mechanics by Basudeb Bhattacharyya– Oxford University Press.
7. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11th ed. – Pearson

Course Outcome: After this course the students are able

- **To achieve sound knowledge in mechanical design;**
- **To study the function of different mechanical systems;**

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
ME101	√	√							√			

EE101 ELEMENTS OF ELECTRICAL ENGINEERING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics and Mathematics that includes Electricity and Magnetism, Newton's law of force, Complex Algebra etc.

Course Objective: The aim of the course is to acquire knowledge by the students in different electrical devices and they can have the expertise in electrical engineering.

Module-1

DC Network Theorem: Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof. Electromagnetism: Biot-savart law, Ampere's circuital law, field calculation using Biot-savart & ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, Self and mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses, Lifting power of Electromagnet. AC fundamental: Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behavior of AC series , parallel and series parallel circuits, Power

factor, Power in AC circuit, Effect of frequency variation in RLC series and parallel circuits, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

Module-2
Electrostatics: Coulomb's law, Electric Field Intensity, Electric field due to a group of charges, continuous charge distribution, Electric flux, Flux density, Electric potential, potential difference, Gauss's law, proof of gauss's law, its applications to electric field and potential calculation, Capacitor, capacitance of parallel plate capacitor, spherical capacitor, isolated spheres, concentric conductors, parallel conductors. Energy stored in a capacitor.

Module-3
DC Machines: Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Speed torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control)

Module-4
Single phase transformer: Core and shell type construction, EMF equation, no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation. 3 phase induction motor: Types, Construction, production of rotating field, principle of operation, equivalent circuit and phasor diagram, rating, torque-speed characteristics (qualitative only). Starter for squirrel cage and wound rotor induction motor. Brief introduction of speed control of 3 phase induction motor (voltage control, frequency control, resistance control)

Module-5
Three phase system: Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

Module-6
General structure of electrical power system: Power generation to distribution through overhead lines and underground cables with single lone diagram.

Text books:
1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Fundamental of electrical Engineering, Rajendra Prasad, PHI, Edition 2005.
3. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
4. Basic Electrical Engineering, J.P. Tewari, New age international publication

Reference books:
1. Basic Electrical Engineering (TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
2. Electrical Engineering Fundamental, Vincent.D.Toro, Pearson Education, Second Edition.
3. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
4. Basic Electrical Engineering, T.K. Nagsarkar & M.S. Sukhija, Oxford
5. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH
6. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.

Course Outcome: After this course the students will

- **Have the excellence in electrical engineering;**
- **Study the behaviour of the different electrical machines;**

P.O Table

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EE101	√	√							√			

EC101 ELEMENTS OF ELECTRONICS ENGINEERING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics, Chemistry and Mathematics that includes Electricity and Magnetism, Material Science, Complex Algebra, Calculus etc.

Course Objectives:
The objective of this subject is to build up the fundamental idea of semiconductor devices and their electrical characteristics when they are associated with the lump elements.

Module-I
Semiconductors: Conductors, Semiconductors and Insulators, electrical properties, band diagrams. Intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.
Diodes and Diode Circuits Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation. 10L

Module-II
Bipolar Junction Transistors: Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action and current amplification factors for CB and CE modes. Biasing and Bias stability. 6L

Module-III
Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles. 8L

Module-IV
Feed Back Amplifier (basic concept), Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain,

feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback, instability and oscillation, condition of oscillation, Barkhausen criteria. **Introduction to integrated circuits:** Introduction to binary number; Basic Boolean algebra; Logic gates and function realization. 10L

TEXT BOOKS:
• Millman & Halkias: Integrated Electronics.
• Sedra & Smith: Microelectronics Engineering.

References:
• Malvino: Electronic Principle.
• Schilling & Belove: Electronics Circuits.
• Millman & Grabal: Microelectronics.
• Salivahanan: Electronics Devices & Circuits.
• Boyelstad & Nashelsky: Electronic Devices & Circuit Theory.

Course Outcomes: At the end of the course students will be able

- **To explain the fundamentals of the operation of semiconductor devices and their electrical characteristics;**
- **To study electrical properties of different semiconductor devices;**

Course Code	*Course Title*	*Program Outcomes (POs)*											
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC 201	ELEMENTS OF ELECTRONICS ENGINEERING	√	√	√									

ME191 ENGINEERING GRAPHICS

Contact: 1L+3P=4P
Credits: 3
Prerequisites: Knowledge in High School Geometry

Course Objective:
The main aim of the course is to provide the students with the basics of engineering drawing and enhance their technical skill in graphics design.

Orthographics Projections, Straight lines, Planes, Solids (Auxiliary Plane Method and Change of position method), Isometric Projections, Hands on practice using AutoCAD. (40L)

Recommended Books:

Gopalkrishna K R, Engineering Graphics (Ist angle projection) Subhas Publication, Bangalore.
Bhat N D., Engineering Drawing. Charotar Publication.

Course Outcome: After this course the students can

- **Achieve elementary knowledge in graphics design;**
- **Learn to draw different mechanical design;**

P.O Table

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
ME191	√	√							√			

CH191 CHEMISTRY LABORATATORY

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Chemistry

List of experiments

1. To Determine the alkalinity in a given water sample.
2. Red-ox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water)
6. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Course Outcome:
The students will be able

- **To enrich their knowledge in chemistry and material science;**
- **To study chemical properties of materials**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CH191	√		√						√			

EE191 ELEMENTS OF ELECTRICAL ENGINEERING LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Physics

List of Experiments:
1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. (a) Verification of Thevenin's theorem.
   (b) Verification of Norton's theorems.
4. Verification of Maximum power theorem.
5. Verification of Superposition theorem
6. Study of R-L-C Series circuit
7. Study of R-L-C parallel circuit

Course Outcome: The students will be able
- **To enhance their knowledge to design different electrical circuits and study their behaviour;**
- **To study the functions of electrical equipments;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EE191	√	√	√									

EC191 ELEMENTS OF ELECTRONICS ENGINEERING LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Physics
Course Objectives: To make students familiar with behavioural characteristics of well known electronic components.

Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT, FET) and electronic equipment like DC power supplies, multimeters etc.
Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
Study of I-V characteristics of Junction diodes.
Study of I-V characteristics of Zener diodes.
Study of Half and Full wave rectifiers with Regulation and Ripple factors.
Study of I-V characteristics of BJTs (CE, CB).
Study of I-V characteristics of FETs (CS, CD).
Innovative Experiments (Basic Logic gate design using DTL logic)

Course Outcome:

The students will be able

- **To learn the basics of electronics and perform experiments;**
- **To study the behaviour of different active components like Diodes, Transistors, FETs etc;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC 191	ELEMENTS OF ELECTRONICS ENGINEERING LAB	√	√	√									

HU181 PROFESSIONAL COMMUNICATION LAB

Contact: 2P
Credits: 1
Prerequisites: Knowledge in English language

a) Honing 'Listening Skill' and its sub skills through Language Lab Audio device;
b) Honing 'Speaking Skill' and its sub skills;
c) Helping them master Linguistic/ Paralinguistic features (Pronunciation/ Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech;
d) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone , Mobile phone & Role Play Mode);
e) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success;
f) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD;
g) Honing 'Reading Skills' and its sub skills using Visual / Graphics/Diagrams /Chart Display/Technical/Non Technical Passages; Learning Global / Contextual / Inferential Comprehension;
h) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions.

Course Outcome:
The students will be able

- **To improve their communication skill to interact with the outside world and different industry personals;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU181							√	√				√

ME181 WORKSHOP

Contact: 1L+2P=3P
Credits: 2
Prerequisites: Knowledge in Material Science and Chemistry

Course Objective: The course is focussed on the basics of product manufacturing. Students can get the technical knowledge in wielding, machining, electrical connection etc.

A. THEORETICAL PART
1. INTRODUCTION TO MANUFACTURING; Socio-economic role, Definition, Major grouping and Examples.
2. ENGINEERING MATERIALS; Classification / Major grouping, Physical, Chemical and Mechanical properties, Applications.
3. DIFFERENT CONVENTIONAL MANUFACTURING PROCESSES MAINLY COVERING BASIC PRINCIPLES, DIFFERENT METHODS AND GENERAL APPLICATIONS; Manufacturing by forming /shaping from solid (input) to solid (product); Forging, Rolling, Drawing, Extrusion; Press tool work- Bending, Shearing, Drawing and Coining.
4. FORMING / SHAPING FROM LIQUID TO SOLID- CASTING; General principles, General classification or Types of casting; Sand mould casting- procedural steps and requirements; Pattern, Mould, Melting, Pouring, Solidification, Extracting and Fettling. Other casting processes (for larger volume and quality); Centrifugal casting, Investment casting, Die casting.
5. JOINING PROCESSES; Welding (Permanent Joining)- General classification and basis; Gas welding, Arc welding, Friction welding and Resistance welding, w.r.t. Principle, Requirements, Relative Advantages and Applications; Brazing and soldering.
6. REMOVAL (MACHINING) PROCESS; Principle and purpose of machining, Machining requirements, Machine tools- Definition, General classification w.r.t, functional principles and applications; Major machining parameters (and responses)- Speed, Feed and Depth of cut; Tool geometry (Rake, Clearance and Cutting angles), Cutting fluid application; Elementary machining operations- Facing, Centering, Turning, Threading, Drilling, Boring, Shaping and Milling.
B. SCHEDULE OF PRACTICAL CLASSES: FEASIBLE TYPES / MODELS OF ASSIGNMENTS:
i) FITTING (in 2 days or 6 hours); Making a gauge from MS plate as shown in Fig.1.

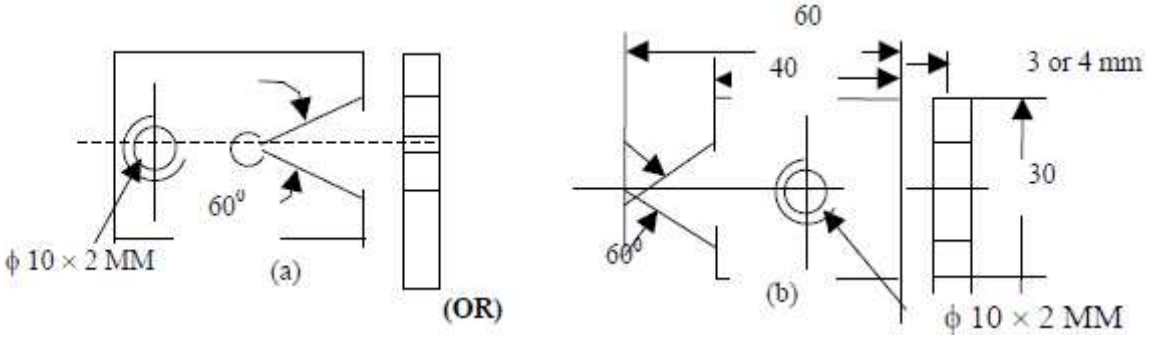

Fig.1: Job for fitting practice

Operations required:

1. Squaring and finishing of the blank by filing
2. Making the Vee-portion by sawing and filing
3. Drilling (in machine) and tapping (hand)

ii) MACHINING (in 3 days or 9 hours); To make a pin as shown in Fig.2 from a 20mm mild steel rod in a lathe.

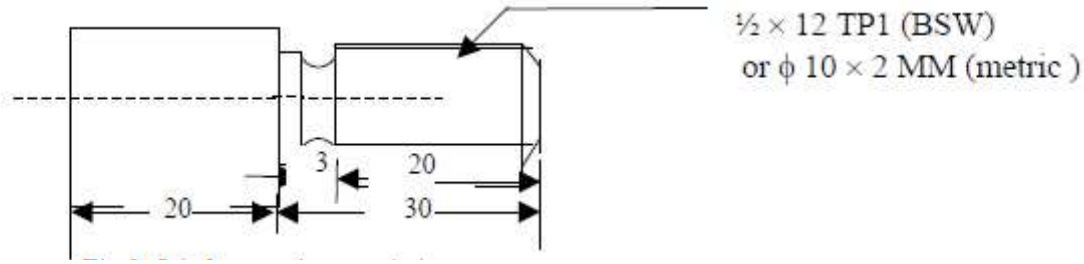

Fig.2: Job for practice on a lathe

iii) MACHINING (in 1 day or 3 hours); To make a MS prism as shown in Fig.3 from a 20mm mild steel rod in a shaping and / or milling machine.

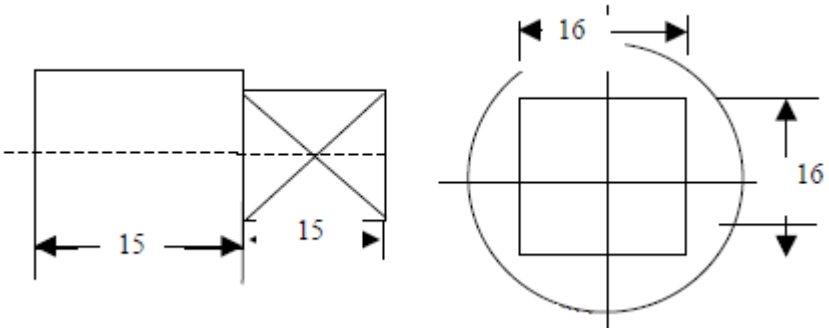

Fig.3: Job for practice on a shaping and/or milling machine

iv) PATTERN MAKING, SAND MOULDING AND CASTING (in 3 classes or 9 hours); To make a wooden pattern and a sand mould with that pattern for casting a cast iron block as shown in Fig.4.

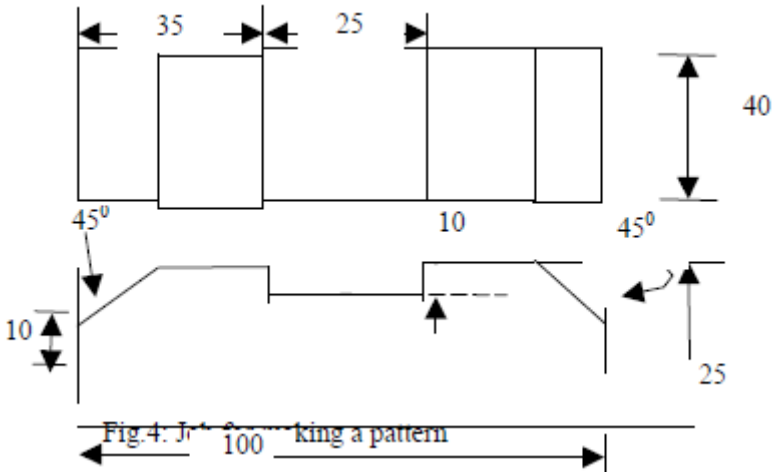

Fig.4: Job for making a pattern

v) WELDING (GAS WELDING) (in 1 class or 3 hours); To join two thin mild steel plates or sheets (1 to 3 mm thick) as shown in Fig. 5 by gas welding.

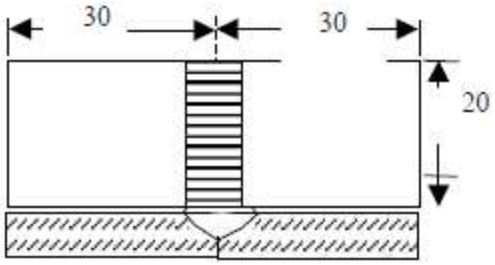

Fig.5: Welding specimen for practice

vi) WELDING (ARC WELDING) (in 1 day or 3 hours); To join two thick (6mm) MS plate as shown in Fig. 5 by arc welding.

vii) SHEET METAL WORK (in 1 day or 3 hours); Forming a cone, for example.

Total Lecture: 40L

Course Outcome: After this course students are conversant with the technical knowledge in different workshop activities.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
ME181	√	√							√			

HU182 NSS/NCC/NSO

Credits: 1
Prerequisites: Knowledge in social and economic issues

As per new syllabus to be introduced for B.Tech. from 2010, National Service Scheme has been introduced as compulsory activity. As per common practice, colleges that are carrying out NSS activities can be involved in social work in the neighbouring areas. Broad areas may be:

a) creating awareness in different social issues.
b) participating in mass education programme.
c) preparation of proposal for local slum area development;
d) awareness programme in electronic waste disposal etc.
e) environment awareness.

The following is the guideline for the NSS course as published by the National Service Scheme, Govt. Of India, Ministry of Youth Affairs & Sports. The topics are listed in the NSS manual.

(a) Environment Enrichment and Conservation:

Whereas the main theme for the special camping programme would be "Youth for Sustainable Development", activities aimed at environment – enrichment would be organised under the sub-theme of "Youth for Better Environment". The activities under this sub-theme would inter-alia, include: plantation of trees, their preservation and upkeep (each NSS unit should plant and protect at least 1000 saplings); creation of NSS parks/gardens, Tarun Treveni Vanas. Construction & maintenance of village streets, drains, etc. so as to keep the

environment clean; Construction of sanitary latrines etc. Cleaning of village ponds and wells; Popularization and construction of Gobar Gas Plants, use of non-conventional energy; Environmental sanitation, and disposal of garbage & composting; Prevention of soil erosion, and work for soil conservation, Watershed management and wasteland development Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

1. Programme of mass immunization;
2. Working with people in nutrition programmes with the help of Home Science and medical college students;
3. Provision of safe and clean drinking water;
4. Integrated child development programmes;
5. Health education, AIDS Awareness and preliminary health care.
6. Population education and family welfare programme;
7. Life style education centres and counseling centres.

(c) Programmes aimed at creating an awareness for improvement of the status of women:
They may, inter-alia, include:

1. programmes of educating people and making them aware of women's rights both constitutional and legal;
2. creating consciousness among women that they too contributed to economic and social well-being of the community;
3. creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
4. imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

Depending on the local needs and priorities, the following activities/programmes may be undertaken:-

1. work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
2. work with the organisations of child welfare;
3. work in institutions meant for physically and mentally handicapped;
4. organising blood donation, eye pledge programmes;
5. work in Cheshire homes, orphanages, homes for the aged etc.;
6. work in welfare organisations of women;
7. prevention of slums through social education and community action;

(e) Production Oriented Programmes:

1. working with people and explaining and teaching improved agricultural practices;
2. rodent control land pest control practices;
3. weed control;
4. soil-testing, soil health care and soil conservation;

5. assistance in repair of agriculture machinery;
6. work for the promotion and strengthening of cooperative societies in villages;
7. assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
8. popularization of small savings and
9. assistance in procuring bank loans
10. Relief & Rehabilitation work during Natural Calamities:

These programmes would enable the students to understand and share the agonies of the people affected in the wake of natural calamities like cyclone, flood, earthquakes, etc. The main emphasis should be on their participation in programmes, and working with the people to overcome their handicaps, and assisting the local authorities in relief and rehabilitation work in the wake of natural calamities. The NSS students can be involved in:-

(i) Assisting the authorities in distribution of rations, medicine, clothes etc.;

(ii) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;

(iii) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;

(iv) Assisting and working with local authorities in relief and rescue operation;

(v) Collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations:

Activities in this field could include:

g) Adult education (short-duration programmes);

h) pre-school education programmes;

i) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;

j) work in creches;

k) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;

l) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;

m) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;

n) non- formal education for rural youth an

o) legal literacy, consumer awareness.

Course Outcome:

The students will be able to improve their involvement in social welfare and interact with the persons involved in rural and urban developmental activities.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU182								√			√	√

M201 ENGINEERING MATHEMATICS – II

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School mathematics that includes Algebra, Calculus, Scalar and Vector.

Course Objective: This course is aimed at enhance the students' ability to solve engineering mathematical problems. This can enrich the problem solving ability of the students.

Module-1
Ordinary differential equations (ODE)- First order and first degree: Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation). (10L)

Module-2
ODE- Higher order and first degree: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations,Solution of simultaneous linear differential equations.
Basics of Graph Theory: Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph,; Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph. (10L)

Module-3
Tree: Definition and properties, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms.
Improper Integral: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. (10L)

Module-4
Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, first and second shifting properties, Change of scale property. Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. (10L)

Suggested Reference Books:
1. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern)
2. Graph Theory: V. K. Balakrishnan, (Schaum's Outline, TMH)
3. A first course at Graph Theory: J. Clark and D. A. Holton (Allied Publishers LTD)
4. Introduction to Graph Theory: D. B. West (Prentice-Hall of India)
5. Graph Theory: N. Deo (Prentice-Hall of India)
6. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)

7. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
8. Calculus: Strauss, Bradley and Smith (3PrdP edition, Pearson Education)
9. Engineering Mathematics (Volume 2): S. S. Sastry (Prentice-Hall of India)
10. Advanced Engineering Mathematics, 3E: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition
11. An Introduction to Differential Equations, R.K. Ghosh and K.C.Maity (New Central Book Agency)

Course Outcome: After this course students will have the knowledge to learn to solve difficult engineering problems.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
M201	√		√									

PH201 PHYSICS-I

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics

Background of the preparing the new and modified Physics course:
As per AICTE model curriculum (2012) of B.Tech programme**,** one of the major objective of Engineering &Technology education in India is to develop Engineering &Technology (E&T) professionals having competencies, intellectual skills and knowledge enabling them to contribute to the society through productive and satisfying careers as innovators, decision makers and leaders in the national and global economies of the 21st century. Accordingly, the approach to curriculum for UG in Engineering & Technology **(E&T)** Programmes needs to lay special emphasis on educating/preparing the students for being able to demonstrate some key abilities like

(a) Effective application of knowledge of mathematics, science and technical subjects;
(b) Planning and design to conduct scientific and technical experiments;
(c) Analysis and interpretation of scientific, technical and economic data collected;
(d) Design of parts, subsystems, systems and/or processes to meet specific needs;
(e) Identification, formulation and solving of problems using simulation or otherwise;
(f) Use of techniques/tools including software in all disciplines, as may be required;

Moreover, it is also mentioned that the E&T curriculum relating to UG E&T Degree Programmes in the country should focus on equipping students with a solid foundation in mathematical, scientific and E&T fundamentals required to solve E&T related problems.
As per AICTE model syllabus the Basic science part in a typical UG curriculum has been illustrated as

S.No.	Course Work - Subject Area	Range of Total Credits (%)		Suggested Breakdown of Credits (for Total=176)
		Minimum	Maximum	

				(No.)
1	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology	15	20	30

Sequencing plan of Basic science courses as per AICTE model syllabus of a typical UG curriculum is

Semesters	Subject Area Coverage
I –II	HS, **BS** and ES Courses common for all Branches; Mandatory Courses;
III-IV	HS, **BS** and ES Courses common for all Branches (to be continued); Also, Mandatory Courses(to be continued, if required); PC (Hard/Soft) Courses in two/three groups (like Electrical, Non-Electrical); Area wise Orientation; Add-On Courses;

Since, in the AICTE document a lot of emphasis has been given on the sound scientific understanding and its applications, while preparing Physics course allied to E&T disciplines special care has been taken on the design of a syllabus which will not only clarify physical laws, principles but at the same time open up an innovative and application oriented mindset of the students. Individual Departments were contacted about the probable requirement of Physics in their stream and accordingly it was decided that for Physics based subjects (EE, ECE, EIE, BME, CSE, IT, MECH, CIVIL-i.e. all existing streams) there will be two course of Physics. In the first year, there will be one Basic Physics course which would be common to all branches. The second physics course would be stream specific and will be taught in the second year of B.Tech programme. If there is any Chemistry based subject (e.g. Chemical Engineering, Food Technology, Biotechnology, Ceramic Technology etc) they do not need this second physics course. A plan of course implementation is presented in Table-III

Table-3: Model Scheme of Instruction for implementing Physics Courses in UG Engineering Programme

Streams	Course	Semester-I	Semester-II	Semester-III	Semester-IV
Computer Science & Engineering	PHYSICS-I (BASICS PHYSICS COURSE; **COMMON TO ALL BRANCHES** Theory: Physics-I Credit: 4 Lab: Physics-I lab Credit: 2	Computer Science & Engineering **Paper Code: PH 101 & PH 191**		Computer Science & Engineering **Paper Code: PH (CSE) 301 & PH (CSE) 391**	
Information Technology		Information Technology **Paper Code: PH 101 & PH 191**		Information Technology **Paper Code: PH (IT) 301 & PH(IT) 391**	
Mechanical Engineering		Mechanical Engineering **Paper Code:**		Mechanical Engineering **Paper Code:**	

		PH 101 & PH 191		**PH (ME) 301 & PH (ME)391**	
Civil Engineering		Civil Engineering **PH 101 & PH 191**		Civil Engineering **Paper Code: PH (CIV) 301 & PH (CIV) 391**	
Biomedical Engineering			Electrical Engineering **Paper Code: PH 201 & PH 291**	Biomedical Engineering **Paper Code: PH (BME) 401 & PH (BME) 491**	
Electrical Engineering	PHYSICS-II (ADVANCED PHYSICS COURSE; **STREAM SPECIFIC COURSE)** Theory: Physics-II Credit: 4 Lab: Physics-II lab Credit: 2		Electronics & Instrumentation Engineering **Paper Code: PH 201 & PH 291**		Electrical Engineering **Paper Code: PH (EE) 401 & PH (EE) 491**
Electronics & Instrumentation Engineering			Electronics & Communication Engineering **Paper Code: PH 201 & PH 291**		Electronics & Instrumentation Engineering **Paper Code: PH (EIE) 401 & PH (EIE) 491**
Electronics & Communication Engineering			Biomedical Engineering **Paper Code: PH 201 & PH 291**		Electronics & Communication Engineering **Paper Code: PH (ECE) 401 & PH (ECE) 491**
	Total Credit point in two courses: **Theory:** 08, **Lab:**04 **Total:** 12				

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The acquaintance of basic physics principles would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. This would create awareness about the vital role played by science and engineering in the development of new technologies. The courses would provide the necessary exposure to the practical aspects, which is an essential component for learning science. **This could be achieved by primarily introducing a course clarifying some of the basics of physical**

sciences attached to engineering curriculum in general, and an advanced course explaining the scientific details of various electronic devices & materials used in electronics and communication engineering. The advance courses will also give an insight into the science & technology of next generation to the budding engineers.

Course Outcome:

Through the 1st year basic physics courses, **s**tudents will be equipped with basic physical laws, principles and formalism to apply them in their core curriculum. After going through the 2nd year course (advanced course), students will be exposed to the physics of materials that they apply in device design and fabrication and at the same time they will be exposed to the basics of new age scientific & technological fronts.

Delivery of the Course:

i) Preparation of Lecture plan by respective teacher(s).
ii) Preparation of session plan detailing the methodology, learners' activity, learning outcome (such as Skill, Competency etc).
ii) Preparation of delivery report by respective teacher(s) in the Institute specified book (Continuous Evaluation Diary)

Mode of Delivery of the course:

i) Chalk-talk method
ii) Showing models (Demonstration)
iii) Analogy
iii) Presentation
iv) Cross-word puzzle
v) Quiz/Brain storming
vi) Role-play
vii) Problem oriented guided inquiry learning (POGIL)

Course Evaluation: CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) to constitute the major evaluations prescribed for the Course.

CIE (Continuous Internal Evaluation): To be conducted by the respective teacher and include mid-term/weekly/fortnightly class tests, surprise test, home work, problem solving, group discussion, quiz, problem oriented guided inquiry learning, mini-project & seminar throughout the Semester, with weightage for the different components being fixed at the institutional level. The teacher will discuss with students their performance, highlighting their strength and weakness.

SEE (Semester End Examination): To be conducted at the institutional level and cover the entire Course Syllabi; For this purpose, Syllabi to be modularized and SEE questions to be set from each **Module**, with choice if any, to be confined to **Module** concerned only. The questions to be comprehensive emphasizing analysis, synthesis, design, problems & numerical quantities.

SYLLABUS For all B.Tech streams (CSE, IT, MECH, CIVIL, ECE, EE, EIE, BME)
(Approved by the BOS of Physics (UG))

Name of the Course: B.Tech
Paper Name: PHYSICS-I (Basic Physics course) **Paper Code:** PH 101/201 **Semester:** 1st & 2nd

Duration: 40 Hours **Full Marks:** 100 **Credits:** 4

Teaching Scheme: **Lecture:** 3 hrs/week **Tutorial:** 1
Examination Scheme (Theoretical): End Semester Exam: 70 **Internal Assessment:** 30

Course Objective: The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The acquaintance of basic physics principles would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. This would create awareness about the vital role played by science and engineering in the development of new technologies. The courses would provide the necessary exposure to the practical aspects, which is an essential component for learning science.

Pre-Requisites: 10+2 level of Physics knowledge

Course Outcome: Through the 1st year basic physics course, **s**tudents will be equipped with basic physical laws, principles and formalism to apply them in their core curriculum. Through laboratory sessions they will be exposed to basic error analysis and some phenomenological experiments which are essential for the understanding of the core curriculum.

Module 1: Classical Mechanics

1.01: Classical Mechanics: Limitations of Newtonian Mechanics, constraint, degree of freedom, generalized coordinates, Lagrange's equation (No derivation), Hamilton's principle, Applications of Lagrange's equation: Linear Harmonic Oscillators-Differential equation and its solution, superposition of two linear SHM's (with same frequency), Lissajous' figures. 4L

1.02: Damped vibration: Introduction – differential equation and its solution, critical damping, Logarithmic decrement. 1L

1.03: Forced vibration: Introduction – differential equation, Amplitude and velocity resonance, Sharpness of resonance and Quality factor, Application to L-C-R Circuit 2L

1.04: Electromagnetic theory-I:

1.04-A: Vector operators, Gradient, Divergence, Curl-Physical significance, Gauss's divergence theorem (statement only), Stoke's theorem (statement only) and their applications. 2L

1.04-B: Development of electromagnetic theory, Electromagnetic spectrum, Concept of displacement current, equation of continuity, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave, electromagnetic waves in a charge free conducting medium, skin depth, Poynting vector. 3L

Module 2: OPTICS 1:

2.01: Interference – Conditions for sustained interference, Young's double slit as an example . Qualitative idea of Spatial and Temporal Coherence, Conservation of energy and intensity distribution, Fresnel's Biprism, thin films of uniform thickness (derivation) Newton’s ring. 4 L

2.02: Diffraction of light – Fresnel and Fraunhofer class. Fraunhofer diffraction for single slit and double slits (elementary treatment, Intensity distribution). Plane transmission grating (No deduction of the intensity distributions is necessary). Missing orders. Dispersive power, Rayleigh criterion (qualitative), Resolving power of grating (Definition and formulae). Use of grating as a monochromator. 3L

2.03: Polarization: General concept of Polarization, Plane of vibration and plane of polarization, Concept of Plane, Circularly and Elliptically polarized light (using wave equations), Polarization through reflection and Brewster's law, Double refraction (birefringence) -Ordinary and Extra-ordinary rays, Nicol's Prism. 3L

2.04: Laser : Spontaneous and Stimulated emission of radiation, Population inversion, Einstein's A & B co-efficient (derivation of the mutual relation), concept of laser as a polarized source, Optical resonator and Condition necessary for active Laser action, Ruby Laser, He-Ne Laser, semiconductor Laser- applications of laser.
3L

2.05: Fiber optics: Optical Fibers – Core and cladding, total internal reflection step index and graded index fiber, Calculation of Numerical aperture and acceptance angle, losses in the fiber, applications. 2L

Module 3: Elementary solid state physics

3.00: Crystallography & Solid state physics: Space lattice, unit cell, crystal systems, Bravais lattices, basis, co-ordination number and atomic packing fraction, scc, bcc and fcc and hcp structures lattice planes, indexing of directions, Miller indices, interplaner spacing, Bragg's law & its application to real crystal structure (NaCl, KCl). 4L

Module 4: Quantum Mechanics I:

4.01: Matter waves: Concept of de Broglie's Matter waves, derivation of wavelength of matter waves in different forms, Concept of Phase velocity and Group velocity (qualitative) 2L

4.02: Wave mechanics: Concept and Physical significance of wave function Ψ and interpretation of
$|\Psi|^2$, Ψ(normalization and probability interpretation), Heisenberg's Uncertainty principle with illustration; Schrödinger's equation- time dependent and time independent form (derivation). Discussion with relevant problems.
3L

4.03: Operator algebra: Operator, Commutator, Formulation of quantum mechanics and Basic postulates, Operator correspondence, Expectation values, Ehrenfest theorem. Discussion with relevant problems. 4L

List of Assignments/Tests:

- **15 marks Internal test 1 & Internal test 2 (best of the two would be considered)**
- **Assignments in regular classes, tutorial classes and surprise tests.**

List of recommended Books:

Module 1: Experiments on Classical Mechanics:

1. Classical Mechanics- J. C. Upadhyay (Himalya Publishers)
2. Classical Mechanics-Shrivastav
3. Classical Mechanics-Takwal & Puranik (TMH)
4. Sound-N. K. Bajaj (TMH)
5. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
6. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
7. A text book of sound-M. Ghosh (S. Chand publishers)
8. Electromagnetics-B.B. Laud (TMH)
9. Electricity Magnetism-B.Ghosh (Book & Allied Publisher)
10. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)

11. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
12. Electricity Magnetism-Fewkes and Yardwood (Oxford University Press)

Module 2: OPTICS 1:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers

Module 3: Elementary solid state physics

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta, Nurul Islam (Book & Allied Publisher)

Module 4: Quantum Mechanics I:

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)

General Reference:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Basic Engineering Physics-I -Sujoy Bhattacharya, Saumen Paul (TMH)
4. University Physics-Sears & Zemansky (Addison-Wesley)

PHYSCIS-I SYLLABUS (PROPOSED) AS PER MODULES & EXAM-GROUP* DIVISION

STREAM	MODULE-1	MODULE-2	MODULE-3	MODULE-4	GR-A *	GR-B*
1st year Basic Physics course	OPTICS 1: 4+3+3+3+2 =15L	Waves and Vibration, Electromagnetic theory-I: 2+2+3+5=12L	Elementary solid state physics 4L	Quantum Mechanics I: 9L	1.01: Classical Mechanics (4L) 1.02: Damped vibration (1L) 1.03: Forced vibration (2L) 2.02:.Diffraction of light (3L) 2.05: Fiber optics (2L) 3.00 Elementary solid state physics. (4L) 4.03: Operator algebra (4L)	1.04 A & B: Electromagnetic theory-I (5L) 2.01: Interference (4L) 2.03: Polarization (3L) 2.04: Laser (3L) 4.01: Matter waves: (2L) 4.02: Wave mechanics (3L)

Course Outcome:

The students will be able

- **To understand different physical phenomena and study their behavior theoretically;**
- **To identify different material properties;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
PH101/201	√	√	√									

CS201 COMPUTER PROGRAMMING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in basic arithmetic

Module-1
Fundamentals of Computer:
History of Computer, Generation of Computer, Classification of Computers, Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Binary & Allied number systems representation of signed and unsigned numbers. BCD, ASCII. Binary Arithmetic & logic gates. Assembly language, high level language, compiler and assembler (basic concepts) Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart.

Module-2
C Fundamentals: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Module-3
Operators & Expressions: Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation.

Module-4
Input and Output: Standard input and output, formatted output -- printf, formatted input scanf.

Module-5
Flow of Control: Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels.

Module-6
Fundamentals and Program Structures: Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments.

Arrays and Pointers: One dimensional arrays, pointers and functions, multidimensional arrays.

Module-7
Structures Union and Files: Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files.

Recommended reference Books:
Introduction To Computing (TMH WBUT Series), E. Balagurusamy,TMH
Kerninghan, B.W. The Elements of Programming Style
Yourdon, E. Techniques of Program Structures and Design
Schied F.S. Theory and Problems of Computers and Programming
Gottfried Programming with C Schaum
Kerninghan B.W. & Ritchie D.M. The C Programming Language
Rajaraman V. Fundamental of Computers
Balaguruswamy Programming in C
Kanetkar Y. Let us C

Course Outcome:
The students will be able
- **To understand the basics of programming and apply their cognitive knowledge to develop different intelligent systems;**
- **To learn basic programming methodologies;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CS201	√		√		√							

ME201 ELEMENTS OF MECHNICAL ENGINEERING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in Physics

Boilers, mountings and accessories, IC Engines, Turbines and pumps, Introduction to Refrigeration and Air-conditioning, Power Transmission and Lubrication. Metal casting and forming processes, Welding, Brazing and Soldering. Introduction to Machine Tools Lathe and Drilling Machines.

Course Outcome:
The students will be able
- **To understand the functions of different mechanical systems;**
- **To analyze the stress and strain of different beams;**

P.O Table:

Paper	a	b	c	d	e	f	g	h	i	j	k	l

Code												
ME201	√	√		√								

Recommended reference Books:

Gopalkrishna K.R., Mechanical Engineering Sciences. Subhas Publications, Bangalore.
Prabhu T. J., Mechanical Engineering. Al SCI Tech.
Gupta, P.N., and Poona, M.P., Elements of Mechanical Engineering. Std Publications Ltd.
Roy and Choudhary, Elements of Mechanical Engineering.

EE201 ELEMENTS OF ELECTRICAL ENGINEERING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics

Module-1

DC Network Theorem: Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof. Electromagnetism: Biot-savart law, Ampere's circuital law, field calculation using Biot-savart & ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, Self and mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses, Lifting power of Electromagnet. AC fundamental: Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behavior of AC series , parallel and series parallel circuits, Power factor, Power in AC circuit, Effect of frequency variation in RLC series and parallel circuits, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit.

Module-2

Electrostatics: Coulomb's law, Electric Field Intensity, Electric field due to a group of charges, continuous charge distribution, Electric flux, Flux density, Electric potential, potential difference, Gauss's law, proof of gauss's law, its applications to electric field and potential calculation, Capacitor, capacitance of parallel plate capacitor, spherical capacitor, isolated spheres, concentric conductors, parallel conductors. Energy stored in a capacitor.

Module-3

DC Machines: Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Speed torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control)

Module-4

Single phase transformer: Core and shell type construction, EMF equation, no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short

circuit tests, regulation and efficiency calculation. 3 phase induction motor: Types, Construction, production of rotating field, principle of operation, equivalent circuit and phasor diagram, rating, torque-speed characteristics (qualitative only). Starter for squirrel cage and wound rotor induction motor. Brief introduction of speed control of 3 phase induction motor (voltage control, frequency control, resistance control)

Module-5
Three phase system: Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method.

Module-6
General structure of electrical power system: Power generation to distribution through overhead lines and underground cables with single lone diagram.

Course Outcome:
The students will be able

- **To study the behaviour of different electrical equipments;**
- **To study different power systems;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EE201	√	√							√			

Text books:
1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Fundamental of electrical Engineering, Rajendra Prasad, PHI, Edition 2005.
3. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
4. Basic Electrical Engineering, J.P. Tewari, New age international publication

Reference books:
1. Basic Electrical Engineering(TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
2. Electrical Engineering Fundamental, Vincent.D.Toro, Pearson Education,
Second Edition.
2. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
3. Basic Electrical Engineering, T.K. Nagsarkar & M.S. Sukhija, Oxford
4. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH
5. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.

EC201 ELEMENTS OF ELECTRONICS ENGINEERING

Contact: 4P
Credits: 4
Prerequisites: Knowledge in High School Physics, Chemistry and Mathematics

Course Objectives:
The objective of this subject is to build up the fundamental idea of semiconductor devices and their electrical characteristics when they are associated with the lump elements.

Module-I

Semiconductors: Conductors, Semiconductors and Insulators, electrical properties, band diagrams. Intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Diodes and Diode Circuits Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation. 10L

Module-II

Bipolar Junction Transistors: Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action and current amplification factors for CB and CE modes. Biasing and Bias stability. 6L

Module-III

Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles. 8L

Module-IV

Feed Back Amplifier (basic concept), Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback, instability and oscillation, condition of oscillation, Barkhausen criteria. **Introduction to integrated circuits:** Introduction to binary number; Basic Boolean algebra; Logic gates and function realization. 10L

Course Outcomes:

At the end of the course students will be able to explain the fundamentals of the operation of semiconductor devices and their electrical characteristics.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC 201	ELEMENTS OF ELECTRONICS ENGINEERING	√	√	√									

TEXT BOOKS:

- Millman & Halkias: Integrated Electronics.
- Sedra & Smith: Microelectronics Engineering.

References:

- Malvino: Electronic Principle.

- Schilling & Belove: Electronics Circuits.
- Millman & Grabal: Microelectronics.
- Salivahanan: Electronics Devices & Circuits.
- Boyelstad & Nashelsky: Electronic Devices & Circuit Theory.

PH291 PHYSICS LABORATATORY

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Physics

General idea about Measurements and Errors (Mandatory):

Measurand (objects to be measured) precision, significant number., accuracy, certainty, resolution; Errors - types and sources of errors (definitions and examples), Systematic error, Random error, Ambiguity error, Dynamic error, with example of Slide calipers, Screw-gauge, Carrey Foster bridge. Study of different types of unit cells with model system.

Experiments on Classical Mechanics:
1. Study of torsional oscillation of torsional pendulum & determination of time period using various load of the oscillator.
2. Experiments on Lissajous figure (using CRO).
3. Study of LCR circuit using ac signal and determination of Q factor.

Experiments on Optics:
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Fresnel's bi-prism method.
6. Determination of wavelength of light by Laser diffraction method.
7. Determination of numerical aperture and the energy losses related to optical fibre experiment
8. Study of Hydrogen/ Helium spectrum using transmission grating and measurement of Rydberg Constant.
9. Inspection of Laser beam profile-to find beam divergence.
10. Study of half-wave and quarter wave plates.
11. Measurement of specific rotation of an optically active solution by polarimeter

Experiments on electromagnetic theory:
12. Measurement of nodal and antinodal points along a transmission wire and measurement of wave length.

Experiments on Quantum Mechanics I
13. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
14. Measurement of Stopping potential using a photocell and determination of Planck's Constant.

Course Outcome:

The students will be able

- **To identify and study the properties of different physical phenomena;**
- **To study the physical properties of different materials;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
PH291	√	√	√									

CS291 COMPUTER PROGRAMMING LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in basic arithmetic

1. DOS System commands and Editors (Preliminaries)
2. UNIX system commands and vi (Preliminaries)
3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number , generate Pascal's triangle, find roots of a quadratic equation
4. Programs to demonstrate control structure : text processing, use of break and continue, etc.
5. Programs involving functions and recursion
6. Programs involving the use of arrays with subscripts and pointers
7. Programs using structures and files.

Course Outcome:
The students will be able

- **To apply their cognitive knowledge to develop different intelligent systems using the programming techniques;**
- **To learn to change the intellectual property of a system by programming;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CS201	√		√		√							

EE291 ELEMENTS OF ELECTRICAL ENGINEERING LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Physics

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. (a) Verification of Thevenin's theorem.
   (b) Verification of Norton's theorems.

4. Verification of Maximum power theorem.
5. Verification of Superposition theorem
6. Study of R-L-C Series circuit
7. Study of R-L-C parallel circuit

Course Outcome:
The students will be able

- **To study different electrical equipments;**
- **To handle different electrical components and study their behaviour;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EE201	√	√							√			

EC291 ELEMENTS OF ELECTRONICS ENGINEERING LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in High School Physics, Chemistry and Mathematics
Course Objectives: To make students familiar with behavioural characteristics of well known electronic components.

Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
Study of I-V characteristics of Junction diodes.
Study of I-V characteristics of Zener diodes.
Study of Half and Full wave rectifiers with Regulation and Ripple factors.
Study of I-V characteristics of BJTs.
Innovative experiments (Basic Logic gate design using DTL logic)

Course Outcome:
The students will be able

- **To learn the basics of electronics and perform experiments;**
- **To study the behaviour of different active components like Diodes, Transistors, FETs etc;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC 291	ELEMENTS OF ELECTRONICS ENGINEERING LAB	√	√	√									

M(ECE)-301 MATHEMATICS FOR ELECTRONICS & COMMUNICATION ENGG

Contact: 4P
Credits: 2
Prerequisites: Knowledge in High School Mathematics

Linear Algebra: Basis, Vector Spaces and Subspaces, Inverse by partitioning, Linear Transformations, Rank and Echelon matrices, Homogeneous linear equations, Basic Solutions, Similarity, Symmetric matrices, Diagonalization, Quadratic forms, Rotation of co-ordinates, Orthogonal Transformations. Probability Theory and Applications: Random Variables and Transformations, Bernoulli, Binomial, Poisson, Uniform, Gaussian, Raleigh, Ricean probability distributions, Expectations, Moments and generating functions, Inequalities, Limit Theorems, Random Processes, Markov and Poisson Random processes, Error function, Complementary Error function, Q function and their applications Theory of Complex variables: Functions of Complex variables, Cauchy-Riemann equations, Properties of analytic functions, Conformal mapping, Line Integrals in a complex plane. Cauchy's Theorems, Evaluation of standard real line integrals using contour integration. Numerical Methods: Introduction, Solution of equations by iteration, Interpolation, Numerical Integration and Differentiation, Solution of Linear equations and Differential equations. Finite fields and PN sequences: Polynomials and Euclidean algorithm, constructing finite fields, subfields, Properties of PN sequences, Generation of PN sequences application of PN sequences.

Course Outcome:
The students will be able

- **To learn to solve device equations by using calculus;**
- **To formulate and model device parameters;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
M(ECE)-301	√		√									

TEXT BOOKS:

E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 1993.
G. Strang, Linear Algebra and its applications, Cenage Learning, 2006
C.W. Therrien and M. Tummala, Probability for Electrical and Computer Engineers, CRC Press, 2005.
T.K Moon and W.C Stirling, Mathematical Methods and Algorithms for Signal Processing, Pearson Education, 2000.

CH201/301/401 Environmental Studies

Prerequisites: Knowledge in Social Science

Course Objectives:
The Objectives of the curriculum are listed below:

- To introduce students to environmental science, its central ideas, concepts, models and applications
- To help students in application of the fundamentals of environmental science to important local, regional, national and global environmental problems and potential solutions to maintain our sustainability
- To give you an opportunity to analyze and discuss the relevance of environmental science to your personal, professional, and academic life
- Communicate scientific information to both professional and lay audiences

Module 1
General:
Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Material cycles- Carbon, Nitrogen and Sulphur Cycles. Human activities – Food, Shelter, Economic and social Security. Basics of Environmental Impact Assessment. Sustainable Development. 5L

Module 2
Natural Resources:
Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Rain water harvesting, 3L
Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. 1L
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources. 1L
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. 2L
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative future source of Energy. 2L

Module 3
Pollution:
Population Growth and Urbanization 2L
Environmental Pollution and their effects (Previous disaster) 1L
Air Pollution (Atmospheric structure, Primary and Secondary pollutant, Green house effect and Global warming, Acid Rain, Ozone Layer depletion, Smog, Control measure). 3L
Water pollution (Effects of heavy metals, Sewage, BOD, COD, Water treatment). 3L
Land pollution and Solid waste management. Noise pollution, e-Waste. 4L

Module 4
Control:
Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education. 2L

Green chemistry:
Introduction, Goals Significance, Basic ideas in the field of green chemistry research. Industrial applications of green chemistry. 2L

Course Outcome:
Upon successful completion of this curriculum students should be able to:

- Describe the structure and function of significant environmental systems.
- Use scientific reasoning to identify and understand environmental problems and evaluate potential solutions.
- Critically evaluate arguments regarding environmental issues.
- Develop new project with good environmental impact leading to better earth for the future.
- Control industrial pollution as there are a good number of technologists with basic environmental awareness

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CH-201/301/401	√		√						√			

Reference Books
1. Garg, S.K and Garg, R., Ecological and Environmental Studies, Khanna Publishers, Delhi, 2012.
2. Henry J.G. and Heinke G.W., Environmental Science and Engineering, 2nd Edition, Prentice Hall of India, New Delhi, 2004.
3. Masters G.M., Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall of India, New Delhi, 2004

EC301 DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE

Contact: 4P
Credits: 4
Prerequisites: Knowledge in Electronics (EC-201) and Engineering Mathematics

Course Objective:

- Enrich the knowledge of the students on basic components of a computing system and their working principles.
- Obtain a basic level of Digital Electronics knowledge and set the stage to perform the analysis and design of complex digital electronic circuits.

Module 1:
Number systems and arithmetic (Fixed and floating point) **6L**

Module 2: Combinational logic analysis and design: logic minimisation methods, Combinational design using MSI, LSI and PLDs **8L**

Module 3: Sequential logic design: latches and flip-flops (SR,D,JK,T), Setup and Hold time , Clock frequency, , counters, shift registers **8L**

Module 4: Finite state machine design, ASM charts, state minimization, state assignment, synthesis using D-FF and JK-FF **6L**

Module 5: Logic families (TTL, ECL, CMOS, BICMOS), Delay, Hazards, MSI devices as state machines, Memory cells. **6L**

Module 6:
Introduction to computer architecture (basic idea): Instruction Set, Architecture, Processor Design: Data path, Control unit, Instruction types, addressing modes, pipelining. **6L**

Course Outcome: The students will be able to

- **Recognize the number systems use in digital logic design and its conversion.**
- **Identify and describe the six basic logic gates and combinational circuits in digital electronics.**
- **Identify and describe flip-flop circuits.**
- **Describe and demonstrate the use digital test equipment and its operating characteristics.**
- **Examine purpose of digital integrated circuits.**

P.O TABLE

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC301	DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE		√	√	√								

Textbooks:

1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2. A.K.Maini- Digital Electronics- Wiley-India
3. Kharate- Digital Electronics- Oxford

Reference:

1. Morries Mano- Digital Logic Design- PHI
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Givone—Digital Principles & Design, Mc Graw Hill
6. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
7. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
8. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
9. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyed & Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications
12. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

EC302 SIGNALS AND SYSTEMS

Contact: 3P
Prerequisite: Elements in Electronics Engineering

Course Objectives:
Objective of the course is to understand signal types, properties and analysis, demonstrate and understand the fundamental properties of linear time-invariant systems.

Module 1
Introduction to signal and systems:
Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity Causality, time invariance and stability. **8L**

Module 2
Time domain analysis of discrete-time and continuous time systems:
Natural response, forced response, impulse response, representation of discrete time signals, properties of convolution, Convolution in time (both discrete and continuous), deconvolution, correlation of two sequences. **5L**

Module 3
Fourier series analysis of continuous-time periodic sigals:
Dirichlet' conditions, Determination of Fourier series , coefficients of signal, symmetry conditions, properties of CTFS. **7L**

Module 4
Signal Transformation:
Fourier transformation of continuous-time signals, fourier transform of standard signals, properties of fourier transform. Z-Transforms: Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion. **10L**

Module 5
Sampling Theorem: Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals. **4L**

Course Outcome: The students will be able to

- **Identify, formulate and solve problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.**
- **In-depth knowledge that allows a fundamentals-based principles ,analytical approach of linear time variant system.**

- **Create, select and apply appropriate techniques, resources, and matlab tools, including programme and modelling with an understanding of the limitations**
- **Understand the impact of solutions for response of any system and knowledge for implementation of those system for future development.**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC302	SIGNALS AND SYSTEMS	√		√			√						

Text books:

1.B.P. Lathi-Linear sysytems and signals, Oxford
2. P.Ramesh Babu, R. Anandanatarajan- Signals & systems, Scitech
3. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
4. S.Haykin & B.V.Veen, Signals and Systems- John Wiley
5. A.Nagoor Kani- Signals and Systems- McGraw Hill

References:

1. J.G.Proakis & D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.
2. C-T Chen- Signals and Systems- Oxford
3. E WKamen &BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson

EC303 SOLID STATE DEVICES

Contact: 3P
Credits: 3
Lectures: 40
Prerequisites: College Mathematics with PDE. Modern Physics with Quantum Mechanics

Course objectives:

1. Understanding of solid-state device physics at an introductory level.
2. Understanding of basic circuit uses of solid-state devices

Module 1: Energy Band Theory **8L**

Energy Bands in Matter **3L**

Concept of Schrodinger's equation in formation of energy bands in crystal. Free electron theory, Band theory, formation of allowed and forbidden energy bands, Concept of effective mass – electrons and holes, Hall effect.

Semiconductors **5L**

Semiconductors and insulators –direct & indirect band gaps, Fermi-Dirac distribution function
(temperature dependence-qualitative discussions). Fermi level for intrinsic and extrinsic semiconductors (dependence on temperature and doping concentration viz. p type, ntype, p-n,

npn and pnp); Diffusion and drift current Generation and recombination, quasi-Fermi energy level

Module 2: Device Fabrication and Junctions 16L

Device Fabrication Technology 6L

Semiconductor crystal structure, growth of single crystal silicon with Czokralski process, Photolithography, Common methods of device growth: Chemical Vapour Deposition, Vapour Phase Epitaxy, Molecular Beam Epitaxy, Liquid Phase Epitaxy. Formation of p-n junction.

Junctions 4L

I-V relation, Junction capacitances, Homo- and Hetero-junctions –examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-), application of Diode capacitance in Varactor Diodes, Diode switching, Law of junctions, Plot of junction voltage, field and depletion charge with distance by solving simple 1D

Poisson's Equation,

Diodes 6L

Classification of different types of diode on the basis of doping concentration: rectifier diode, Zener diode, tunnel diode, photodiodes, photo voltaic effects, PNPN transistors - simple working principle, I-V characteristics

Module 3: Transistors 16L

Bipolar Junction Transistor 8L

Physical mechanism, current gain, minority current distribution; Solution of continuity equation and Poisson's equation for BJT. Punch-through and avalanche effect; Frequency limitations, high frequency transistors, Power transistors.

Field Effect Transistors 8L

Field effect transistors: MOS-capacitors, flat band and threshold voltages; p and n channel MOSFETS, CMOS and VLSI MOSFETS, channel modulation & channel isolation, channel inversion, Ideal Threshold voltage , depletion width, surface field and potential (gradual channel & depletion approximations); I-V characteristics with expressions for saturation and non-saturation regions; Equivalent circuit for MOSFET, MOSFET for VLSI -scaling issues (basic concept of Short Channel Effects only),

Course Outcome: The students will be able to

- **Understand the basic physics of electrons in solids and carriers and carrier transport in semiconductors;**
- **Understand the physics and design elements of p-n junctions, silicon MOSFETs, homo-junction bipolar transistors;**
- **Introduction to advanced contemporary devices qualitatively;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC303	SOLID STATE DEVICES	√				√	√						

Text Books :

1. Streetman & Banerjee, "Solid State Electronic Devices", Pearson Prentice Hall

2. Neamen- Semiconductor Physics and Devices TMH
3. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
4. Maini & Agrawal- Electronics Devices and Circuits- Wiley

Reference Books :

1. Sze & Tg, "Physics of Semiconductor Devices" Wiley Inter Science
2. Milman, Halkias & Jit- Electronics Devices and Circuits- TMH
3. Bell-Electronics Devices and Circuits-Oxford
4. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
5. Singh & Singh- Electronics Devices and Integrated Circuits –PHI
6. Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson

EC 304 CIRCUIT THEORY AND NETWORKS

Contact: 4P

Contact: 4P

Credits: 4

SERTATIONites: Basic Electrical

Course objective:

The objective of the course is to understand the analysis of circuits using Kirchhoff's current and voltage laws
(KCL and KVL), theorems, create current and voltage equations, solve various cases of problems.

Module 1

Resonant Circuits: Series and Parallel resonance, Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth, Phasor diagrams, Practical resonant and series circuits. 4L

Module 2

Mesh Current Network Analysis: Kirchoff's Voltage law, Formulation of mesh equations, Solution of mesh equations by Cramer's rule and matrix method, Solution of problems with DC sources. 3L

Node Voltage Network Analysis: Kirchoff's Current law, Formulation of Node equations and solutions, Solution of problems with DC sources. 3L

Module 3

Network Theorems: Definition and Implication of Superposition Theorem, Thevenin's theorem, Norton's theorem , Reciprocity theorem, Compensation theorem, maximum Power Transfer theorem , Millman's theorem, Star delta transformations , Solutions and problems with DC sources. 10L

Graph of Network: Concept of Tree and Branch, tree link, junctions, Incident matrix, Tie set matrix, Determination of loop currents and node voltages. 6L

Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets. 6L

Module 4

Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems. 6L

Laplace transform: Concept of Complex frequency , transform of f(t) into F(s) , transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions, properties of Laplace transform , linearity, real differentiation, real integration, initial value theorem and final value theorem, inverse Laplace transform , application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems. Laplace transform and Inverse Laplace transform. 6L

Course outcomes: At the end of course student should

- **Analyze a circuit given sinusoidal inputs.**
- **Compute average power consumed or supplied by a circuit.**
- **Design simple circuits for maximum power transfer to a load.**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC304	CIRCUIT THEORY AND NETWORKS	√		√		√							

Reference Books:

1. A.B.Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthesis" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vikas
11. V.K. Chandna, "A Text Book of Network Theory & Circuit Analysis",Cyber Tech
12. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill .
13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI
14. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circuits" New Age

EC391 DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Elements of Electronics (EC-201) and Engineering Mathematics

Course Objective: The main objective of this course is to obtain a basic level of Digital Electronics knowledge and set the stage to perform the analysis and design of complex digital electronic circuits.

1. Realization of different gates like AND, OR, NOR, NOT, NAND etc
2. Realization of every gate using universal gate.
3.Gray to binary code conversion and vice versa.
4.Odd even parity generation and checking.
5.4 bit magnitude comparator circuitr.
6.Circuit design using gates: MUX, decoders, adder, subtractor,BCD adder
7.Realization of RS,JK,D,T flip flop using gate.
8.Realization of asynchronous up/down counter.
9. Realization of synchronous up/down counter.
10.Design of sequential counter with irregular sequences.
11.realization of ring counter and Johnson counter.
12.8bit register design.
13.2/4 bit ALU design.

Course Outcome: The students will be able to

- **Describe Digital Circuit using SSI/MSI**
- **Identify and describe the six basic logic gates and combinational circuits in digital electronics.**
- **Identify and describe flip-flop circuits.**

P.O TABLE

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC391	DIGITAL ELECTRONICS & COMPUTER ARCHITECTURE LAB		√	√	√								

EC392 LINEAR CIRCUITS AND SIGNALS LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Basic Electronics

1. Generation of different types of periodic and aperiodic waveforms.
2. To study the RMS value of given signals
3. To calculate the duty cycle of rectangular pulse
4. Verification of Network Theorems
5. Transient Response in R-L & R-C Networks ; simulation / hardware
6. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware

7. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
8. To compare Fourier and Laplace transformations of a signal.
9. To study convolution theorem in time and frequency domain.
10. To Study Signal Synthesis via sum of harmonics.
11. To study LPF & HPF, band pass and reject filters using RC circuits.
12. To demonstrate how analog signals are sampled and how different sampling rates affect the outputs.
13. To study sampling theorem for low pass signals and band pass signals.

Course outcome: The students will be able to

- **Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of signals and systems problems.**
- **Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.**
- **Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.**
- **Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC392	LINEAR CIRCUITS AND SIGNALS LAB	√		√		√							

PH401 PHYSICS-II

Contact: 3P
Credits: 3
Prerequisites: Knowledge in Basic Physics and Mathematics

Background of the preparing the new and modified Physics course:
As per AICTE model curriculum (2012) of B.Tech programme**,** one of the major objective of Engineering &Technology education in India is to develop Engineering &Technology (E&T) professionals having competencies, intellectual skills and knowledge enabling them to contribute to the society through productive and satisfying careers as innovators, decision makers and leaders in the national and global economies of the 21st century. Accordingly, the approach to curriculum for UG in Engineering & Technology **(E&T)** Programmes needs

to lay special emphasis on educating/preparing the students for being able to demonstrate some key abilities like

(a) Effective application of knowledge of mathematics, science and technical subjects;
(b) Planning and design to conduct scientific and technical experiments;
(c) Analysis and interpretation of scientific, technical and economic data collected;
(d) Design of parts, subsystems, systems and/or processes to meet specific needs;
(e) Identification, formulation and solving of problems using simulation or otherwise;
(f) Use of techniques/tools including software in all disciplines, as may be required;

Moreover, it is also mentioned that the E&T curriculum relating to UG E&T Degree Programmes in the country should focus on equipping students with a solid foundation in mathematical, scientific and E&T fundamentals required to solve E&T related problems.
As per AICTE model syllabus the Basic science part in a typical UG curriculum has been illustrated as

S.No.	Course Work - Subject Area	Range of Total Credits (%)		Suggested Breakdown of Credits (for Total=176) (No.)
		Minimum	Maximum	
1	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology	15	20	30

Sequencing plan of Basic science courses as per AICTE model syllabus of a typical UG curriculum is

Semesters	Subject Area Coverage
I –II	HS, **BS** and ES Courses common for all Branches; Mandatory Courses;
III-IV	HS, **BS** and ES Courses common for all Branches (to be continued); Also, Mandatory Courses(to be continued, if required); PC (Hard/Soft) Courses in two/three groups (like Electrical, Non-Electrical); Area wise Orientation; Add-On Courses;

Since, in the AICTE document a lot of emphasis has been given on the sound scientific understanding and its applications, while preparing Physics course allied to E&T disciplines special care has been taken on the design of a syllabus which will not only clarify physical laws, principles but at the same time open up an innovative and application oriented mindset of the students. Individual Departments were contacted about the probable requirement of Physics in their stream and accordingly it was decided that for Physics based subjects (EE, ECE, EIE, BME, CSE, IT, MECH, CIVIL-i.e. all existing streams) there will be two course of Physics. In the first year, there will be one Basic Physics course which would be common to all branches. The second physics course would be stream specific and will be taught in the second year of B.Tech programme. If there is any Chemistry based subject (e.g. Chemical Engineering, Food Technology, Biotechnology, Ceramic Technology etc) they do not need this second physics course. A plan of course implementation is presented in Table-III

Table-3: Model Scheme of Instruction for implementing Physics Courses in UG Engineering Programme

Streams	Course	Semester-I	Semester-II	Semester-III	Semester-IV
Computer Science & Engineering	PHYSICS-I (BASICS PHYSICS COURSE; **COMMON TO ALL BRANCHES**) Theory: Physics-I Credit: 4 Lab: Physics-I lab Credit: 2	Computer Science & Engineering **Paper Code: PH 101 & PH 191**		Computer Science & Engineering **Paper Code: PH (CSE) 301 & PH (CSE) 391**	
Information Technology		Information Technology **Paper Code: PH 101 & PH 191**		Information Technology **Paper Code: PH (IT) 301 & PH(IT) 391**	
Mechanical Engineering		Mechanical Engineering **Paper Code: PH 101 & PH 191**		Mechanical Engineering **Paper Code: PH (ME) 301 & PH (ME)391**	
Civil Engineering		Civil Engineering **PH 101 & PH 191**		Civil Engineering **Paper Code: PH (CIV) 301 & PH (CIV) 391**	
Biomedical Engineering			Electrical Engineering **Paper Code: PH 201 & PH 291**	Biomedical Engineering **Paper Code: PH (BME) 401 & PH (BME) 491**	
Electrical Engineering	PHYSICS-II (ADVANCED PHYSICS COURSE; **STREAM SPECIFIC COURSE)** Theory: Physics-II Credit: 4		Electronics & Instrumentation Engineering **Paper Code: PH 201 & PH 291**		Electrical Engineering **Paper Code: PH (EE) 401 & PH (EE) 491**
Electronics & Instrumentation Engineering			Electronics & Communication Engineering **Paper Code: PH 201 & PH 291**		Electronics & Instrumentation Engineering **Paper Code: PH (EIE) 401 & PH (EIE) 491**

Electronics & Communication Engineering	Lab: Physics-II lab Credit: 2		Biomedical Engineering **Paper Code:** **PH 201 & PH 291**		Electronics & Communication Engineering **Paper Code:** **PH (ECE) 401** **&** **PH (ECE) 491**
	Total Credit point in two courses: **Theory:** 08, **Lab:**04 **Total:** 12				

Course Objective:

The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The acquaintance of basic physics principles would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. This would create awareness about the vital role played by science and engineering in the development of new technologies. The courses would provide the necessary exposure to the practical aspects, which is an essential component for learning science. **This could be achieved by primarily introducing a course clarifying some of the basics of physical sciences attached to engineering curriculum in general, and an advanced course explaining the scientific details of various electronic devices & materials used in electronics and communication engineering. The advance courses will also give an insight into the science & technology of next generation to the budding engineers**.

Course Outcome:

Through the 1st year basic physics courses, **s**tudents will be equipped with basic physical laws, principles and formalism to apply them in their core curriculum. After going through the 2nd year course (advanced course), students will be exposed to the physics of materials that they apply in device design and fabrication and at the same time they will be exposed to the basics of new age scientific & technological fronts.

Delivery of the Course:

i) Preparation of Lecture plan by respective teacher(s).
ii) Preparation of session plan detailing the methodology, learners' activity, learning outcome (such as Skill, Competency etc).
ii) Preparation of delivery report by respective teacher(s) in the Institute specified book (Continuous Evaluation Diary)

Mode of Delivery of the course:

i) Chalk-talk method
ii) Showing models (Demonstration)
iii) Analogy
iii) Presentation
iv) Cross-word puzzle
v) Quiz/Brain storming
vi) Role-play
vii) Problem oriented guided inquiry learning (POGIL)

Course Evaluation: CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) to constitute the major evaluations prescribed for the Course.
CIE (Continuous Internal Evaluation): To be conducted by the respective teacher and include mid-term/weekly/fortnightly class tests, surprise test, home work, problem solving, group discussion, quiz, problem oriented guided inquiry learning, mini-project & seminar throughout the Semester, with weightage for the different components being fixed at the institutional level. The teacher will discuss with students their performance, highlighting their strength and weakness.
SEE (Semester End Examination): To be conducted at the institutional level and cover the entire Course Syllabi; For this purpose, Syllabi to be modularized and SEE questions to be set from each **Module**, with choice if any, to be confined to **Module** concerned only. The questions to be comprehensive emphasizing analysis, synthesis, design, problems & numerical quantities.

SYLLABUS FOR ELECTRONICS & COMMUNICATION ENGINEERING (ECE)
(Approved by the BOS of Physics (UG))

Name of the Course: B.Tech
Paper Name: PHYSICS-II (Advanced Physics course) **Paper Code:** PH(ECE) 401
Semester: 4th
Duration: 40 Hours **Full Marks:** 100 **Credits:** 4

Teaching Scheme: Lecture: 3 hrs/week Tutorial: 1
Examination Scheme (Theoretical): End Semester Exam: 70 Internal Assessment:30

Course Objective: The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The acquaintance of basic physics principles would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. This would create awareness about the vital role played by science and engineering in the development of new technologies. The courses would provide the necessary exposure to the practical aspects, which is an essential component for learning science. **This could be achieved by primarily introducing a course clarifying some of the basics of physical sciences attached to engineering curriculum in general, and an advanced course explaining the scientific details of various electronic devices & materials used in electronics and communication engineering. The advance courses will also give an insight into the science & technology of next generation to the budding engineers**.
Pre-Requisites: 1st year Basic Physics knowledge
Course Outcome: Through the 1st year basic physics courses, **s**tudents will be equipped with basic physical laws, principles and formalism to apply them in their core curriculum. After going through the 2nd year course (advanced course), students will be exposed to the physics of materials that they apply in device design and fabrication and at the same time they will be exposed to the basics of new age scientific & technological fronts.
Module 1: Electric & Magnetic properties of materials:
1.01: Dielectric Properties: Dielectric, dipole moment, Polarization, polarziability - electronic, ionic, orientational, Types of polarization – electronic, ionic, dipolar, space charge; Temperature dependence, dielectric breakdown, Piezo-electricity, field due to dipole

(without derivation); Depolarization field, depolarization factors, Local electric field at an atom, Lorentz field, Lorentz relation; – Clausius-Mossotti equation (with derivation) frequency dependence of dielectric constant-losses in dielectric, ferroelectric effect.
6L

1.02: Magnetism & Storage devices: Magnetic field and Magnetization; Magnetic susceptibility, Paramagnetism, Concept of magnetic moment, Bohr Magneton, Curie's Law; Ferromagnetism, antiferromagnetism, and ferrimagnetism; Exchange interaction between magnetic ions (qualitative); Curie-Weiss law, concept of θ_P, phenomenon of hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets; Comparison and applications of Soft ferromagnets (Permalloys, Ferrites). Magnetic storage devices (examples related to computers) 3L

1.03: Applications: Magnetic ckts-Rawland ring, electro magnet, permanent magnet, comparison with electrical ckt. Magnetic resonance, NMR and MRI (qualitative discussions related to applications).
Liquid crystal display (LCD)-Introduction-various phases and applications.
2L

1.04: Superconductivity: Basic concepts, critical temperature, critical field, type-I & type-II superconductor, qualitative study up to Meissner effect.
1L

Module 2: QUANTUM MECHANICS II, ENERGY BAND THEORY & ORGANIC SEMICONDUCTORS

2.01: Applications of Schrödinger's equation –Particle in one dimensional rigid box, 1D-Potential Barrier (emphasis on tunneling effect), Particle in three dimensional rigid box; Concept of degeneracy and degenerate states.
4L

2.02: Free electron theory- Free electron theory-Drude model, Ohm's law, Wideman Franz law, Electron scattering and resistance, relaxation time, diffusion length, mean free path.
2L

2.03: Band Theory: Introduction to Band theory (mention qualitatively improvement over free electron theory)- Kronig-Penny model (Use Schrödinger picture to obtain Energy-band (E-k) diagram), formation of allowed and forbidden energy bands, Concept of effective mass – electrons and holes, crystal momentum, Density of states (qualitative), Energy bands of metal, insulator, semiconductor, magneto-resistance, magnetostriction, Piezoelectric effect, Hall effect, Hall coefficient. 6L

2.04: Semiconductors and insulators: Direct & indirect band gaps, Fermi-Dirac distribution function (temperature dependence-qualitative discussions). Fermi level for intrinsic and extrinsic semiconductors (dependence on temperature and doping concentration viz. p type, n-type, p-n, npn and pnp) ; Diffusion and drift current (qualitative). Generation and re-combination, quasi-Fermi energy level (basic concepts)
3L

2.05: Physics of Organic semiconductors: Failure of energy band theory-exciton, bi-exciton, polaron, bipolaron, soliton, organic semiconductors (qualitative discussions)-comparison with silicon based semiconductor electronics, applications.
3L

Module 3: OPTOELECTRONIC DEVICES

3.01: OPTO ELECTRONIC DEVICES: Basic background of photonic devices, Photoconductivity, Optical devices, Importance of reverse current in optical detectors, photo-

diodes, photo voltaic effects (solar cells), Light Emitting Diode (as direct band gap material), avalanche and photodiode,
Photo-transistors (Basic idea & application), LDR-operations & characteristis. 4L

3.02: Nonlinear optical effects: Introduction, various electro-optic & magneto-optics effects-Faraday rotation, Keer effect. 3L

Module 4: Introduction to Nanomaterials
4.00: Reduction of dimensionality, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Density of states and energy spectrum for Zero dimensional solid, One dimensional quantum wire, Two dimensional potential well, Particle in a three dimensional box, Some special nanomaterials properties and applications. 3L

List of Assignments/Tests:

- **15 marks Internal test 1 & Internal test 2 (best of the two would be considered)**
- **Assignments in regular classes, tutorial classes, surprise tests or through Problem oriented guided inquiry learning (POGIL)**

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List of recommended Books:

Module 1: Electric & Magnetic properties of materials:
1 Introduction to solid state physics-Kittel (TMH)
2. Solid State Physics- Ali Omar (Pearson Eduction)
3. Solid state physics- S. O. Pillai
4. Solid State Physics-A. J. Dekker (Prentice-Hall India)
5. Electricity Magnetism-Fewkes and Yardwood (Oxford University Press)

Module 2: QUANTUM MECHANICS II, ENERGY BAND THEORY & ORGANIC SEMICONDUCTORS
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics- Ali Omar (Pearson Eduction)
6. Integrated Electronics-Millman Halkias (TMH)
7. Solid State Physics-A. J. Dekker (Prentice-Hall India)
8. Solid state physics-Gupta Kumar (K. Nath publishers)
9. Quantum Mechanics-Marzbacher

Module 3: OPTOELECTRONIC DEVICES
1. Optoelectronic devices-Pallab Bhattacharjee
2. Integrated Electronics-Millman Halkias (TMH)
3. Solid state electronics-S. M. Zee & Sanjoy Banerjee
4. Nonlinar optics- Ghatak & Tyagrajan.

5. Nonlinar optics-Klein
6. Fibre optical communication-Senior

Module 4: Introduction to Nanomaterials

1. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
2. Nanoscience-H. E. Schaefer (Springer)

PHYSCIS-II SYLLABUS, Paper Code: PH 401 (ECE) (PROPOSED)
AS PER MODULES & EXAM-GROUP* DIVISION

STREAM	MODULE-1	MODULE-2	MODULE-3	MODULE-4	GR-A *	GR-B*
ECE	QUANTUM MECHANICS II, ENERGY BAND THEORY & ORGANIC SEMICONDUCTORS 4+3+4+3+3=17L	OPTOELECTRONIC DEVICES 5L	Electrical & Magnetic properties of materials: 7+7=14L	Introduction to Nanomaterials 4L	1.01: Dielectric Properties (7L) 2.01: Applications of Schrödinger's equation (4L) 2.04: Semiconductors and insulators (3L) 3.02: Nonlinear optical effects (3L) 4.00: Introduction to Nanomaterials (3L)	1.02: Magnetism & Storage devices (3L) 1.03: Applications (2L) 1.04: Superconductivity (1L) 2.02: Free electron theory (2L) 2.03: Band Theory (6L) 2.05: Physics of Organic semiconductors (3L) 3.01: OPTO ELECTRONIC DEVICES (4L)

Course outcome: The students will be able to

- **Study the physical properties of materials;**
- **Use research-based knowledge and research methods including design of experiments, analysis of different semiconductor devices;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
PH(ECE)-401	√	√	√									

CS401 Data Structure & C++

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Basic Arithmetic and Computer Fundamentals Allotted hours: 24L

Module- I: Introduction to Data Structure **[3L]**
Concepts of data structures: Data and data structure, Array, Abstract Data Type.
Structure: Structure using pointer, array of structure.

Module- II: Linear Data Structure
[7L]
Stack and Queue: Stack and its implementations (using array), applications. Implementation of queue-both linear and circular (using array), applications, queue implementation by using stack, dequeue.
Linked List: Singly linked list, circular linked list, doubly linked list and applications. Implementation of Stack & Queue using Linked List.

Module- III: Nonlinear Data structures
[7L]
Trees representation (using array, using linked list).
Binary trees - binary tree traversal (pre, in, post order), threaded binary tree, expression tree.
Binary search tree- operations (creation, insertion, deletion, searching).
Heap sort (concept of max heap using tree).
Graphs: Weighted/Un-Weighted Edges, complete graph, connected components – strongly connected component, weakly connected component, path, and shortest path).

Module- IV: Algorithm, Searching, Sorting
[7L] Greedy method.
Divide and conquer method.
Searching: Sequential search, Binary search, Interpolation Search.
Sorting Algorithms: Bubble sort, insertion sort, shell sort, selection sort, merge sort, quick sort
Hashing: Hashing functions, collision resolution techniques.

Module- V: Object and Classes:
Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes Inheritance objects and memory static class data. Const and classes.

Module- VI: Operator overloading:
Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords.

Module- VII: Explicit and Mutable:
Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation: Classes within classes, inheritance and program development.

Course outcome: The students will be able to

- **Study different programming language;**
- **Manipulate the intellectual properties of different systems;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CS-401	√	√				√						

TEXT BOOKS:

1. Sartaj Sahni, Data Structures, Algorithms and Applications in C++, Universities Press, 2005
2. A.V. Aho, J.E. Hopcroft and J. D. Ullman, Data structures and Algorithms, Pearson, 2004.
3. T.H.Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, Introduction to Algorithms, PHI, 2004
4. Mark Allen Weiss, Algorithms, Data structures and problem solving with C++, Pearson, 2002.
5. Object Oriented Programming in C++ by Robert Lafore Techmedia Publication.
6. The complete reference C – by Herbert shieldt Tata McGraw Hill Publication.
7. Object Oriented Programming in C++ Saurav Sahay Oxford University Press.
8. Object Oriented Programming in C++ R Rajaram New Age International Publishers 2nd.
5. OOPS C++ Big C++ Cay Horstmann Wiley Publication.

EC401 ANALOG ELECTRONICS

Contact: 3P
Credits: 3
Prerequisites: Knowledge in Elements of Electronics Engineering (EC-201)

Course Objectives:
This subject will teach students how to build those components and how to analyse noise, distortion, offsets and estimate circuit performance. Students will be able to know about Current sources, single-stage amplifiers, and operational amplifiers are critical components in the design of real systems.

Module 1
Voltage regulation: Series regulators, shunt regulator, switching regulators, integrated circuit voltage regulators, application of IC voltage regulators. 3L
Transistor biasing and stability: Different biasing techniques' for BJT, voltage divider bias, stability calculation for CE mode. 5L
Transistor modeling: h-parameter basics, h-parameter model for single stage transistor amplifier in CE,CB,CC mode, expression for voltage gain, current gain, input and output impedance for CE,CC,CB mode, emitter follower circuit. 4L
Module 2
MOSFET: Basic of MOSFET, MOS amplifier, MOSFET as switch, Biasing of discrete MOSFET amplifier, CMOS common source (CS), common gate (CG), common drain (CD) amplifier with small signal model and gain calculation. 6L
Module 3

OPAMP applications: adder, subtractor, integrator, differentiator, comparator, Schmitt trigger, free running oscillator, log-antilog amplifier. 5L

Multivibrators and wave shaping : Astable Multivibratior, square and triangular wave generation using astable multivibrator, Mono stable multivibrator, generation of standardized pulse using monostable multivibrator, non liner waveform shaping circuits,555 timer, generation 7L

Module 4

Power amplifier: Classification of class A,B,AB power amplifiers, transfer characteristics, power dissipation, power conversion efficiency of class A,B,AB type power amplifiers, cross over distortion. 6L

Special function circuits: VCO, PLL. 4L

Course Outcomes: The students will be able

- **To explain the fundamentals of the operation of transistors;**
- **To explain the sources of noise in the circuit;**
- **To Design current sources, single-stage amplifiers, and operational amplifiers;**
- **To build circuits to counteract process and component mismatch with nano-electronic components and devices;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC401	ANALOG ELECTRONICS	√		√	√								

TEXT BOOKS:

A.S. Sedra & K.C. Smith, Microelectronic Circuits, Oxford Univ. Press, 2004
Richard C. Jaeger and Travis N. Blalock, Microelectronic Circuit Design, McGraw Hill, 2007
Donald A. Neamen, Electronic Circuit Analysis and Design, Irwin Publications, 1996.
R. R. Spencer & M. S.Ghousi, Introduction to Electronic Circuit Design, Pearson Education, 2003

EC402 Microprocessor & Microcontroller

Contact: 3P
Credits: 3
Prerequisites: Knowledge in Digital Electronics

Course Objective:

To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Module 1: 8L

To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Introduction to Microprocessor and microcontrollers, their advantages and disadvantages. Architecture of 8085 Microprocessor. Address / Data Bus multiplexing and demultiplexing. Status and Control signal generation. Instruction set of 8085 Microprocessor. Classification of instructions, addressing modes, timing diagram of the instructions. 8L

Module 2:
Assembly language programming: Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc. Interrupts of 8085 processor: classification and programming. Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085 Microprocessor.

5L

Module 3:
8051 architecture: 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.

Assembly language Programming using 8051 **6L**
Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges. Logical operations: Byte-level, bit-level, rotate and swap operations. Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic. Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns.

Module 4:
The 8086 microprocessor
Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts. Assembly language programming: Addition, Multiplication, Block Transfer, Ascending order, Descending order, finding largest & smallest number etc. **7L**

Module 5: **Peripheral IC chips**
8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word (s) format. Peripheral IC chips interfacing. **6L**

Course Outcome: The student will be able to

- **Learn the internal organization of some popular microprocessors/ microcontrollers;**
- **Learn hardware and software interaction and integration;**
- **Learn the design of microprocessors/microcontrollers-based systems;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC402	MICROPROCESSOR & MICROCONTROLLER		√		√		√						

Design/development of solutions: Conducting experiments in ALP Programming.

Modern tool usage: Share knowledge regarding up gradation of Microprocessor.

TEXT BOOKS:

1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar (Penram International) (strongly recommended)
2. The 8051 microcontroller - K. Ayala (Thomson)
3. Microprocessors & interfacing – D. V. Hall (Tata McGraw-hill)
4. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
6. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

References:

Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press).

8086 Microprocessor –K Ayala (Cengage learning)

Microprocessors – The 8086/8088, 80186/80386/80486 and the Pentium family – N. B. Bahadure (PHI).

The 8051 microcontrollers – Uma Rao and Andhe Pallavi (PEARSON).

EC403 ANALOG COMMUNICATION

Contact: 3P
Credits: 3
Prerequisite: Mathematics, Signal Theory

Course Objective: This curriculum is designed for enabling the students to assimilate the principles of electronic communication. Theory of traditional communication systems and their working methodology would be stressed.

Module:1 (2L)

Introduction to Analog Communication: Elements of communication system - Transmitters, Transmission channels & receivers, Concept of modulation, its need. (**2L**)

Module:2 (12L)

Continuous Wave Linear Modulation: a) Amplitude modulation: Time domain representation of AM signal, modulation index, frequency domain (spectral) representations, transmission bandwidth, Phasor diagram, power & efficiency calculations (single and multi tone message); b) Double side band suppressed carrier (DSBSC) modulation, Single side band suppressed carrier modulation (SSBSC): time and frequency domain expressions, bandwidth and transmission power. Basic concept of VSB, Spectra and band-width. (**6L**)

Generation & Detection of Amplitude Modulation: a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator. b) Generation of SSB: Filter method, Phase shift method and the Third method **(2L)**

Demodulation for Linear Modulation: Demodulation of AM signals: Detection of AM by envelope detector, Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. **(2L)**
Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. **(2L)**

Module:3 (6L)
Angle Modulation: a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, total power calculation for a single tone message. Phasor diagram; b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator. c) Demodulation of FM and PM: Concept of frequency discriminators, Phase Locked Loop
Module:4 (6L)
Frequency Division Multiplexing, Time Division Multiplexing, (FDM) b) Stereo – AM and FM: Basic concepts with block diagrams c) Random Signals and Noise in Communication System**:** i) Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit. iii) Noise performance in Analog Communication systems: SNR calculation for DSBFC, DSBSC, SSBFC, SSBSC and FM.

Course Outcome: The students will be able to

- **Experience to modulate amplitude and phase/frequency of the electromagnetic wave;**
- **Learn the constraints of designing communication systems namely noise, power, spectrum would be explained;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC403	ANALOG COMMUNICATION	√	√		√								

Text Books:
7. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
8. B.P.Lathi -Communication Systems- BS Publications
2. V Chandra Sekar – Analog Communication- Oxford University Press
References:
9. Carlson—Communication System,4/e , Mc-Graw Hill
10. Proakis & Salehi Fundamentals of Communication Systems- Pearson
11. Singh & Sapre—Communication Systems: 2/e, TMH
12. P K Ghosh- Principles of Electrical Communications- University Press
13. L.W.Couch Ii, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
14. Blake, Electronic Communication Systems- Cengage Learning
15. S Sharma, Analog Communication Systems- Katson Books

PH491 PHYSICS-II LAB

Contact: 3P
Credits: 2
Paper Name: PHYSICS-II Lab **Paper Code:** PH (EE) 491**Semester:** 4th

Duration: 3 Hours/Week* **Full Marks:** 100 **Credits:** 2

Teaching Scheme: **Practical :3 hrs/week**
Examination Scheme (Practical): End Semester Exam: 60 **Internal Assessment:40**
***At least 7 experiments to be performed during the semester**

Experiments on Electric & Magnetic properties of materials:

1. Study of hysteresis curve of a ferromagnetic material using CRO.
2. Use of paramagnetic resonance and determination of lande-g factor using esr setup.
3. Measurement of Curie temperature of the given sample.
4. Measurement of specific charge of electron using CRT.
5. Measurement of losses in a dielectric using LCR ckt.
6. Study of dipolar magnetic field behavior.

Experiments on QUANTUM MECHANICS II & ENERGY BAND THEORY

7. Determination of band gap of a semiconductors/thermistor/four probe method.
8. Determination of Hall co-efficient of a semiconductor.
9. Measurement of Magnetoresistance of a semiconductor.
10. Determination of velocity of ultrasonic wave using piezoelectric crystal.
11. Experiment on Tunnel diode.

Experiments on OPTO ELECTRONIC DEVICES

12. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
13. Study of characteristics LED.
14. Experiment phototransistor.
15. Study of LDR characteristics.

Course Outcome: The students will be able to

- **Experience to study the behaviour of different semiconductor devices;**
- **Learn the functions of the circuits using the semiconductor devices;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
PH-491	√	√	√									

CS481 Data Structure & C++ Lab

Contacts: 3P
Credits: 2
Allotted hours: 30L

Array & Structure Overview
[6P]
Implementation of Array & Structure
Linear Data Structure
[9P]
Implementation of Stack and Queue.
Implementation of Circular queue, Dequeue.
Implementation of Singly Linked List ,Circular Linked List.
Implementation of Stack, Queue using linked list.
Non-Linear Data Structure **[6P]**
Implementation of binary search tree.
Implementation of AVL trees.
Searching, Sorting, Hashing
[9P]
Implementation of searching techniques(Linear Search, Binary Search, Interpolation Search)
Implementation of different Sorting techniques: Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Heap sort, Radix sort etc.

Course Outcome: The students will be able to

- **Experience to program using data structures;**
- **Handle different datatypes and program using the datatypes;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
CS-481	√				√	√						

EC491 ANALOG ELECTRONICS LAB

Contact: 3P
Credits: 2

Course Objective:

Students are motivated to design and analyze different electronic circuits.
students can achieve the ability to verify their design practically and compare with the theoretical result

1. Study of Diode as clipper & clamper
2. Study of Zener diode as a voltage regulator
3. Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter
4. Design a two-stage R-C coupled amplifier & study of it’s gain & Bandwidth.

5. Study of class A & class B power amplifiers.
6. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
7. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
8. Design a simple function generator using IC.
9. Study of D.A.C & A.D.C.
10.Study on Integrator using OPAMP IC 741
11.Study on Differentiator using OPAMP IC 741

Course Outcome: The students will be able to

- **Experience to design circuits using semiconductor devices;**
- **Study the operation of operational amplifiers and other amplifiers;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC491	ANALOG ELECTRONICS LAB		√	√	√								

EC492 MICROPROCESSOR & Microcontroller LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Digital Electronics

1. Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.
2. Familiarization with 8085 & 8051 simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.
3. Assignments (any six) based on above
    a. Table look up
    b. Copying a block of memory
    c. Shifting a block of memory
    d. Packing and unpacking of BCD numbers
    e. Addition of BCD numbers
    f. Binary to ASCII conversion
    g. String Matching, Multiplication using shift and add method and Booth's Algorithm
    h. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.
    i. Interfacing of 8255
    j. Study of 8051 Micro controller kit and writing programs as mentioned above. Write programs to interface of Keyboard, DAC and ADC using the kit.
    Serial communication between two trainer kits

Course Outcome: The students will be able to

- **Learn the internal organization of some popular microprocessors and microcontrollers.**
- **Learn hardware and software interaction and integration;**
- **Learn the design of microprocessors/microcontrollers-based systems;**

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC492	MICROPROCESSOR & MICROCONTROLLER LAB		√		√		√						

Engineering knowledge: Apply knowledge of digital Electronics.

Design/development of solutions: Conducting experiments in ALP Programming.

Modern tool usage: Share knowledge regarding up gradation of Microprocessor.

HU 481 TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE

CONTACT: 1L+2P
CREDIT: 2
Prerequisites: Knowledge in English Language

Guidelines for Course Execution:
Course Objectives:
This course has been designed:
1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.
Detailed Course Outlines:
A. ***Technical Report Writing***: 2L+6P
1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)
B. ***Language Laboratory Practice***
I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory Practice Sessions: 2L
2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P
a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their
Listening Skill & Speaking Skill honed
b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions: 2L+6P
a) Teaching Strategies of Group Discussion
b) Introducing Different Models & Topics of Group Discussion
c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure Interview Sessions; 2L+6P
a) Training students to face Job Interviews confidently and successfully
b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking
Skill in a formal situation for effective communication
4. Presentation: 2L+6P
a) Teaching Presentation as a skill
b) Strategies and Standard Practices of Individual /Group Presentation
c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids
5. Competitive Examination: 2L+2P
a) Making the students aware of Provincial /National/International Competitive Examinations
b) Strategies/Tactics for success in Competitive Examinations
c) SWOT Analysis and its Application in fixing Target
Books – Recommended:
Nira Konar: English Language Laboratory: A Comprehensive Manual
PHI Learning, 2011
D. Sudharani: Advanced Manual for Communication Laboratories &
Technical Report Writing,Pearson Education (W.B. edition), 2011
References:
Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)
B) Listening (Levels 1-4 Audio Cassettes/Handbooks) Cambridge University Press 1998
Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004

Course Outcome: The students will be able to

- **Learn to write project reports, technical reports etc.;**
- **Learn to interact with the outside world;**
- **Learn to improve their personality;**

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU-481								√			√	√

HU501 FINANCIAL MANAGEMENT & ACCOUNTING

Contracts: 3L
Credits- 3
Prerequisites: Knowledge in Basic Arithmetic and Calculus

Module 1

Introduction to Accounting

a)Important Definitions
b) Basic concepts and conventions
c)Types of Accounts with Golden Rule of Accounting
d) Journal, Ledger and Trial Balance
e) Preparation of Trading Account, Profit & Loss A/C and Balance Sheet for business organisations.

Module 2

Financial Management

Introduction to Financial Management

Introduction,Definition and concept, scope, objective, functions of Finance Manager.

Ratio Analysis:

a) Definition, Objectives, Advantages &Disadvantages.
b) Classification of Ratios: Liquidity ratios, Capital Structure ratios, Activity ratios & Profitability Ratios

Capital Budgeting:

Nature of Investment Decision, Importance of Capital Budgeting, capital budgeting process, Invesment criteria, payback period, Rate of return, cash flow, discounting cash flow NPV method and IRR method, Benefit cost ratio, ARR.

Module 3

Cost Accounting

a)Introduction to cost accounting-Cost Centre, Cost unit, Elements of costs
b)Statement of cost or cost sheet
c)Marginal cost & C-V-P analysis with BEC.

Budget and Budgetary Control

Concepts of Budget, Budgeting and budgetary control, advantages, disadvantages, uses, Master Budget, Zero Based Budget ,Cash budget, Flexible budget.

Module 4

Working capital management

Introduction-working capital concept-financing working capital-importance of working capital-management of working capital-working capital cycle-management of different components of working capital-working capital forecast.

Course outcome:

- Students will be able to understand capital budgeting.
- Students will be able to state budget and budget control.
- Students will be able to state basic ideas about the capital management

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU-501			√					√		√		

Reference books:

Financial Management, Khan & Jain, S. Chand
Management Accounting, Khan & Jain, S. Chand
Modern Accountancy, Haniff & Mukherjee, TMH
An Introduction to Accountancy, S.N.Maheswari, Vikas publication
Cost Accounting: Theory and Practices, B. Banerjee, PHI
Financial Management, IM Pandey, Vikas

EC501 Digital Communication

Contracts: 3L
Credits- 3
Prerequisite: Analog Communication, Probability & Statistics

Course Objective:
To present the fundamentals of modern digital communication system design and to evaluate the performance of digital signalling schemes on realistic communication channels. Emphasis is placed on physical layer digital communications, including waveform design and receiver design. The student will learn about theoretical bounds on the rates of digital communication systems.

MODULE – I: Probability Theory and Random Processes:

Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density. 6L

MODULE – II: Signal Vector Representation:
Analogy between signal and vector, distinguish ability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors. 6L

MODULE – III: Digital Data Transmission:
Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and b -law companding, differential PCM, delta modulation and adaptive delta modulation. Digital transmission components,

source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction. 10L

MODULE –IV: Digital Modulation Techniques:
Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram, Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA) 14L

Course outcome:
After going through this course the students would understand the evolution of digital communication algorithms and methods. The student would be able to digital communication systems in terms of signal chain modules, different codes techniques and their utility.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC501	DIGITAL COMMUNICATIONS	√	√		√								

TEXT BOOKS:

I. Digital Communications, S. Haykin, Wiley India.
II. Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
III. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
IV. Digital Communications, J.G.Proakis, TMH Publishing Co.

REFERENCE BOOKS:

I. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.

II. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
III. Digital Communication, A. Bhattacharya, TMH Publishing Co.

EC502 ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Contracts: 3L
Credits- 3
Prerequisites: Basic electrical and concept of vector calculus.

Course Objective: To get a broad overview of basic concepts of classical Electromagnetic Theory and Transmission Line.

Module 1
I. Coordinate Systems (rectangular, spherical, cylindrical), Vector Fields, Gradient, Divergence and Curl operators, Divergence and Stoke's theorem.
(5L)
II. Electrostatics: electric field E, Coulomb's law, Gauss's law, Electric Potential, Poisson's and Laplace's equation.
(4L)
III. Magnetostatics: magnetic field B, Biot-Savart law, Ampere's law, Vector Potential.
(4L)

Module 2
IV. Electrodynamics: Maxwell's equations (free space, space-time and phasor representation); continuity equation. **(4L)**
V. Circuit Theory as an approximation to Field Theory: voltage, current, resistance, inductance, capacitance.
(2L)
VI. Electromagnetic Waves (free space): wave equation, uniform plane waves, spherical waves, wave polarization (linear, circular), Poynting's theorem.
(5L)

Module 3

VII. Electromagnetic Fields in Linear Material Media: electric polarization, permittivity, field D; magnetic polarization, permeability, field H; conductivity; boundary conditions; Maxwell's
equations in material medium.
(6L)
VIII. Electromagnetic Waves (material medium): dielectrics (loss tangent), conductors (skin depth); reflection from perfect conductor and perfect dielectric (normal incidence), standing wave.
(6L)

Module 4

IX. Transmission Lines: circuit model, wave equation for voltage and current; sinusoidal steady state analysis (lossless line), characteristic impedance, reflection coefficient, standing

wave ratio, impedance transformation; properties of parallel wire, coaxial, microstrip lines. **(6L)**

Course Outcome: To relate electrical concepts as encountered in other courses to foundations of the theory. To understand the relation between circuit and field concepts.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC502	ELECTROMAGNETIC THEORY AND TRNSMISSION LINES	√	√			√							

TEXT BOOKS:

1. Matthew N.O. Sadiku, Principles of Electromagnetics, Oxford University Press.
2. W.H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, Tata McGraw-Hill.
3. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, Prentice-Hall of India.
4. N. Narayana Rao, Elements of Engineering Electromagnetics, Pearson Education.
5. D.J. Griffiths, Introduction to Electrodynamics, Prentice-Hall of India.
6. G.S.N. Raju, Electromagnetic Fields and Transmission Lines, Pearson Education.
7. R. Meenakumari and R. Subasri, Electromagnetic Fields, New Age International Publishers.

EC503 Control System

Contracts: 3L+1T
Credits- 4
Prerequisites: Signal system and Basic electrical

Course objectives:

1. To familiarize the students with concepts related to the operation analysis and stabilization of control systems.
2. To understand feedback systems (open loop and closed loop) and system modeling.
3. To understand time domain and frequency domain analysis of control systems required for stability analysis. To understand the recompense technique that can be used to stabilize control systems.

Module I CONTROL SYSTEM MODELING
Basic Elements of Control System – Open loop and Closed loop systems – Differential equation – About transfer function and its generation technique, Modeling of Electric, mechanical and biomedical systems and others different systems- Block diagram reduction Techniques - Signal flow graph, mason's gain formula. **9L**

Module II TIME RESPONSE ANALYSIS
Time response analysis –Different input deterministic test response – Order and Type of the systems incorporation with time response-First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors and others characteristics – P, PI, PD and PID Compensation, Analysis using MATLAB simulator. **9L**

Module III STABILITY ANALYSIS
Concept of Stability for Pole & Zero of the systems, Routh -Hurwitz Criterion, Root Locus Computational Algorithm, Construction of Root Locus Stability, Application of Root Locus Diagram - Analysis using MATLAB Simulator. **9L**

Module IV FREQUENCY RESPONSE ANALYSIS
Frequency Response - Bode Plot Computational Algorithm, Construction of Bode diagram, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots and Computational Algorithm - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB Simulator. **9L**

Module V STATE VARIABLE ANALYSIS, CONCEPT OF DIGITAL AND NON-LINEAR CONTROL SYSTEMS
State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability -State space representation for Discrete time systems. Sampled Data control systems –Deterministic and Non-deterministic discrete system response. Jury's Stability test, Introduction of non-linear control systems. Analysis using MATLAB Simulator. **9L**

Course Outcome:
At the end of the course students shall familiarize with concepts related to the operation analysis and stabilization of control systems. Also understand feedback systems (open loop and closed loop) and system modeling and stability of a system.

TOTAL: 45 PERIODS

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*

EC503	CONTROL SYSTEMS	√				√	√						

TEXTBOOK

1. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.

2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.

REFERENCES

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
2. M.Gopal, Digital Control and State Variable Methods, 2nd Edition, TMH, 2007. Schaum's Outline Series,'Feedback and Control Systems' Tata McGraw- Hill, 2007.
3. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design',Tata McGrow-Hill, Inc., 1995.
4. Richard C. Dorf & Robert H. Bishop, " Modern Control Systems", Addidon – Wesley,1999.

EC504 Antenna and Propagation

contact/week: 3 periods
credits: 3
Prerequisites: Electro-Magnetic Theory

Course Objective: An introduction to the theory of electromagnetic radiation, types of radiators and wave propagation properties. An overview of basic antennas, both conventional and modern, with a view towards current applications.

Module 1
I. Review of Maxwell's Equations, Maxwell's Equations incorporating magnetic charge and magnetic current; Potential formulation of Electrodynamics; Introduction to Radiation. (2)
II. Basic Radiators: oscillating electric dipole, oscillating magnetic dipole, Huygen's source. (4)
Module 2
Definition of Radiation Resistance, Directivity, Gain, Radiation Pattern, Antenna Impedance. (2) III. Basic Wire Antennas (semi-qualitative): half-wave dipole, quarter-wave monopole, loop antenna; applications. (4) IV. Basic Aperture Antennas (semi-qualitative): slot, horn, reflector; applications. (4) V. Antenna Array: array factor, pattern multiplication, broadside, endfire, phased array; Yagi-Uda array. (3)
Module 3
VI. Microstrip Antenna (semi-qualitative): feed mechanism, polarization, multiband; applications. (4) VII. Antenna Types (qualitative): helix, folded dipole, planar antennas for wireless communication, antennas for near field communication, integrated antennas; applications. (4)
Module 4

VIII. Wave Propagation (near earth, qualitative): Ground, Sky, Space, Microwave Duct, Effect of Earth's Magnetic Field. (3)

Course Outcome: The student should be familiar with

1. Extension and alternate formulation of Maxwell's equations.
2. Radiation mechanism of basic wire and aperture radiators.
3. Parameters describing antenna transmission/reception properties.
4. Characteristics of typical wire, aperture antennas; properties of antenna arrays.
5. Properties of planar antennas.
6. Wave propagation near earth and in free space.
7. An overview of basic antennas, both conventional and modern, with a view towards current applications.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC504	ANTENNAS AND PROPAGATION	√			√		√						

Text Books:

1. Sisir K. Das and Annapurna Das, Antenna and Wave Propagation, Tata-McGraw Hill Education Private Limited.
2. A.R. Harish and M. Sachidananda, Antennas and Wave Propagation, Oxford University Press.
3. Rajeswari Chatterjee, Antenna Theory and Practice, New Age International (P) Limited, Publishers.
4. R.K. Shevgaonkar, Electromagnetic Waves, Tata-Mc Graw Hill.
5. A. Sarin, Antenna Theory and Propagation, Kalyani Publishers.
6. G.S.N. Raju, Antannas and Wave Propagation, Pearson Education.
7. A.K. Gautam, Antenna and Wave Propagation, S.K. Kataria and Sons.
8. Edward C. Jordan and Keith G. Balmain, Electromagnetic Waves and Radiating Systems, Prentice-Hall of India Private Limited.

EC505 Telecommunication Systems

contact/week: 3 periods
credits: 3
Prerequisites: **Analog & Digital Communication, Digital Electronics**

Course Objective: To familiarize students with wired communication system – its architecture, working principle, types and application area.

Module No.	Topic	Lecture
1	**Introduction** : Evolution of Telecommunication ; Equipment used in telecommunication System , Cables used in Telephone Network **Telephone Systems:** Pulse dialing & Tone dialing; Telephone Instruments - rotary dial and push button types.	3 3
2	**Switching System :** Basics of Switching System, Circuit Switching & Packet Switching. Evolution of Automatic Switching System, Principle of Operation of Crossbar Electromechanical Systems; Multiple Stage Switching System **Electronic Switching:** Stored program control, centralized SPC, distributed SPC, software architecture, application software. **Time Division Switching:** Basic time division space switching, Basic time division time switching, time multiplexed space switching, time multiplexed time switching, combination switching, Frequency division switching	5 3 4
3	**Traffic Engineering:** Blocking network, blocking probability, grade of service, traffic load, Erlang-B congestion formula. **Telephone Networks:**; Subscriber loop systems, Switching hierarchy & routing, transmission systems, charging plan, signaling techniques-in channel & common channel signaling.	3 3
4	**ISDN:** Introduction, ISDN channels & access arrangements, ISDN service capabilities, user network interfaces, drawbacks of ISDN, introduction to B-ISDN. Optical Network, SONET,SDH	4 2
	TOTAL	30

P.O TABLE

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC505	TELECOMMUNICATION	√	√		√								

	SYSTEMS												

P.O STATEMENT

1. Design/development of solutions: Ability to utilise a systems approach to design and operational performance
2. Individual and team work: Capacity for independent critical thought, rational inquiry and self-directed learning 3. Design/development of solutions: Ability to utilise a systems approach to design and operational performance
5. Communication: Capacity for independent critical thought, rational inquiry and self-directed learning.

Course Outcome:

1. Student will be able to know connection system of telephone instruments, dialing system and various switching system.
2. They will also know regarding the development of the telecommunication system.
3. It also gives them the basic idea about computer communication.

Text Book :

1. T. Viswanathan, " Telecommunications Switching Systems & Networks", PHI
2. P. Gnansivam,"Telecommunication Switching Systems & Networks"; New Age.
3. B.A.Farouzan "Data Communication and Networking"; TMH
4. A. Ghosh; "Line Communication System", New Age

EC591 COMMUNICATIONS SYSTEMS LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Electronics and Communication

Course Objective:

To provide the basic skills required to understand, develop, and design various engineering applications involving analog communication theory. To provide basic laboratory exposure to communication principles and applications.

List of Experiments:

1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal(for both DSB-& SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a FM demodulation
6. Measurement of selectivity, sensitivity, fidelity of a super heterodyne receiver.

7. Study of PAM and demodulation.
8. Study of PCM and demodulation.
9. Study of delta modulator and demodulator.
10. Study of adaptive delta modulator and demodulator.
11. Study of ASK modulator and demodulator.
12. Study of BPSK modulator and demodulator.
13. Study of BFSK modulator and demodulator.
14. Study of QPSK modulator and demodulator.

Course Outcome:
On course completion, the students would be exposed to the practical methods of the use of generating communication signals. To be able to understand the concept of analog and digital communication techniques and their applications.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC591	COMMUNICATIONS SYSTEMS LAB		√	√	√								

EC592 ELECTROMAGNETIC THEORY AND TRNSMISSION LINES LAB

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Electro-Magnetic Theory

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
2. Input Impedance of a terminated coaxial line using shift in minima technique.
3. Study of Smith chart on Matlab platform.
4. Radiation Pattern of dipole antenna.
5. Radiation Pattern of a folded-dipole antenna.
6. Radiation pattern of a 3-element Yagi-Uda Antenna.
7. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.
8. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.
9. Study of Spectrum Analyzer.

			Program Outcomes (POs)

Course Code	*Course Title*												
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC592	ELECTROMAGNETIC THEORY AND TRNSMISSION LINES LAB	√	√		√								

EC593 Control System Lab

Contact: 3P
Credits: 2
Prerequisites: Knowledge in Electrical Engineering

Course Objective :
To help the students understand and practice the modeling, simulation, and implementation of a physical dynamical system by a linear time invariant ordinary
differential equation
To highlight the electrical modeling of a second order system and analyze the
under-damped, over-damped and critically damped cases
To study the effects of poles and zeros location in the s-plane on the transient and
steady state behavior

- Introduction of several preliminary commend for MATLAB Control System tool Box, MATLAB- SIMULINK tool box. Transfer function Generation approach for Modelling the LTI system.
- Determination of step response for 1st order & 2nd order system with unity feedback &
calculation of control system specifications for variations of system design.
- Simulation ofdifferent test response & for Type-I & Type-II system with unity feedback using MATLAB.
- Study on BIBO system with step response analysis by pole shifting.
- Determination of Stepresponse for some standard transfer function with Simulink & Control Block set Calling.
- Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolboxfor a given 2nd order transfer function & determination of different control systemspecifications.
- Determination of P,PI, PD, PID & IPD controller action on 1st order & 2^{nd}Order simulated process.
- Determination of approximate transfer function experimentallyusing Bode Plot.

- Determination of State Space Analysis in consideration on Controllability &Obsersvability,Performance Analysis.
- Study of position control system using servomotor. Introduction of
- Sampled Data control domain analysis with standard transfer function.

Course Outcome:

How stable and better control of devices can be achieved.
How transfer function of a system depicts the behavior of a system.
Modeling a control system in both (time and frequency) domains.

TEXTBOOK

1. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC593	CONTROL SYSTEMS LAB	√	√				√						

HU601 MANAGEMENT THEORY AND PRACTICE

contact/week: 3 periods
credits: 3
Prerequisites: Knowledge in Economics, Accounts

1. Basic concepts of management: Definition – Essence, Functions, Roles, Level.
2. Functions of Management : Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure –Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.
3. Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
4. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship
6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.

8. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
HU-601								√			√	√

Readings:

1. Management : Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz , Revised edition, Tata McGraw Hill(TMH)
3. Management – Stoner, James A. F. (Pearson)
4.Management - Ghuman, Tata McGraw Hill(TMH)

EC601 RF & Microwave Engineering

contact/week: 3 periods
credits: 3
Prerequisites: EM Theory

Course Objective: A broad semi-qualitative overview to the field of microwave engineering. To become familiar with basic techniques and terminology used in analysis of transmission line, waveguide and semiconductor based microwave devices and systems.
Course Outcome: The student should be familiar with

1. Guided microwave propagating structures.
2. Circuit theory models used to describe such structures.
3. Passive and solid state microwave devices.
4. Properties and structure of microwave transmission line filters, (solid state) amplifiers, oscillators, switches.
5. Microwave sources: solid state and tube based.
6. Some applications of microwaves.

Module 1
I Introduction: Review of Maxwell's Equations, Electromagnetic Waves and Transmission Lines; TEM, TE, TM waves, Microwaves. (2)
II (Metallic) Waveguide: Rectangular Waveguide (TE10 mode), Dispersion, Field Coupling; (3)
III Circuit Theory of Waveguiding Systems Equivalent Voltages and Currents, Waveguide Reactive Elements, Impedance, Equivalent Transmission Line Model; (2) Scattering Matrix (reciprocal and lossless networks); Scattering Matrix of a two port network; (1) Shunt, Series Single Stub Impedance Matching (microstrip). (1)
IV Resonator (semi-qualitative): Transmission Line Resonator (half-wave, quarter-wave line); (1) Rectangular Resonator (TE101 mode), Circular Waveguide Resonator (TE111, TE011 modes); (1) Dielectric Resonator (cylindrical TE10d mode), Microstrip Resonator; (1)

Module 2

V Passive Microwave Devices (qualitative) (microstrip) Phase Shifter, Power Divider, Directional Coupler; (2) Ferrite based Isolator, Circulator. (1)
VI Solid-State Devices (qualitative) Detector Diode, PIN Diode, Transistor, Microwave Integrated Circuit, applications; (2)
VII Microwave Filter, Amplifier, Mixer, Switch (semi-qualitative) Periodic Structure (frequency characteristics); (1) Filter Design and Realization using Microstrip Lines; (2)

Module 3
Transistor Amplifier (general circuit, gain, stability, example); Mixer; Switch. (3)
VIII Microwave Source (qualitative) Tube: Space-Charge Waves, Magnetron, Travelling Wave Tube; (2) Solid-State: IMPATT Diode, Gunn Device, Gunn Oscillator, Transistor Oscillator (general circuit, example). (2)

Module 4
IX Microwave System (qualitative) Communication: Satellite, Terrestrial; Radar; Radiometer (Remote Sensing); Heating. (3)

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC601	RF & MICROWAVE ENGINEERING	√		√			√						

Text Books:
1. A. Das and S.K. Das, Microwave Engineering, TMH.
2. A. Singh and S. Verma, Fundamentals of Microwave Engineering, PHI.
3. M.L. Sisodia and V.L. Gupta, Microwave Engineering, New Age International Publishers.
4. M.L. Sisodia and G.S. Raghuvanshi, Microwave Circuits and Passive Devices, New Age International (P) Limited, Publishers.
6. V.S. Bagad, Microwave and Radar Engineering, Technical Publications Pune.
7. G.P. Srivastava and V.L. Gupta, Microwave Devices and Circuit Design, PHI.
8. K.C. Gupta, Microwaves, New Age International Publishers.
9. M. Kulkarni, Microwave and Radar Engineering, UMESH Publications.
10. A.K. Gautam, Microwave Engineering, S.K. Kataria and Sons.
11. M. Mitra, Microwave Engineering, Dhanpat Rai and Company.
12. M.L. Sisodia, V.L. Gupta and J.P. Agrawal, Microwave and Radar Engineering, New Age International Publishers.
13. David M. Pozar, Microwave Engineering, John Wiley and Sons (Asia) Private Limited.
14. Samuel Y. Liao, Microwave Devices and Circuits, Prentice-Hall of India Private Limited.
15. F. Gustrau, RF and Microwave Engineering, Wiley.

16. Robert E. Collin, Foundations for Microwave Engineering, John Wiley and Sons (Asia) Private Limited.

EC602 VLSI CIRCUITS AND SYSTEMS

contact/week: 3 periods
credits: 3
Prerequisites: Knowledge in Electronics

Aim of the Course: Aim of the course is to provide students the basic and intermediate level knowledge on VLSI circuits and systems. Students will learn the basic circuit elements used in VLSI as well as learn MOS based circuit design concepts. From combinatorial & sequential circuits to low power circuit & analog VLSI circuit knowledge will enrich them to enter in the field of VLSI circuit design as a researcher or as a VLSI design engineer.

Course Objective:

I. Describe MOS transistor structure and operation
II. Write current voltage equations for nMOS & pMOS
III. State VLSI design flow and design hierarchy
IV. Design NAND, NOR, half adder, full adder transmission gate, pSeudo nMOS circuits
V. Design different inverters(Resistive load,CMOS)
VI. Describe Bi-stable element behavior
VII. Design MOS based sequential circuits
VIII. Design pass transistor circuits, DOMNO & NORA logic circuits
IX. Design low power CMOS circuits
X. Describe adiabatic logic circuits
XI. Design subsystems like carry select adder, serial-parallel multiplier, booth multiplier
XII. Describe operation of FPGA,PLA & PLD
XIII. Design analog VLSI circuits

Introduction: MOS transistor structure and operation, Current voltage equations for n-channel and p-channel MOSFET,VLSI design flow and design hierarchy. Brief overview of circuit design techniques (Hierarchical design, Design abstraction, computer aided design). (3) **CMOS combinational circuit:** NAND gate, NOR gate, Half adder, Full adder, Other complex logic circuts, CMOS transmission gates, Simple circuits design with CMOS transmission gate. pSeudo nMOS logic. (4) **MOS inverter:** VTC characteristics, Resistive load inverter, CMOS inverter, calculation of critical voltages. Delay time definitions and calculation. Switching power dissipation of CMOS inverter. (5) **Sequential MOS logic circuits:** Bistable element behavior, SR latch circuit, CMOS D Latch and JK flip flop, Schmitt trigger circuit. (4) **Advanced MOS logic circuits:** Dynamic pass transistor circuits, Precharge-evaluate logic, Domino CMOS logic circuits, NORA logic circuits. (5) **Low power CMOS logic circuits:** switching, short circuit & leakage power dissipation, variable threshold CMOS circuits, Multiple threshold CMOS circuits, pipelining and parallel processing approach, Switching activity estimation and optimization, Adiabatic logic circuits. (4) **Subsystem design:** carry select adder, serial-parallel multiplier, booth multiplication algorithm, RAM, ROM, Static RAM, Dynamic RAM,FPGA,PLA,PLD (4) **Analog VLSI Circuits:** MOS switches, MOS resistor, MOS current source and sink, Current Mirror,

CMOS differential amplifier, Source follower, Current amplifier, Switched capacitor circuit, resistor realization with switched capacitor circuits. (5)

Course Outcome:

Outcome of this course is:

Students will be able to apply the theoretical VLSI circuits knowledge for designing chips in the domain of VLSI. Getting a strong foundation on the theoretical knowledge on VLSI circuits and systems will help them to analyze ,synthesize and design VLSI chips which in turn helps the society to have chips for simplifying /helping everyday life either in form of knowledge sharing or in the form of product development.

PEO(in tabular form)

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC602	VLSI CIRCUITS AND SYSTEMS		√		√		√						

Text Books:

1. Neil H.E Weste, Kim Haase, David Harris, A.Banerjee, "CMOS VLSI Design : A circuits & Systems Perspective", Pearson Education
2. Wayne Wolf," Modern VLSI Design – System-on-chip Design", Prentice Hall India/Pearson Education
3. Sung-Mo Kang & Yusuf Lablebici, "CMOS Digital Integrated Circuits, Analysis & Design", Tata McGraw-Hill Edition
4. Philips E. Allen & Douglas R. Holberg, " CMOS Analog Circuit Design" , Oxford University Press

References:

5. David Hodges, Horace G Jackson, & Resve A Saleh, " Analysis & Design of Digital Integrted Circuits", Tata McGraw-Hill Edition
6. Ken Martin," Digital Integrated Circuits", Oxford University Press
7. R. L. Geiger, P.E.Allen, Noel R. Strader," VLSI Design techniques for Analog and Digital Circuits", McGraw-Hill International Edition

EC603 DIGITAL SIGNAL PROCESSING

Contact / week: 3 periods
credits: 3
Prerequisites: Knowledge in Electronics

Course Objectives:

- Understand basic tradeoffs in digital representation of signals: sampling rate, bandwidth, bit rate, fidelity
- Analyse minimum phase, linear phase, and all-pass discrete-time systems
- Check the stability of filters

- Choose filter structures according to their performance characteristics: sensitivity, complexity, delay, etc
- Program digital signal processors to perform DSP in real-time
- Analyse and design filters based on pole/zero placement.
- Design linear phase FIR filters using windows and equipripple technique
- Design IIR filters from continuous-time filters
- Design filters using Matlab and exploit more sophisticated design tools in Matlab
- Analyse signal spectra using DFT/FFT
- Apply FFT to filtering applications

Module-1
Review: Continuous Time Signals and Systems
Discrete Time Signals (time domain, deterministic): Samples of Continuous Time Signals, Sampling Theorem, Frequency Units, A/D and D/A Conversion Discrete Time Systems (time domain): Linear Time Invariant (stable, causal), Difference Equation, Impulse Response, Convolution (linear) Discrete Time Signals (transform domain, deterministic): Discrete Time Fourier Transform, Z Transform (time shift property) Discrete Time Systems (transform domain): Frequency Response, Transfer Function Discrete Time Random Signals (stationary): Time Domain (autocorrelation), Frequency Domain (power spectral density); Processing by Linear Time Invariant System 8L

Module-2
Discrete Fourier Transform (as an approximation to continuous time Fourier Transform),Circular Convolution; Introduction to Fast Fourier Transform .Discrete Cosine Transform (signal compression) .Two Dimensional Transforms (applications)
6L

Module-3
Digital Filters: Concept of Filtering, Structure FIR filters (window method, linear phase) (2) IIR filters (bilinear transform) Phase and Group delay; Spectral Transformation; Filter Implementation in Time and Frequency Domain; Filter Applications
10L

Module-4
Application Domains of Digital Signal Processing:
Wireless Communication (OFDM, Mobile Phone), Speech/Music Processing, Image Processing, Biomedical Engineering, Digital Signal Processor
6L

Course Outcomes:
This course introduces students to the fundamental techniques and applications of digital signal processing. Through lectures, homework, and laboratory experiments, students should be able to do the following upon completion of this course:
1. Design digital filters through pole-placement techniques.
2. Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.
3. Design digital FIR filters using the window method.
4. Use a computer to design digital filters via the frequency sampling approach and the Remez exchange algorithm (Parks-McLellan filter).
5. Implement digital filters in a variety of forms: direct form I and II, parallel, and cascade, and then analyze their sensitivity to finite precision effects such as input quantization, coefficient quantization, and multiplication round off.
6. Analyze signals using the discrete Fourier transform (DFT).

7. Understand circular convolution, its relationship to linear convolution, and how linear convolution can be achieved via the discrete Fourier transform.
8. Understand the Decimation in time and frequency FFT algorithms for efficient computation of the DFT.
9. Alter the sampling rate of a signal using decimation and interpolation.
10. Direct form I and II, parallel, cascade, and lattice filter structures and their sensitivity to finite precision input, arithmetic, and coefficient quantization.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC603	DIGITAL SIGNAL PROCESSING	√			√		√						

List of Text Books:

1. S. Sharma, Digital Signal Processing, SK Kataria and Sons.
2. P. Ramesh Babu, Digital Signal Processing, SCITECH.
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya, Digital Signal Processing, TMH.

Reference Book:

1. J.R. Johnson, Introduction to Digital Signal Processing, PHI.
2. T. Bose, Digital Signal and Image Processing, Wiley.
3. S.K. Mitra, Digital Signal Processing, TMH.
4. J.G. Proakis and D.G. Manolakis, Digital Signal Processing

Computer Communication and Networking (EC 604)

Contact : 4L
Prerequisite: Digital Communication

Course Objective:
1. An understanding of how devices like Hub, Switch, Router and Bridge are used in network.
2. An understanding of how securely data can be transmitted from one place to remotely place using various protocols.

Course Outcome:
After the course, student will be able to
1. Analyze various protocols used in data communication
2. Design networking structure in data communication.
3. Transmit data securely from one place to another.

Module No.	Topic	Lecture
1	Computer network : Introduction; Advantage of computer network; Types of computer network ; Components of computer network : Hosts, terminals, transmission media, connectors etc. Network architecture layering concept, OSI Reference Model	2 2 3
2	Circuit, message and packet switching DTE and DCE, RS232, Modems- Type, Speed calculation; ADSL Modem ALOHA- Pure and Slotted ; CSMA/CD; Error detection and correction, stop and wait protocol, sliding window protocol ; Repeater, Hub, Switch, Bridge	2 3 7
3	LANs and their Interconnection - Basic concepts and IEEE standards, Architecture, protocol, management and performance of Ethernet, token bus and ring Internet Addressing : IP v4 and IPv6; Advantages of IPv6; Router, Routing – static, dynamic; Routing Protocol- RIP, IGRP, OSPF, Dijkastra algorithm	4 6
4	Congestion control, Leaky Bucket Algorithm ; Process to process delivery, TCP, UDP. DNS, SMTP, FTP, HTTP, WWW, electronic mail Network security - Cryptographic Principle, AES, RSA, Digital signature, VPN, Firewall	4 3 4
	Total	40

PO Mapping:

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC604	COMPUTER COMMUNICATION AND NETWORKS		√		√		√						

Problem analysis: Analyse performance of a large network system, checking no of packets transmitted and received
Design/development of solutions: Conducting experiments in network setup
Individual and team work: Setup network among different departments and provides security
Modern tool usage: Share knowledge regarding up gradation of computer network.

Reference Books:

1. B. A. Forouzan, Data Communication and Networking; TMH
2. A Tanenbarum, "Computer Networks" –4th Edition, PHI/ Pearson Education
3. W Stallings, "Data and Computer Communication" ; Pearson Education

EC605 Electrical and Electronic Instrumentation

contact/week: 3 periods
credits:3
Prerequisites: Knowledge in Electrical and Electronics Engineering

Course Objective:
1. In depth knowledge of measurement methods and instruments of electrical quantities.
2. Understanding design aspects and performance criterion for measuring instruments.
3. Implementation of the different signal generators and its analysis techniques.
4. To understand the working principle of the transducers.
5. To aware the students about the advances in Instrumentation.

Module 1:
Measurements and measurement Systems: Classification of instruments-Absolute and secondary instruments, Deflection and null type instruments.Functions of Instruments and measurement systems-Indicating function, Recording function and Controlling Function.**4L**
Module 2: Characteristics of Instruments and measurement systems-Static Characteristics, Reproducibility and Draft, Accuracy and Precision, Hysteresis, Loading Effect. Errors in measurement-Statistical Treatment of data. **6L**
Module 3:Dynamic response of Instruments, Dimensions of mechanical quantities. Electromechanical Indicating Instruments: Ballistic Galvanometer, Ohmmeters, Megger, Electrodynamometer Wattmeter, Energy meters foe A.C circuit. **4L**
Measurement of resistance-Wheatstone Bridge,Kelvin's double bridge. Measurement of Self Inductance-Maxwell's Induction Bridge,Hay's Bridge,Anderson's Bridge,Owen's Bridge.Measurement of Capacitance-De Sauty's Bridge,Schering Bridge. Measurement of Frequency-Wien's Bridge. Cathode Ray Oscilloscope(CRO)-Cathode Ray Tube(CRT),Observation of waveform on CRO,Measurement of voltage,current,phase and frequency. **8L**
Module 4:
Electrical and Electronic Instrumentation Primary sensing elements and Transducers-Pressure Sensitive primary Devices-Bourdon Tubes,Bellows,Diaphragms. Classification of Transducers— rimary,Secondary,Active,Passive Transducer,,Analog And Digital and Inverse Transducers,Characteristics and Choice of Transducer-Input,Transfer and Output

Characteristics. Strain Guages,Thermocouples,Resistance Thermometers,LVDTs. Advantages,Disadvantages and Uses of LVDT.Piezo-electric Transducers,OptoElectronic Transducer,Temperature Transducer,Measurement of Sound. **6L**

Module 5:

Measurement of Non-Electrical Quantities : Electromagnetic Flow Meters,Measurement of Liquid Hot wire Anemometer,Measurement of Humidity,Hygrometers,Measurement of pH Values. Data Acquisition Systems.

4L

Course Outcome:

1. An ability to apply knowledge of electronic instrumentation for measurement of electrical quantities.
2. Ability to apply the principles and practices for instrument design and development to real world problems.
3. Ability to select and use latest hardware for measurements and instrumentation.
4. An ability to design and conduct experiments for measurement and ability to analyze and interprets data.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC605	ELECTRICAL AND ELECTRONIC INSTRUMENTATION		√	√	√								

Text Books:

1. Golding E.W. & Wides F.C. : Electrical Measuring Instruments & Measurements ; Wheeler
2. Harris, F. K. – Electrical Measurements, Wiley.
3. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.
4. Reissland M.U.: Electrical Measurement, New Age International

EC691 RF AND MICROWAVE ENGINEERING LABORATORY

Prerequisites: Knowledge in Microwave Engineering

1. Radio Frequency Antenna: Yagi-Uda Array/Dipole (antenna current/voltage distribution using B/E field probe; radiation pattern)
2. Introduction to Microwave Bench (oscillator, modulator, isolator, attenuator, frequency meter, slotted waveguide section, load termination, probe, VSWR meter)
3. Microwave Bench: Measurement of Frequency, Guide Wavelength, Standing Wave Ratio

4. Microwave Bench: Measurement of Load Impedance (Load(impedance)=Sliding Screw Tuner(reactance; capacitive, inductive)+Matched Load(resistance))
5. Passive Microwave Devices: Directional Coupler, Circulator (properties using power meter), Phase Shifter (verification of phase shift)
6. Microwave Filter, LNB
7. Microwave Antenna: Microstrip, Horn, Parabolic Reflector (microwave communication)
8. Software/Network Analyzer

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC691	RF & MICROWAVE ENGINEERING LAB		√		√		√						

EC692 VLSI CIRCUITS AND SYSTEMS LAB

Prerequisites: Knowledge in VLSI design

Course Objective:

After completion of this Laboratory course students will be able to

- Design different static CMOS based circuits
- Simulate different static CMOS based circuits
- Design dynamic circuits
- Simulate dynamic circuits
- Design sequential circuits
- Simulate sequential circuits
- Design amplifier circuit
- Simulate amplifier circuit

1. Design and simulation of CMOS AND, NAND, NOR gates by static CMOS design.
2. Design and simulation CMOS half and full adder.
3. Design and simulation of pSeudo nMOS circuit.
4. Design Resistive load and CMOS inverter circuits and obtain transient response.
5. Design and simulation of 2 stage Dynamic logic circuit.
6. Design and simulation of a standard cell (Static RAM/any other).
7. Design and simulation of S-R latch
8. Design and simulation of D-Flip flop

9. Design and simulate J-K Flip flop.
9. Design a NORA logic circuit and simulate.
10. Design and simulate a CMOS differential amplifier.

PEO(in tabular form)

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC692	VLSI CIRCUITS AND SYSTEMS LAB		√		√		√						

EC693 DIGITAL SIGNAL PROCESSING LABORATORY

Prerequisites: Knowledge in Digital Signal Processing

Course Objectives:
To introduce the basic principles, methods, and applications of digital signal processing, to explore its algorithmic, computational, and programming aspects, and to learn programming of DSP hardware for real-time signal processing applications.

Course outcomes:

1. Learn to represent real world signals in digital format and understand transform-domain (Fourier and z-transforms) representation of the signals;
2. Learn to apply the linear systems approach to signal processing problems using high-level programming language;
3. Learn the basic architecture of microprocessors and digital signal processors;
4. Learn to implement linear filters in real-time DSP chips, Introduce applications of linear filters and their real-time implementation challenges.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*

EC693	DIGITAL SIGNAL PROCESSING LAB		√		√		√						

List of Experiments:
1. Waveforms, Plot
2. Implementation of Difference Equation in Time Domain (simple digital filters, audio effects)
3. Frequency Domain Description of Signals: DFT (sinusoidal signals)
4. Design and Application of Digital Filters: FIR Filters
5. Design and Application of Digital Filters: IIR Filters
6. Speech Processing
7. Implementation of a Practical DSP System
8. Introduction to Image Processing (image type/format, 2D DFT, 2D filtering in frequency domain, edge detection)

EC701 Information Theory & Coding

Contracts: 3L
Credits- 3
Prerequisites: Probability and statistics, Signal Theory, Digital Communication

Course Objective: This curriculum is designed for enabling the students to assimilate the principles of information theory. Source coding, error correction strategies and their working methodology would be stressed.

Module-I
Source Coding [7L]
Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Module-II
Channel Capacity And Coding [7L]
Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Module-III
Linear And Block Codes For Error Correction [8L]
Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Module-IV
Cyclic Codes [7L]
Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

Module-V
BCH Codes [8L]
Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Module-VI
Convolutional Codes [8L]
Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Course Outcome: On course completion, the students would be exposed to the idea of information as measurable quantity. Methods of probabilistic source coding and error correction techniques are ingrained quantitatively.

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC701	INFORMATION THEORY AND CODING	√		√	√								

Text Books:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information Theory - R B Ash; Prentice Hall.

Reference Book:
1. Introduction to Information Theory - M Mansurpur; McGraw Hill.
2. Information and Coding - N Abramson; McGraw Hill.
3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

EC702A Embedded Systems

Contracts: 3L
Credits: 3
Prerequisite: Programming Language Fundamental, Computer Architecture, Digital and Analog Electronics

Course Objective:

1) An understanding of how devices such as microprocessor, analog to digital converter, watchdog timer are modeled and how the models are used in the design and analysis of embedded circuits.
2) The capability to use analyzes and design embedded circuits.
3) The capability to design and construct Embedded circuits and to design software programs.

Course Outcome:

After completion of this course the students will be able to
1) Design different types of Embedded Circuits.
2) Analyze performance of Embedded Circuits.
3) Design different type software programs which is used in Embedded Systems.
4) Find application area of Embedded Systems.

Module No.	Content of the Module	Lecture Required
1	**Introduction to Embedded System :** Embedded Systems – Definition, Difference between Embedded system and General Computing Systems, Importance of Embedded Systems , Hardware architecture of the real time systems	**6**
2	**Devices and Communication Buses :** IO types and examples, Serial and Parallel communication devices, Wireless communication devices, timer and counting devices, Watchdog timer, real time clock, Serial bus communication protocols, parallel communication network using ISA, PCI, Internet embedded system network protocols	**9**
3	**Programming Concept :** Program models, DFG models, State Machine Programming Models for event controlled Program flow, software programming in assembly language and high level language, program elements – macros, function, data type, data structure, modifier, statements etc.	**7**
4	**Real Time Operating Systems :** Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, Task, Inter process communication, Semaphore function, basic design of a RTOS, Interrupt routine in RTOS, RTOS task scheduling models. **Examples of Embedded System :** Mobile phones, Robotics, Biomedical Applications etc.	**6** **2**

P.O. Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC702A		√		√		√						

Reference:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems : Rajkamal (TMH)
4. Embedded Systems : L. B. Das (Pearson)
5. Embedded System design : S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)

EC702B High Speed Communication Circuits
Contact: 3P
Credits: 3
Total Lectures: 32L
Prerequisites: Analog & Digital Communication, Electromagnetism, Antenna Theory, Analog & Digital Electronics

Course Objective: This course would cover circuit level design issues of high speed communication systems, with primary focus being placed on wireless and broadband data link applications. Specific circuit topics include transmission lines, high speed and low noise amplifiers, VCO's, mixers, power amps, high speed digital circuits, and frequency synthesizers

Module: 1 Introduction 4L
Communication Systems Overview, Transceiver Architectures

Module: 2 High-speed circuits' building blocks 7L
Wave Guides and Transmission Lines, S-Parameters and Impedance Transformers, Generalized Reflection Coefficient, Smith Chart, MOS Transistors, Passive Components, Gain-Bandwidth Issue for Broadband Amplifiers

Module: 3 High Frequency, Broadband Amplifiers 7L
Enhancement Techniques for Broadband Amplifiers, Narrowband Amplifiers, Noise Modeling in Amplifiers, Noise Figure, Impact of Amplifier Nonlinearities, Low Noise Amplifiers, LNA Design Examples and Recent Techniques

Module: 4 Voltage Controlled Oscillators 4L
Voltage Controlled Oscillators, VCO Examples and Mixers, Noise in Voltage Controlled Oscillators, Leeson's model

Module: 5 Power Amplifiers 4L
Classes of Power Amplifiers, Modulation of Power Amplifiers, Linearization Techniques for Power Amplifiers, Adaptive Biasing.

Module: 6 Phase-Locked Loops 4L
Phase-Locked Loops and Integer-N Frequency Synthesizers, Noise in Frequency Synthesizers, Design of Fractional-N Frequency Synthesizers and Bandwidth Extension Techniques.

Module: 7 RF Transceiver Design Example 2L

Course Outcome: This course would enable the student to critically analyze a communication system in terms of designers' perspective. The performance of individual communication frontend modules translates into metrics like BER, throughput and bandwidth. With the knowledge imparted in this course the students would be able to understand the significance. The project involved would make the student confident about implementation and bring him in terms with factual reality.

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC702B		√	√	√								

Books

1. Razavi B., "RF Microelectronics". 2nd Edition. Prentice Hall
2. Lee T.H. "Planar Microwave Engineering: A Practical Guide to Theory, Measurement, and Circuits". Cambridge University Press

Lee T.H. "The Design of CMOS Radio-Frequency Integrated Circuits". ". Cambridge University Press

EC702C Optical Communication & N/W
Contacts: 3L
Credits: 3
Prerequisites: Solid-State Devices, Electromagnetic Theory, Communication

Course Objective:
i) To acquaint the students with advantages and scope of Optical Communication.
ii) To introduce the students to the existing components of Optical Communication.
iii) Application of Optical communication to design communication networks.

Module-1
Introduction to communication systems: [2]
Principles, components; Different forms of communications in brief, advantages of optical fibre communication, spectral characteristics.

Module-2
Optical Fibre wave guide: [2]
Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion.

Module-3
Optical Sources: [5]
Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres. Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers. Quantum Well Lasers; Modes and narrow linewidth lasers. Modulation; Bandwidth for modulation, Optical transmitters: components.

Module-4
Optical Detectors: [2]
Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio.

Module-5
Point-to-point link and Wavelength Division Multiplexing:
[11]
Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis and Bit-Error-Rate calculation.

Module-6
Optical Network:
[4]
LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking:SDH/SONET.
Different forms of access networks:
[4]
Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH
networks; All optical networks.

Course outcome:
After going through this course the students would understand the evolution of optical networks, its various components and applicability in modern world of communication. The student would be able to analyze link budgets and choose from different options to meet the budget.

P.O Table

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC702C	√	√		√								

Books:
1. Optical Networks – A practical perspective : Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Fibre Communication : Gerd Kaiser (TMH)
4. Optical Communication Systems : John Gowar (PHI)

EC702D Radar Engineering
Contacts: 3L
Credits: 3
Prerequisite: Electromagnetic Theory, Communication, Network Theory, Signal Theory

Course Objective: This curriculum acquaints the students with the principles of RADAR operation. Practical application in modern perspective is explained.

Module –I: Introduction to Radar.

Historical background, radar terminology, radar band s, Radar block diagram, radar equation: detection of signals in noise and signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter. 6L

Module – II: Radar Types
Pulse radars and CW radars,Advantages of coherent radar, Doppler radar and MTI: Doppler effect, delay-line cancellers, blind speeds, staggered PRFs, Digital filter bank, Moving Target Detector, limitations of MTI, tracking with radar, monopulse tracking, conical scan, limitation to tracking accuracy, 8L

Module –III: Radar signals & clutter
Basic radar measurement, theoretical accuracy of radar measurements, Range and velocity ambiguities, the ambiguity diagram, pulse compression-principles, the matched filter, chirp waveforms, Waveform design: nonlinear FM, phase codes, waveform generation and compression. Descriptions of land & sea clutter, statistical models for surface clutter, detection of targets in clutter. 10L

Module –IV: Devices and Radar Systems
Radar transmitter: Solid-state RF power source, Magnetron, other RF power sources, Radar receiver: Super heterodyne receiver, receiver noise figure, duplexers & diplexers, Receiver protectors, Applications: Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, Stealth and counter-stealth: stealth techniques for aircraft and other target types, low frequency and UWB radar, System design examples 8L

Course Outcome: After completion of this course the students would be able to identify the functional modules of RADAR. Also classification of RADAR according to application would be clear along with quantitative understanding of the basics.

P.O Table

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC702D		√	√	√								

Text Books:
1. Introduction to Radar Systems-3/E, M. I. Skolnik, Tata McGrawhill
2. Principles of Modern radar system , M. H. Carpentier, Artech House
Reference Books:
1. Fundamentals of radar signal processing, M. I. Richards, McGraw-Hill
2. Handbook of radar measurement , Barton, David & Ward, H. R, Artech House
3. Radar Technology , Brookner, Eli, Artech House
4. Radar Handbook , ed. M. I. Skolnik, Mc-Graw Hill, 1990
5. Skolnik, M. I, “Fifty years of Radar”, Proc. IEEE, vol. 73 (Feb. 1985), pp. 182-197

C702E Power Electronics
Contacts: 3L

Credits: 3
Prerequisites: Knowledge in High Power Electronic Devices

Course objective:
a) To introduce to students the theory and applications of power electronics systems for high efficiency, renewable and energy saving conversion systems.
b) To prepare students to know the characteristics of different power electronics switches, drivers and selection of components for different applications.
c) To develop students with an understanding of the switching behavior and design of power electronics circuits such as DC/DC, AC/DC, DC/AC and AC/AC converters.

Course outcome:
This course primarily contributes to program outcomes that develop student abilities to:
a. Ability to apply knowledge of mathematics, science and engineering.
b. Ability to identify, formulate and solve engineering problems.
c. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
This course secondarily contributes to program outcomes that develop student abilities to:
a. Ability to design and conduct experiments.
b. Ability to design a system, component or process to meet desired needs.
c. Ability to function on multidisciplinary teams.
d. Ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations.

Module I
Advances in Power Electronics Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky barrier diode, Power BJT, Power MOSFET, SCR, TRIAC, IGBT and GTO. Ratings, Static and Dynamic Characteristics, Trigger, driver and switching-aid circuits and cooling. SCR turn –on and turn - off methods, Triggering circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit.

Module II
Rectifiers Single phase and three phase controlled Rectifiers with inductive loads, RL load Effect of source inductance- performance parameters .Dual Converters. 6

Module III
Step up and Step down choppers Time ratio control and current limit control, Buck, Boost, Buck Boost and Cuk Converters, Concept of Resonant Switching. 4

Module IV
Single phase and three phase inverters – PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM - multiple PWM Voltage and harmonic Control – Series resonant inverter-Current Sources Inverter. 6

Module V
AC Voltage Controllers, Single phase and three phase Cyclo-conveters – Power factor control and Matrix Converters. 4

Module VI

DC and AC Drives DC Motor Speed control Induction Motor Speed Control Synchronous Motor Speed Control 8

Total Lecture Hours 34

P.O Table

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC702E		√		√					√			

Text Books:

b) P.C. Sen, Power Electronics
c) M.H. Rashid, Power Electronics, PHI/ Pearson Education
d) C.W. Lander, Power Electronics, McGraw Hill
e) B.K.Bose, Modern Power Electronics, JAICO
f) Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons

EC702F Designing digital systems with VHDL

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Digital Electronics

Aim of the Course: Aim of the course is to provide students the basic and intermediate level of knowledge on VHDL based digital system design. Students will learn VHDL language and will also learn to implement the digial systems using VHDL language .The knowledge from basics of VHDL language to design and synthesize digital circuit swill enrich them enough to take challenges in the field of VHDL based system design and to enter into the industry as design engineer.

Course Objective:

- ✓ After completion of this course students will be able to
- ✓ Basic of VHDL language
- ✓ Identify different modeling styles of VHDL
- ✓ Write test benches using VHDL
- ✓ Design digital circuits using VHDL
- ✓ Synthesize the digital circuits by VHDL

Module -1: Basics of VHDL language [8L]
VHDL entity, architecture. Data types, Basic sequential statements, assignment statements and operators, objects: signals, variables, constants files, libraries, packages.

Module 2: Modeling styles in VHDL [10L]
Behavioral modeling: Process concept, case statement, loop, next, exit statements, assert and report statement, direct instantiation and simple test benches. Dataflow modeling: Concurrent conditional assignments, concurrent selected signal assignment, block statement, modeling sequential circuits.

Module 3: Structural modelling

Component declaration, generics and instantiation ,configuration statement, configuration declaration unit, generate statement.
Case study: Designing simple combinatorial and sequential circuits using VHDL.

Module 4: Test bench [4L]
Test bench architecture, File I/O operations, Examples of test bench.

Module 5: Digital circuits with VHDL [8L]
Design of register, ALU, Register array, RAM, ROM, Tri-state Buffer,3 x 3 crossbar switch controller

Module 6: Synthesis by VHDL [10L]
RTL level description, constraints, attributes, technology libraries, flattering, factoring, mapping to gates.

Course Outcome:
Outcome of this course is :
Students will be able to apply the VHDL programming knowledge for real world problem solving in the field of digital system design. Getting a strong foundation on the VHDL language will help them to analyze ,synthesize and design digital systems. With the digital system design using VHDL knowledge students will be able to design digital systems which may help to solve the problem faced by society at large in form of product development.

PO(in tabular form)

	a	b	c	d	e	f	g	h	i	j	k	l
EC702F	√	√				√						

BOOKS:
1. Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett. Daniel Pack Morgan & Claypool Publishers.
2. The AVR Microcontroller and Embedded Systems: Using Assembly and C .
Author: Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi. Publisher: Pearson Education.

EC703A BIOMEDICAL INSTRUMENTATION

Contacts: 3L
Credits: 3
Prerequisites: Basic Electronics Engineering

Course Objective:
The purpose of this course is to introduce the students to the basics of Electro-physiology and its measurements, non-electrical parameters related to various systems of human body and their measurements, Electrodes and Transducers used in bio signal acquisition. This course will enable the students to learn the basic principles of different instruments/equipment used in the health care industry. Also student will get to know about various Medical Imaging techniques used for diagnosis along with other diagnostic and therapeutic devices.

Instructional objectives:

1. To understand the Origin of Bioelectric potential and their measurements using appropriate electrodes and Transducers.
2. To understand how to measure various biochemical and nonelectrical parameters of human system.
3. To understand the Electro-physiology of various systems and recording of the bioelectric signals.
4. To understand the working principles of various Imaging techniques.
5. To understand the design aspects of various Assist and Therapeutic Devices.

Module I

BIOPOTENTIAL ELECTRODES AND TRANSDUCERS (9L)

Electrode theory -Electrode electrolyte interface, half-cell potential, Hydrogen, Calomel, Ag-AgCl electrode, needle and wire electrode, surface electrodes, Microelectrode -metal micropipete.Physiological Transducers:Resistive transducers ,Thermistor, Inductive Transducers-Capacitive Transducers-Photoelectric Transducers-Piezoelectric Transducers-, Biochemical Transducers -pH electrodes.

Module II

BIOELECTRIC POTENTIALS AND ELECTROPHYSIOLOGICAL MEASUREMENTS (9L) Sources of Bioelectric potentials -Resting and Action potential-Propagation of Action potential Electrophysiology of Heart, Nervous System and Muscle Activity Bio -signals: ECGEEG, Evoked potential, EMG-ERG -Electrodes and Lead System, Typical waveforms and Signal characteristics Signal Conditioning circuits: Design of low Noise Medical Amplifier, Isolation Amplifier, Protection Circuits and Electrical Safety.

Module III

NON -ELECTRICAL PARAMETER MEASUREMENTS (9L)

Measurement of Blood Pressure, Blood Flow, Plethysmography, Cardiac Output, Heart Sounds Lung Volumes and their measurements -Auto analyzer–Blood cell Counters, Oxygen saturation of Blood.

Module IV

MEDICAL IMAGING TECHNIQUES (9L)

X-ray machine,Computer Tomography,Angiography,Ultrasonography,Magnetic Resonance Imaging System–Nuclear Imaging Techniques,Thermography–Lasers in Medicine Endoscopy.

Module V

TELEMETRY, ASSIST AND THERAPEUTIC DEVICES (9L)

Bio telemetry–Elements and Design of Bio telemetry system. Assist and Therapeutic devices: Cardiac Pacemakers–Defibrillators, Artificial Heart Valves Artificial Heart Lung machine, Artificial Kidney, Orthopaedic Prosthetics– Respiratory therapy equipment–Patient Monitoring System.

Course Outcomes:

Students who complete this course will be able to:

Outcome 1: Classify systems modeling biomedical sensors and instrumentation .

Outcome 2: Calculate the static and dynamic characteristics of bioinstrumentation systems .

Outcome 3: Design simple analog circuits (e.g. instrumentation amplifiers and active filters) used in bioinstrumentation .
Outcome 4: Apply sampling theorem fundamentals to design A/D conversion processes for biomedical signal acquisition.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC -703A			√	√		√						

TEXTBOOKS

1.Leslie Cromwell, Fred J. Weibell and Erich A. Pfeifer,"Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2006
2.Khandpur.R.S "Handbook of Biomedical Instrumentation", 2nd edition, 12 reprint, Tata McGraw Hill, 2008.

REFERENCES

1.Joseph J. Carr and John M. Brown,"Introduction to Biomedical Equipment Technology", 4thedition, Pearson Education, 2008.
2.John G. Webster,"Medical Instrumentation Application and Design", 3rd edition, Wiley India, 2008.

EC703B Advanced Microcontroller

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Digital Electronics and Microprocessor

Aim of the Course: Aim of the course is to provide students the basic and intermediate level of knowledge on AVR microcontroller. Students will learn the architecture, instruction set as well as the interfacing & device communication techniques with this microcontroller. From basics of hardware structure to the interface programming will enrich the students enough to enter into the world of AVR based system design either as a system design engineer or as an entrepreneur.

Course Objective:
After completion of this course students will be able to

- Describe the hardware architecture of the AVR series of microcontrollers.
- Write programs for AVR platform using assembly language programming.
- Establish communication of AVR microcontroller with other devices which supports UART,Rs-232,SPI,IIC,IrDA & PC serial port.
- Interface AVR microcontroller with LED, LCD displays, ADC/DAC,RTC & serial EEPROM.

Module -1: Introduction to AVR [2L]
AVR Microcontroller introduction. History & evolution of AVR Microcontroller family.

Module 2: Architecture of AVR [10L]

Basics of RISC Architecture.AVR RISC architecture, Register file, ALU, I/O Memory,Registers:SP,GIMSK,MCUCR,TCCRO,TCNTO,TCCR1A,TCCR1B,TCNT1H,OCR1AH,OCR1AL,OCR1BH,OCR1BL,WDTCR,EEAR,EEDR,EECR(Register description and purpose).EEPROM, I/O Ports, SRAM, Interrupt structure, watchdog timer, UART operation, power down mode of operation.

Module 3: AVR Instruction set [8L]
Program and Data addressing mode instructions: Register direct (single and double register based).I/O direct, date direct, data indirect ,indirect program addressing, relative program addressing. Arithmetic and logical instructions, Program control instructions, Bit & bit test instructions.

Module 4: AVR and communication links [10L]
RS-232 link, RS-422/423 link, RS-485 link, SPI & microware bus, IIC bus, PC parallel port, ISA bus, universal serial bus, IrDA data link, CAN(Controller area network) Bus.

Module 5: Hardware interfacing with AVR [10L]
AVR and PC serial port interfacing, interfacing with ADC & DAC. Interfacing with seven segment and dot matrix display, interfacing with LCD display, interfacing with stepper motor & serial EEPROM, interfacing with RTC(real time clock).

Course Outcome:
Students will be able to apply the AVR programming knowledge for real world problem solving in the field of embedded systems. Getting a strong foundation on the theoretical knowledge on AVR will help them to analyze ,synthesize and design AVR microcontroller based systems. With the interfacing and device communication knowledge students will be able to design AVR microcontroller based embedded systems that may help to solve the problem faced by society at large in form of product development.

P.O Table:

	a	b	c	d	e	f	g	h	i	j	k	l
EC703B		√		√		√						

BOOKS:

1. Atmel AVR Microcontroller Primer: Programming and Interfacing -Steven F. Barrett. Publisher: Daniel Pack Morgan & Claypool Publishers.
2. The AVR Microcontroller and Embedded Systems: Using Assembly and C -Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi. Publisher: Pearson Education.

EC703C Advance Biomedical Control System and Simulation Technique

Contacts: 3L
Credits: 3
Prerequisites: Control system

Course objective: Students will be able to use the knowledge and skills to exhibit strong skills in problem solving, leadership, teamwork, and communication; use these skills to

contribute to their communities; make thoughtful, well-informed career choices; and demonstrate a continuing commitment to grow interest in their own and others' education.

Module 1
Biomedical Control Modeling: Concepts of bio control systems- Open loop and closed loop control systems Dynamic equations- block diagram representation of physical systems mechanical systems, electrical systems-analogous with comparison of Biomedical system, Bio control Block diagram representation, Introduction on Bio-Mechanics. Bio- Transfer function generation approach. 6L

Module 2
Bio feedback concept: Characteristics Equation formation, Physical concept of Bio-Feedback,
Design aspects of bio-feedback. Concept of negative and positive feedback for standard biomedical system. 4L

Module 3
Transfer Functional Approach and Analysis: Standard test signals- impulse, step and ramp response analysis of first order, second order and higher order systems, transfer function generation. 3L

Module 4
Stability Analysis and control aspect of standard bio transfer function. Routh stability criterion, root locus concept,Time domain analysis -,Steady state response- Steady state errors and error constants- Effects of proportional derivative, proportional integral in bio systems, performance indices. Frequency domain analysis -Bode diagrams- Determination of Frequency domain specifications and transfer function from the Bode diagram- Stability Analysis from Bode plots, Nyquist plots and applications of Nyquist criterion to find the stability. State model representation of bio control system-derivation of state models from block diagrams, Relationship between state equations and transfer functions- Characteristic equation, State Transition Matrix. Controllability and observability. 8L

Module 5
Deterministic and Non-deterministic sample data control: Basic concept, Discrete domain representation, Sampled data (SD) control computational technique, Discrete domain stability analysis with jury test. 4L

Module 6
Processes control Representation of Biological System, Processes control approach of different External, Internal & Sense Organs. 6L

Module 7
Nonlinear biomedical control: Introduction, Lyapnov analysis, Comparative study on Non deterministic and non linier biomedical control system, Approach from LTI system to nonlinear systems. 2L

Module 8
Advanced PID controller (Linear & Discreet domain), Nonlinear approach on PID controller, Advance PID controller and Computational Technique: PID tuning– Basic concept and analysis with ZN, PSO, GA, BF, Fuzzy logic and MATLAB simulation approach. 3L

Course outcome: At the end of course student will be able to understand biology and physiology as related to biomedical engineering needs apply knowledge of advanced mathematics (including differential equations and statistics), sciences, and engineering to solve problems at the interface of engineering and biology and to model biological systems . They will be also gain the knowledge to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems.

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC703C	√			√		√						

Text books:

1. Ajit K Mandal, "Introduction to Control Engineering : Modeling , Analysis and Design" New Age International (P) Ltd , Second Edition, New Delhi, 2006
2. M. Gopal "Digital Control and State Variable Methods", 2nd Ed. Tata McGraw-Hill, New Delhi, 2002

Reference Books:

1. Franklin, G. F., J. G. Powell, and M. L. Workman, Digital Control of Dynamic Systems , 3rd Edition, Pearson Education , Inc Reading Mass, 2000.

EC703D Database Management System

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Programming Language

Course Objectives:
The major objective of this paper is to provide a strong formal foundation in database concepts, technology and practice to the participants to groom them into well-informed database application developers. The sub-objectives are:
1. To provide a sound introduction to the discipline of database management as a subject in its own right, rather than as a compendium of techniques and product-specific tools.
2. To familiarize the participant with the nuances of database environments towards an information-oriented data-processing oriented framework
3. To give a good formal foundation on the relational model of data

Module I
Introduction [4L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Entity-Relationship Model [6L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Module I
Relational Model [5L]
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module III
SQL and Integrity Constraints [8L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module IV
Relational Database Design [9L]
Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Module V
Internals of RDBMS [7L]
Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

Module VI
File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Course Outcomes:
1. Understand, appreciate and effectively explain the underlying concepts of database technologies
2. Design and implement a database schema for a given problem-domain
3. Normalize a database
4. Populate and query a database using SQL DML/DDL commands.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC703D	√		√			√						

Text Books:
8. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
9. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing Company.
10. Ramakrishnan: Database Management System , McGraw-Hill

11. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
12. Jain: Advanced Database Management System CyberTech
13. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
14. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference:

10. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
11. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
12. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

EC703E Artificial Intelligence

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Computer programming, algorithms, Turing Machine

Course Objective:

- To introduce the fundamental concepts of artificial intelligence;
- To equip students with the knowledge and skills in logic programming using Prolog
- To explore the different paradigms in knowledge representation and reasoning
- To understand the contemporary techniques in machine learning
- To evaluate the effectiveness of hybridization of different artificial intelligence techniques.

Module I-Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents [2] Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Module II-Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Module III-Search techniques [5]
Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Module IV-Heuristic search strategies [5]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Module V-Adversarial search [3]
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative
deepening.

Module VI-Knowledge & reasoning [3]
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Module VII-Using predicate logic [2]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Module VIII-Representing knowledge using rules [3]
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Module IX-Probabilistic reasoning [4]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Module X-Planning [2]
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Module XI-Natural Language processing [2]
Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Module XII-Learning [2]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module XIII-Expert Systems [2]
Representing and using domain knowledge, expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog & Lisp. [6]

Course Outcomes:
Upon completion of the subject, students will be able to:

a. understand the history, development and various applications of artificial intelligence;
b. familiarize with propositional and predicate logic and their roles in logic programming;
c. understand the programming language Prolog and write programs in declarative programming style;
d. apply and integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems;
e. explore the nature of human intelligence and its role in problem solving

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC703E	√		√			√						

Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

EC801 MOBILE COMMUNICATION

Contacts: 3L
Credits: 3
Prerequisites: Analog and Digital communication

Purpose:
The main objective of the course is to To study the concept of cellular system, GSM & CDMA mobile communication.

Instructional objectives:
Enhance specialist knowledge in the area of Wireless Communications Systems which build upon studies and the undergraduate level. Further develop improved skills of independent learning and critical appraisal. Develop an extensive insight into industrial applications and requirements; Develop critical insight of management issues relating to engineering business.

Module – I:
Cellular Mobile Wireless Networks: Systems and Design Fundamentals:
Brief introduction to mobile wireless communication and systems, Description of cellular System, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement Techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent Channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, Handoff process, different types of handoff. 6L

Characteristics of wireless channel and propagation path loss models: Different Multi-path Propagation mechanisms, Multi-path effects on mobile communication, Fading, different Types of fading, small and large scale fading, slow and fast fading, narrowband and Wideband fading, Inter symbol interference, fast fading model, Doppler effect due to Velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground Reflection model, log distance path loss model, log normal shadowing model, macro and Micro cell propagation models, types of base stations and mobile station antennas. 6L

Module – II:

Modern Mobile Wireless Communication Systems

Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (CT2), Digital European Cordless Telecommunications (DECT),

Public wide-area Wireless Networks: 1G to 3G cellular networks 2L

Multiple Access Technologies in cellular communication Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies: Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system,

Spectral Efficiency for DS-CDMA system 3L

Cellular Communication Networks and Systems Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multiframe,

Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Super frames and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber 3L

The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model 3L

Overview of CDMA systems: IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS) CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture - Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS Time Slots . 3L

Module – III:

Wireless Local Area Networks (WLAN): IEEE 802.11 Standards and Protocols

IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA

collision avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11 Distributed Coordination function (DCF) and Point coordination function (PCF), Back off algorithm, Virtual carrier sense, MAC frame format. Security and QoS issues,

WLAN applications .4L

Wireless Broadband Networks and Access Evolution of broadband wireless, IEEE 802.16 standards : **WiMAX** , Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer, IEEE 802.16 Scheduling Services, Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Non-real-time Polling Service (nrtPS), Best Effort (BE) Overview of 3G Long Term Evolution (3G LTE) for broadband wireless communication, Orthogonal Frequency Division Multiple Access (OFDMA). 3L

Module – IV:
Mobile Internet Protocol Basic Mobile IP, Mobile IP Type-MIPV4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Configuring PDP Addresses on Mobile Station, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through GPRS/UMTS PS Domain, Transparent Access, Use of Mobile IP for Non-transparent access, Dynamically accesses IP address from External Network. 3L

P.O Mapping

Course Code	*Course Title*		*Program Outcomes (POs)*										
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
EC801	MOBILE COMMUNICATION		√		√		√						

Problem analysis: Analyse the Dynamic channel
Design/development of solutions: Conducting experiments in wireless network setup
Individual and team work: Setup network among different departments and provides security
Modern tool usage: Share knowledge regarding up gradation of wireless network.

Recommended Books:
Text:
1. Wireless Communications - Theodore S. Rappaport, Prentice Hall of India,
PTR publication
2. Principles of Wireless Networks-Kaveh Pahlavan, Prashant
Krishnamurthy, PHI
Reference: 1. Wireless communication- Singhal_TMH

EC802A FPGA & Reconfigurable Computing

Contacts: 3L
Credits: 3
Aim:

Aim of the course is to provide students with the basic and intermediate level of knowledge on reconfigurable computing and FPGA. The students are able to learn the basics of reconfigurable computing and the basics of FPGA, they will also learn the VHDL language and the implementation details on FPGA and the application areas of reconfigurable computing.

Course Objective:
After completion of this course students will be able to

- ✓ State reconfigurable computing introductory concepts
- ✓ Describe reconfigurable logic devices
- ✓ Write programs using VHDL for FPGA based design
- ✓ State the configurations for reconfigurable computing
- ✓ State implementation details for reconfigurable computing
- ✓ Identify the application areas for reconfigurable computing

Module I: Introduction to Reconfigurable Computing (RC) History, State-of-the-Art and Future Trends, Computing requirements as Power, Area and VLSI scaling, Mapping of Algorithm analysis and speed-up, RC architectures- Fine Grain and Coarse Grain, Hybrid and Embedded Architectures, Supercomputers. 5L
Module II: Reconfigurable Logic Devices: FPGA and its internal architecture, computing elements, LUT, BRAM, interconnects, I/O Blocks, programming of FPGA and Syllabus for interfacing case study, ALU design, designing with embedded processors, introduction to Power PC and ARM processors. 6L
Module III: Hardware Description Language for RC: Design cycle, algorithms, Hardware Description Language, VHDL, different design styles: data flow, structural and behavioral and practical logic circuit implementation example on FPGA, debugging, writing test bench, High level synthesis and Low level synthesis. 6L
Module IV: RC Configuration: Application segmentation and Resource partitioning, spatial and temporal configuration, systolic architectures and algorithms, Bit serial, on the fly, multiplexing vs. run-time reconfiguration 4L
Module V: RC Implementation: Virtual Hardware Components (VHC) design process, high level synthesis of VHC and optimization, VHC data-path and control unit design, simulation and verification of VHC, determination of reconfigurable scheme and associated loading mechanisms (temporal and spatial partitioning) for RC. 6L
Module VI: RC applications: RC for DSP, DSP application building blocks, RC for Image processing, Bioinformatics and Network Security 5L

Course Outcome:
Outcome of this course is:
PO(in tabular form)

	a	b	c	d	e	f	g	h	i	j	k	l
EC802A		√		√		√						

Text Books:
1. M. Gokhale and P. Graham; Reconfigurable Computing: Accelerating Computation with FPGAs, Springer, 2005
2. C. Maxfield ; The design Warrior's Guide to FPGAs: Devices, Tools and Flows, Newnes, 2004

3. C. Bobda, Introduction to Reconfigurable Computing: Architectures, Algorithm and Applications, Springer, 2005

Reference Books:

1. W. Wolf , FPGA Based Systems Design, PHI, 2004
2. P. Lysagt and W. Rosenstiel, New Algorithms, Architectures and Applications for Reconfigurable Computing, Springer, 2005

EC802B Digital Image Processing

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Digital Signal Processing

Course Objectives: The objective of this course is to introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images.

Course Outline:
Module I: Review and Introduction: Introduction to the DIP areas and applications. Image Digitization: Sampling and quantization. (2)

Module II: Image Transforms: 2-D DSFT and 2-D DFT, 2-D discrete cosine transform (DCT), 1-D and 2-D Karhonen Loeve (KL) or principal component analysis (PCA) and 1-D and 2-D discrete wavelet transforms and relation to filter banks. (6)

Module III: Image Enhancement: Point and algebraic operations, edge detection and sharpening, filtering in the spatial and transformed domains. (5)

Module IV: Image Restoration: Degradation models, inverse and pseudo-inverse filtering, 2-D Wiener filtering and implementation. (3)

Module V: Image Compression and Encoding: Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding. (3)

Module VI: Feature Extraction and Segmentation: Contour and shape dependent feature extraction, textural features, region-based and feature-based segmentation. (4)

Module VII: Pattern Classification: Standard linear and Bayesian classifiers, supervised vs unsupervised classification, classification performance index. (3)

Module VIII: Applications in satellite, sonar, radar and medical areas. (4)

Course Outcome: The student should be familiar with

1. Image acquisition and representation.
2. Image transforms.
3. Image enhancement, restoration and compression schemes.

4. Image feature extraction and pattern classification.
5. Applications of image processing.

P.O Table:

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 802B		√		√		√						

Textbook:

"Digital Image Processing", R.C. Gonzalez and R.E. Woods, 3rd Edition, Prentice-Hall, 2008.
Reference: 1. "Digital Image Processing using MATLAB", R.C. Gonzalez, R.E. Woods, and S. L. Eddins, Pearson Prentice-Hall, 2004.

EC802C Satellite Communication & Remote Sensing

Contacts: 3L
Credits: 3
Prerequisites: analog and digital communication.

Course objectives: Students are able to know the art, science, and technology of obtaining reliable information about physical objects and the environment, through the process of recording, measuring and interpreting imagery and digital representations of energy patterns derived from noncontact sensor systems.

Module 1
Historical background, Basic concepts, Freguency allocation for satellite services, orbital & spacecraft problems, comparision of networks and services, modulation techniques used for satellite communication.(2) Orbits- Two body problem, orbital mechanics, geostationary orbit, change in longitude, orbital maneuvers, orbital transfer, obital perturbations. (2)

Module 2
Launch Vehicles- principles of Rocket propulsion, powered flight, Lauchvehicles for communication satellite (1) RF link- noise, the basic RF link, satellite links (up and down) , optimization RF link, intersatellite link, noise temperature, Antenna temperature, overallsystem temperature, propagation factors, rain attenuation model. Tropospheric and Ionospheric EFFECT. (5)

Module 3
Multiple access- FDMA, TDMA, CDMA techniques, comperision of multiple access techniques, error connecting codes.(5)
Satellite subsystems and satellite link design- AOCS, TT&C, power system, spacecraft antenna, transponder, Friis transmission equation, G/T ratio of earth station. (6)

Module 4
Remote Sensing:

1. Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian satellite sensing satellite system, Active, Passive, ground based andspace based remote sensing. (3)
2. Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques Alitmeter , Scatterometer, Radiometer.(9)
3. Ground based and radio oceulation techniques, spectral response of water, Sea surface temperature, wind spced, colour monitor, clouds andacrosal, water vopor, convective system, Trace gases.(7)

Course Outcome:
At the end of the course students shall familiarize with the concepts related to Satellite Communication & Remote Sensing.
P.O Table:

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 802C			√	√		√						

References:
1. Remote Sensing and GIS - B. Bhatta (oxford university press) Remote sensing of the Environment – J.R. Jenson (Pearson)
Global Navigation satellite systems - B. S. Rao (TMH)
Satellite communication – D. Roddy (TMH)
Remote Sensing - R.A. Schowengerdt (Academic press)

EC802D Smart Antenna

Contacts: 3L
Credits: 3
Prerequisites: EM Theory
Course Objective: An introduction to the theory of smart antennas, its requirements and its implementation. The techniques used to enhance capacity in wireless communication systems.
Course Outcome: The student should be familiar with

1. Need for smart antennas.
2. Beam forming networks, MIMO systems.
3. Adaptive processing using LMS algorithm, Neural networks.
4. Direction of Arrival estimation methods.
5. Implementation of smart antennas.

MODULE-I: INTRODUCTION:
Antenna Basics, Phased array antenna, power pattern, beam steering, degree of freedom, adaptive antennas, smart antennas – key benefits of smart antenna technology, wide band smart antennas, Propagation Channels 4L

MODULE-II: SMART ANTENNAS FOR WIRELESS COMMUNICATIONS:

Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input - Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios. 10L

MODULE-III: ADAPTIVE PROCESSING:
Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, Neural network approach, Adaptive beam space processing, Implementation issues. 8L

MODULE-IV: DIRECTION OF ARRIVAL ESTIMATION (DOA) METHODS:
Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, MUSIC algorithm – root music and cyclic music algorithm, the ESPRIT algorithm. 8L

MODULE-V: IMPLEMENTATION OF SMART ANTENNA SYSTEM:
DOA based beam former design using simulation and hardware. Adaptive beam forming implementation using Altera Stratix® series FPGA, QRD RLS Algorithm. CORDIC algorithm. 6L

P.O Table:

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 802D			√	√		√						

TEXT BOOKS:

1. Smart Antenna for Wireless Communication ,
T.S.Rappaport and J.C.Liberti, Prentice Hall, 1999
2. Smart Antennas,
L.C.Godra, CRC Press, 2004
3. Adaptive Filter Theory,
S. Haykin. Prentice Hall, 1985
4. Introduction to Smart Antennas,
C.A.Balanis, Morgan and Claypool, 2007

EC802E Wireless communication and networks

Contacts: 3L
Credits: 3
Prerequisites: Digital communication

Course Objective: Familiarization of students with different wireless data communication protocols. Design considerations for Wireless networks.

MODULE-I:
Cellular Mobile Wireless Networks: Systems and Design Fundamentals:

Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff. 6L

Characteristics of wireless channel and propagation path loss models:

Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell propagation models, types of base stations and mobile station antennas. 6L

MODULE-II:

Modern Mobile Wireless Communication Systems:

Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (CT2), Digital European Cordless Telecommunications (DECT), Public wide-area Wireless Networks: 1 G to 3G cellular networks 2L

Multiple Access Technologies in cellular communication

Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct-sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies:

Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-CDMA system 3L

Cellular Communication Networks and Systems Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Superframes and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber 3L

The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model 3L

Overview of CDMA systems: IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS) CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, and UMTS Time Slots 3L

MODULE-III:

Wireless Local Area Networks (WLAN): IEEE 802.11 Standards and Protocols IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA collision

avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11 Distributed Coordination function (DCF) and Point coordination function (PCF), Back off algorithm, Virtual carrier sense, MAC frame format. Security and QoS issues, WLAN applications 4L

Wireless Broadband Networks and Access: Evolution of broadband wireless, IEEE 802.16 standards : WiMAX , Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer, IEEE 802.16 Scheduling Services, Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Non-realtime Polling Service (nrtPS), Best Effort (BE) Overview of 3G Long Term Evolution (3G LTE) for broadband wireless communication, Orthogonal Frequency Division Multiple Access (OFDMA) 3L

MODULE-IV:

Mobile Internet Protocol:

Basic Mobile IP, Mobile IP Type-MIPV4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Configuring PDP Addresses on Mobile Station, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through GPRS/UMTS PS Domain, Transparent Access, Use of Mobile IP for Non-transparent access, Dynamically accesses IP address from External Network. 3L

Course Outcome:

After completion of this course the students are going to be able to understand the pertinent issues in Wireless Communication system design. The different protocols for high data-rate communications are discussed.

P.O Table:

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 802E		√	√	√								

TEXT BOOKS:

1. Wireless Networks: Applications and Protocols, T. S. Rappaport, Pearson Education
2. Wireless Communication and Networks: 3G and Beyond, I. Saha Misra, TMH Education.
3. Wireless Communications: Principles and Practice, T.S.Rappaport, PHI Learning.
4. Wireless Communications, A. Goldsmith, Cambridge University Press.

REFERENCE BOOKS:

1. Lee's Essentials of Wireless Communications, MH Prof. Med/Tech
2. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
3. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

EC802F ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Contact: 3L
Credits: 3
Prerequisites: basic idea about electronics instrument and measurement of parameters.

Course objectives: Students are able to explain the static and dynamic characteristics of an instrument , Calculate and analyze the measurement error, accuracy, precision and limiting Error, describe the basic elements of electronic instrument.

Module I
Basic Measurement Concepts:
Measurement systems – Static and Dynamic Characteristics – Units and Standards of measurements, –errors analysis, –moving iron meters, dynamometer, wattmeter– multimeter, – True rms meters– Bridge measurements, Wheatstone Bridge, Kelvin, Wein, Maxwell, Hay, Schering and Anderson Bridges. **6L**

Module II
Basic Measurement Concepts:
Electronic Multimeter ,Current measurement with analog electronic instruments. Chopper stabilized amplifier for measurement of very low voltage and currents. Cathode Ray Oscilloscopes- Block Schematic, Principles and applications. Dual Trace and Dual Beam Oscilloscopes, Digital Storage Oscilloscopes **7L**

Module III
Signal Generator and Analysis
Function Generators- RF Signal Generators- Sweep Generators – Frequency Synthesizer- Wave Analyzer- Harmonic Distortion Analyzer – Spectrum Analyzer **7L**

Module IV
Digital Instruments
Comparison of analog & digital techniques- digital voltmeter- mutlimeter – frequency counters- measurement of frequency and time interval – extension of frequency range- measurement errors.**7L**

Module V
Data Acquisition Systems
Elements of digital data acquisition system- interfacing of transducers –multiplexing – computer controlled instrumentation : IEEE 488 Bos. Optical Power Measurement, Optical Time Domain Reflectometer. **7L**

P.O Mapping:

paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC802F	√	√			√							√

(a) **Engineering knowledge:** Ability to apply the knowledge acquired in subject areas like, Basic Sciences, Engineering Sciences, Professional Subjects and Environmental Issues;
(b) **Problem analysis:** Strong foundation in theoretical/experimental work for being able to analyze, synthesize and design engineering products (eg microcontroller), processes (eg DSP/VLSI) and systems (eg Communication engineering) as desired;
(l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcome:
To be able to understand the use of static and dynamic characteristics of an instrument, Digital Instruments, Data Acquisition Systems etc.

Books:
1. Modern Electronic Instrumentation & Measurement Techniques – Albert D. Helfrick& William D. Copper, Prentice Hall of India, 2003
2. Elements of Electornics Instrumentation & Measurement, Pearson Education 2003
3. Measurement System- Application & Design – Ernest O.Doeblin, Tata McGraw Hill 2004

EC803A Advance Bio-Signal Processing and Human Machine Interaction

Contacts: 3L
Credits: 3
Prerequisites: Analog and Digital Signal Processing

Course Objective:

- Develop new methods of signal processing that extract useful information from physiologic signals.
- Advance our knowledge of patho-physiology through the investigation of behavior manifest in physiologic signals

Module 1 2L
Introductions to different bio medical signals:- Bio signal conversion systems- conversion requirement for biomedical signals – signal conversion circuits and simulators.

Module 2 3L
Origination concepts of Bio-medical signals:- Parametric investigation towards different bio signals. ECG signal characteristics – ECG analysis- time and frequency domain methods – Parametric model – Phenomenological model – linear prediction theory – Autoregressive method.

Module 3 5L
Introduction to mathematical analysis on ECG, EMG, EOG, EEG Signals:- Adaptive filters – Principle noise canceller model – 50 Hz adaptive cancelling using a sine wave model– Maternal ECG cancellation in fetal electrocardiography – ECG,EMG,EEG,EOG recording technique – High frequency noise cancellation in Electrosurgery. Signal averaging –Basics and limitations.

Module 4 4L
Advance digital signal processing towards bio signals- Discrete Fourier Transform(DFT) – Properties – circular and sectioned convolution – Filtering long duration sequences – FFT computation using DIT and DIF algorithms .Wavelet Transformation, Mathematical approach of Bilinear transform and others transform.

Module 5 5L

Bio Signal Processing:- ECG QRS detection Techniques – Estimation of R-R interval – Estimation of ST segment inclination – Arrhythmia analysis monitoring– Long term ECG recording – Basics of ECG data reduction techniques. EMG, EEG and EOG processing technique through MATLAB Simulator.

Module 6 5L

Bio Signal filtration concept:- FIR design: Windowing techniques – Need and choice of Windows – Linear phase Characteristics. IIR design: Analog filter design – Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation, Warping, prewarping – Frequency transformation, IIR design and its application towards bio signals.

Module 7 3L

Different simulative platform transformation technique for bio signals.(MATLAB, Origin etc.)

Module 8 4L

Introduction of approach towards Human Machine interaction. Review study on Human-Computer Interaction, Concept of interpretation technique for different bio signal. Concept of different delicate sensor and transducer used to collect bio signal, Application based study on Bio-signal.

Course Outcomes:

We expect that our graduates will have an:

1. Understanding of biology and physiology as related to biomedical engineering needs
2. Ability to apply knowledge of advanced mathematics (including differential equations and statistics), sciences, and engineering to solve problems at the interface of engineering and biology and to model biological systems
3. Ability to design and conduct experiments, including making measurements and interpreting experimental data from living systems and addressing the problems associated with the interaction between living systems and non-living materials and systems
4. Ability to identify, formulate and solve biomedical engineering problems
5. Ability to design systems or processes to meet desired needs
6. Ability to function on diverse teams and provide leadership
7. Understanding of professional and ethical responsibility and the impact of engineering in our global society
8. Ability to communicate by oral, written and graphic modes
9. Recognize the need for and engage in life-long learning
10. Liberal education to provide knowledge of contemporary issues.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC 803A			√	√		√						

EC803B Renewable Energy

Contacts: 3L
Credits: 3
Prerequisites: Knowledge in Opto-Electronic Devices, Photovoltaic Effect
Course Objective:

1. To harness the environment friendly RE sources and to enhance their contribution to the socio-economic development.
2. To meet and supplement rural energy needs through sustainable RE projects.
3. To provide decentralized energy supply to agriculture, industry, commercial and household sector.
4. To supplement efforts in bridging the gap between demand and supply of power, with renewable energy sources and strengthening the grid system and evacuation arrangements for RE projects.

To support efforts for developing, demonstrating and commercializing new and emerging technologies in the RE sector, and to this end, help establish linkages with national and international institutions for active collaboration.

Module I
Classification of Energy Sources (2) Advantages of Non Conventional Energy Sources over Conventional Sources Economics, Impact on Environment Electricity Generation from Non Conventional Energy Sources.

Module II
Solar Energy: (12) Solar radiation and its Characteristics, Solar Collector: flat Plate, focusing, Solar Energy use for water heating, Solar thermal power generation, Hybrid solar power Principle of energy conversion in solar cells, Photovoltaics, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array, Efficiency and cost of PV systems.

Module III
Wind Energy: (7) Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines.

Module IV
Hydel Energy: (2) Electricity generation from micro hydel plants, location, auxiliaries and associated problems.
Bio Energy: (4) Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier. co generation Bio diesel; (2) Sources, usability and advantages over mineral product.

Module V
Tidal Energy: Principle, selection of site, Economics and future prospect (2) Wave Energy: Principle , selection of site and future prospect (2) Geo thermal Energy: Principle , location , economics and prospect (2)

Module VI
Fuel Cells: (5) Principle of fuel cells, Different types of fuel cells, advantages and limitations Magneto hydrodynamics energy conversion: (2) Principle, Economics and environmental aspect of MHD generation.

Course Outcome:
Students will be able to display advanced understanding of relevant scientific theories, ideas, methodologies and the newest technologies in renewable energy science, and use this new required knowledge to excel in their professional development.

Paper code	a	b	c	d	e	f	g	h	i	j	k	l
EC 803B		√	√						√			

Problem analysis: Analyze performance of a solar cell system
Design/development of solutions: Conducting experiments in Non Conventional Energy Sources over Conventional Sources Economics.
TEXT BOOKS:

- Alternative Energy: Political, Economic, and Social Feasibility
- The Clean Tech Revolution
- Clean Tech Nation: How the U.S. Can Lead in the New Global Economy (2012) by Ron Pernick and Clint Wilder
- Climate Change and Global Energy Security
- Deploying Renewables 2011 (2011) by the International Energy Agency

EC803C Material Science & Engineering

Contacts: 3L
Credits: 3

Prerequisites: Solid State devices, Analog Electronics, Electro-Magnetic wave theory

Course Objective: The aim of this subject is to develop a thorough understanding of the main concepts, techniques and performance criteria used in the analysis and design of optical communication systems. Such systems lie at the heart of the information and communication technologies (ICT) that underpin modern society. Optical communications have become the preferred option for many communication devices, due to their robustness to noise, ease of standardisation and increased scale of integration.

Module I
Structure of Solids : Atoms and their binding, Bonds, Crystal Systems, Bravais LatticeMiller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Lattice defects-Qualitative ideas of point, line, surface and volume defects. [5]

Module II

Dielectric Propertise : Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications. [4]

Module III

Magnetic Properties: Elementary ideas of classification of magnetic materials– Diamagnetism, Paragnetism, Ferrognetism, Ferrimagnetism, Magnetic Domains. [2] Superconductors: Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Haed and Soft Materials, SQUID. [3] Optical properties: Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects. [3]

Module IV

Materials for Optical Communication: LED and Laser Materials, Optical Fibre. [3] Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magneto-electronic Materials, CD, DVD, CCD. [5] Materials for Display Devices: CRT, LED, LCD, TFT, Plasma Display. [3] Advanced Materials: Metallic Glasses, Nano-materials, etc. [2]

P.O TABLE

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC803C	√		√						√			

P.O STATEMENT

1. Engineering knowledge: Ability to apply knowledge of basic science and engineering fundamentals
2. Problem analysis: Ability to undertake problem identification, formulation and solution
3. Design/development of solutions: Ability to utilise a systems approach to design and operational performance
4. Modern tool usage: In-depth technical competence in at least one engineering discipline
5. Communication: Capacity for independent critical thought, rational inquiry and self-directed learning

Course Outcome: Having completed this subject the student is expected to:

1 Understand the various blocks that constitute a optical communication system and understand how they interrelate.
2 Be able to qualitatively and quantitatively analyse and evaluate optical communication systems.
3 Recognise the broad applicability of solid state devices in society.
4 Use software tools to analyse, design and evaluate optical communication systems

Books:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)

5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)
6.Optical Fiber Communication- John M Senior

EC803D Computer Architecture

Contacts: 3L
Credits: 3
Prerequisites: Basic Electronics, Introduction to Computing, Digital Electronic

Course Objective: Computer Architecture is the design and internal organization of a computer system to meet its requirements, as efficiently as possible, within technology and cost constraints. Computer architecture addresses all levels of the computer system, from the core, to the chip, to the board, to the whole system and its interconnect. Finding the right balance in the design and proposing new design alternatives are key tasks of the computer architect.

Module 1: Computer Organization & Architecture, Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture, ALU designs [combinational ALU & sequential ALU], Instruction set: Instruction format & types. [8L]

Module 2: Memory Organization: Memory system overview, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, mapping and management techniques, memory replacement policies [10L]

Module 3: CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture. [4L]

Module 4: Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD, SIMD, MISD, MIMD architectures, and Pipeline optimization techniques. [7L]
Module 5: Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors. [6L]

Module 6: Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioural & mixed style modeling techniques. [3L]

Course Outcome:

- Students will come to know about basic of computer organization & architecture.
- Students will come to know about basic of computer memory structure & different mapping technique.
- Students will come to know about different CPU architecture & Processor-memory communication technique.

- Students will come to know about pipelining architecture.
- Students will come to know about parallelism.
- Students will come to know about VHDL programming techniques
- This course is a formidable prerequisite for the course Operating System, Embedded System to be offered in the subsequent semester.

P.O Table:

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC803D		√		√		√						

Text & Reference books:

1. William Stallings —" Computer Organization & Architecture Designing for performance" , 8/e , Pearson
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky —"Computer Organization", 5/e, MGH
3. Mano M.M—"Computer System Architecture", 3/e,Pearson
4. Kai Hwang & Naresh Jotwani-- " Advanced Computer Architecture Parallelism, Scalability,Programmability",2/e, MGH
5. Pedroni---"Circuit Design And Simulation With VHDL", 2/e, PHI

EC803E Robotics

Contacts: 3L
Credits: 3
Prerequisites: Basic idea of Control System including Feedback control systems, Some idea of machine learning and some familiarity with MATLAB is required.

Course objectives:

• To introduce the basic concepts, parts of robots and types of robots.
• To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
• To discuss about the various applications of robots, justification and implementation of robot.

Module I- Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D Alembert Equations of Motion, Synthesis of elements with modularity constraints,manipulations-trajectory planning,joint interpolated trajectories. [15L]
Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Moluie Robots. [6L]

Module II-Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques,Imaging Geometry, Segmentation Recognition & Interpretation. [8L]
Robot Programming Language Characteristics of Robot Level & Task Level languages. Robot intelligence-State Space search, Robot learning,Robot Task Planning,Knowledge Engineering. [10L]

Course Outcomes :

The Student must be able to design automatic manufacturing cells with robotic control using

the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

PO Table

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l
EC803E	√			√		√						

PO Statement

1. Engineering knowledge: Apply the knowledge of Control Systems with feedback, and an engineering specialization to the solution of Construction of Robots.
3. Design/development of solutions: Design solutions for robots and design system components or processes that meet the specified needs for sensing by robots with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling Robotics solutions

References:

1. K.S Fu R.C . CSG Lee-Robotics Control,Sensing, Vision & Intelligence,McGraw-Hill.
2. M.P. Groover,M.Weins,R.N. Nagel,N.C. Odrey –Industrial Robotics,McGraw Hill
3. Andrew C.Straugard-Robotics & AI,PHI
4. S. Sitharama Iyengar,Alberto Elefes-Autonomous Mobile Robots Control,Planning & Achitecture,IEEE Computer Society Press