SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

Course Curriculum of 4-Year B.Tech. Degree Programme in Electrical Engineering (Batch: 2018-22)

Credit Structure

B.Tech. Core		B.Tech. Elective	
Category	**Credits**	**Category**	**Credits**
Departmental Core Subjects	122	Departmental Electives	9
Humanities & Basic Sciences Subjects	36	Open Electives	13
Management Subjects	2		
Total	160	Total	22
		Grand Total	182

Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week
1	I	21	25
2	II	22	27
3	III	26	31
4	IV	25	29
5	V	24	28
6	VI	24	28
7	VII	27	32
8	VIII	13	17
	Total	182	--

Course Structure: B.Tech. 2018-22

Semester - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CE-151	Engineering Mechanics	3	1	0	4
2	ME-151	Engineering Drawing & Computer Aided Drafting	0	1	1	2
3	ME-152	Manufacturing Practice	0	0	1	1
4	HU-153	Professional Communication - I	2	0	0	2
5	CH-154	Chemistry – I	3	0	1	4
6	MA-151	Mathematics – I	3	1	0	4
7	PH-151	Physics – I	3	0	1	4
					Total Credits	21
8	EP-199	Endeavour Project (Beyond the Syllabus)				
					Total Contact hours/week	25

Semester - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CS-152	Introduction to Computers & Programming	2	0	2	4
2	EC-152	Basics of Electrical & Electronics Engineering	3	0	1	4
3	HU-154	Professional Communication- II	1	1	0	2
4	CH-155	Chemistry – II	3	0	1	4
5	MA-152	Mathematics- II	3	1	0	4
6	PH-152	Physics- II	3	0	1	4
					Total Credits	22
7	EP-199	Endeavour Project (Beyond the Syllabus)				3
					Total Contact hours/week	27

Semester – III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-251	Signals & Networks	3	1	1	5
2	EE-252	Electrical Technology	3	1	1	5
3	EC-262	Electronics Devices & Circuits	3	1	1	5
4	CS-261	Fundamentals of JAVA Programming	3	0	2	5
5	HU-251	Business & Technical Communication	1	1	0	2
6	MA-251	Mathematics-III	3	1	0	4
					Total Credits	26
7	EP-299	Endeavour Project (Beyond the Syllabus)				
					Total Contact hours/week	31

Semester - IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-253	Measurements & Electronic Instrumentation	3	1	1	5
2	EE-254	Electrical Machine	3	1	1	5
3	EE-255	Industrial Instrumentation	3	0	1	4
4	EC-257	Signals & Systems	3	1	0	4
5	EC-258	Digital Electronic Circuits & Applications	3	1	1	5
6	XX-XXX	Open Elective – I	X	X	0	2
					Total Credits	25
7	EP-299	Endeavour Project (Beyond the Syllabus)				3
					Total Contact hours/week	29

Semester - V

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-351	Control Systems Engineering	3	1	1	5
2	EE-352	Power Systems	3	0	1	4
3	EE-353	Power Electronics	3	1	1	5
4	EE-354	Utilization of Electrical Power	3	0	0	3
5	EC-352	Digital Signal Processing	3	1	1	5
6	XX-XXX	Open Elective – II	X	X	0	2
					Total Credits	24
7	EP-399	Endeavour Project (Beyond the Syllabus)				
					Total Contact hours/week	28

Semester - VI

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-355	Advanced Electrical Machines	3	1	0	4
2	EE-356	Electric Drives	3	0	1	4
3	EE-357	Power System Analysis & Operation	3	1	0	4
4	EE-358	Control & Electronic System Design	0	0	2	2
5	EC-357	Embedded Systems	3	0	1	4
6	EE-3XX	Departmental Elective – I	3	0	0	3
7	EE-3XX	Departmental Elective – II	3	0	0	3
					Total Credits	24
8	EP-399	Endeavour Project (Beyond the Syllabus)				3
					Total Contact hours/week	28

Semester - VII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-451	Power Apparatus & System Design	3	0	1	4
2	EE-452	HVDC & FACTS	3	0	1	4
3	CS-463	Programming Concepts	0	0	1	1
4	EE-450	Summer Internship	-	-	-	3
5	EE-455	Comprehensive Viva Voce	-	-	-	2
6	EE-460	Minor Project	0	0	3	3
7	IN-454	Internet of Things	0	0	3	3
8	HU-451	Interview Skills	0	0	1	1
9	MA-454	Quantitative Aptitude	0	1	0	1
10	BM-451	Ethics & IPR	2	0	0	2
11	XX-XXX	Open Elective – III	3	0	0	3
					Total Credits	27
12	EP-499	Endeavour Project (Beyond the Syllabus)				
					Total Contact hours/week	32

Semester - VIII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-4XX	Departmental Elective – III	3	0	0	3
2	EE-470	Major Project	0	0	4	4
3	XX-XXX	Open Elective – IV	3	0	0	3
4	XX-XXX	Open Elective – V	3	0	0	3
					Total Credits	13
5	EP-499	Endeavour Project (Beyond the Syllabus)				3
					Total Contact hours/week	17

List of Departmental Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-365	Power Systems Transients & Protection	3	0	0	3
2	EE-366	High Voltage & Insulation Engineering	3	0	0	3
3	EE-367	Machine Analysis	3	0	0	3

List of Departmental Elective(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-368	Industrial Application of High Voltage Engineering	3	0	0	3
2	EE-369	Control Theory	3	0	0	3
3	EE-370	Advance Machine Drives	3	0	0	3

List of Departmental Elective(s) - III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	EE-456	Advanced Power Electronic Converters	3	0	0	3
2	EE-457	Advanced Power System	3	0	0	3
3	EE-458	Non Linear Control	3	0	0	3

List of Open Elective(S) - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	HU-252	Language through Literature & Films	0	2	0	2
2	BM-270	Foundations of Economic Science	2	0	0	2

List of Open Elective(S) - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	HU-351	Fun with Drama	0	2	0	2
2	BM -370	Marketing Management	2	0	0	2

List of Open Elective(S) - III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-471	Bioprocess Technology	3	0	0	3
2	CE-462	Air Pollution & Industrial Waste Management	3	0	0	3
3	CS-462	Management Information Systems & E-Commerce	3	0	0	3
4	EC- 475	Computer Networks	3	0	0	3
5	EE-465	Energy Conversion Process	3	0	0	3
6	MA -451	Probability Theory	3	0	0	3
7	ME-465	Solar Energy & Applications	3	0	0	3
8	PH-451	Nanotechnology	3	0	0	3
9	PH-453	Chaos in Engineering System	3	0	0	3

List of Open Elective(S) - IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-475	Bioremediation Technology	3	0	0	3
2	CE-464	Environmental Management	3	0	0	3
3	CS-459	Statistical Simulation & Data Analysis	3	0	0	3
4	EC-473	Robotics & Automation	3	0	0	3
5	ME-466	Power Generation & Economics	3	0	0	3

List of Open Elective(S) - V

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-472	Bioelectronics &Biosensors	3	0	0	3
2	CS-461	Soft Computing	3	0	0	3
3	EE-466	Hydro Power Generation	3	0	0	3
4	MA-453	Mathematical Statistics	3	0	0	3
5	ME-467	Total Quality Management	3	0	0	3
6	PH-455	Electromagnetic Theory & Application	3	0	0	3

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Semester - I

(Departmental Core Subject)

CE-151	L-T-P-C
Engineering Mechanics	3-1-0-4

Objective: *The subject deals with the concepts of static & dynamic systems involving kinematic & dynamic analysis.*

Course Content

Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram; Reaction; Static indeterminacy. Structures: Difference between trusses, frames & beams, Assumptions followed in the analysis of structures; 2D truss; Method of joints; Method of section; Frame; Simple beam; types of loading & supports; Shear Force & bending Moment diagram in beams; Relation among load, shear force & bending moment. Friction: Dry friction; Description & applications of friction in wedges, thrust bearing (disk friction), belt, screw, journal bearing (Axle friction); Rolling resistance. Virtual work & Energy method: Virtual Displacement; Principle of virtual work; Applications of virtual work principle to machines; Mechanical efficiency; Work of a force/couple (springs etc.); Potential energy & equilibrium; stability. Center of Gravity & Moment of Inertia: First & second moment of area; Radius of gyration; Parallel axis theorem; Product of inertia, Rotation of axes & principal moment of inertia; Moment of inertia of simple & composite bodies. Mass moment of inertia. Kinematics of Particles: Rectilinear motion; Curvilinear motion; Use of Cartesian, polar & spherical coordinate system; Relative & constrained motion; Space curvilinear motion. Kinetics of Particles: Force, mass & acceleration; Work & energy; Impulse & momentum; Impact problems; System of particles. Kinematics & Kinetics of Rigid Bodies: Translation; Fixed axis

rotational; General plane motion; Coriolis acceleration; Work-energy; Power; Potential energy; Impulse-momentum & associated conservation principles; Euler equations of motion & its application.

Text/Reference Books

1. Engineering Mechanics: Statics and Dynamics. Shames I. H. 4th Ed. PHI. 2002.
2. Engineering Mechanics. Vol I - Statics, Vol II - Dynamics. Meriam J. L. & Kraige L. G. 5th Ed. John Wiley. 2002.
3. Engineering Mechanics. Vol. I & II. Hibbler R. C. Pearson Press. 2002.

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Semester - I

(Departmental Core Subject)

ME-151 L-T-P-C
Engineering Drawing & Computer Aided Drafting 0-1-1-2

Objective: *Engineering drawing is a visual language of an engineer. It permits students to convert an object into its visual representation.*

Course Content

Importance of engineering drawing; Conventions & standards: ISO; Scales; Curves; Orthographic projections : points, lines, planes & solids; Sections of solids; Isometric projections; Development of surfaces; Intersection of solids.

List of Experiments

1. Introduction to Engineering Graphics, Sheet Layout, instruments, BIS standards, Lines, Lettering & Dimensioning
2. Scales -Types of Scales-Plain Scale, Diagonal scale, vernier scale
3. Curves- conic sections, ellipse, parabola, hyperbola, cycloid, epicycloid, hypocycloid
4. Orthographic Projections-Introduction, multi-view projection system, orthographic views, Methods of multi-view projections, projecting side views, Sectional Views
5. Projection of Points -Introduction, position of points in I, II, III & IV quadrant
6. Projection of Lines & Auxiliary projections-, Line inclined to one plane & parallel to the other-Line inclined to both the planes. Projection on auxiliary planes
7. Projection of Planes- Introduction, Perpendicular & parallel to the reference planes Projections of planes inclined to one reference plane & perpendicular to the other, plane inclined to both ref. planes

8. Projection of solids with axes inclined to one of the reference plane & parallel to the other
9. AUTOCAD- Fundamentals of 2-D, Drawing & Edit commands. Draw 2D& 3D object drawing
10. Section of Solids- Sections of prisms, pyramids, cone cylinder
11. Development of Surfaces- Methods of development-Cube, prisms, pyramids, cone cylinder
12. Intersection of Surfaces- Line method-cutting plane method, Intersection of two prisms- Intersection of cylinder & cylinder
13. Isometric Projection- Isometric axes lines & planes, Isometric Scale, Isometric views of standard shapes, solids

Text/Reference Books

1. Engineering Drawing. Dhananjay A.J. Tata McGraw-Hill. 2008
2. Engineering Drawing. Bhatt N. D. & Panchal V.M. 43rd Ed. Charator Publishing House. 2001.
3. Engineering Drawing. Shah M. B. & Rana B. C. 2nd Ed. Pearson Education. 2009.
4. Graphic Science and Design. French T. E., Vierck C. J. & Foster R. J. 4th Ed. McGraw-Hill. 1984.
5. Fundamentals of Engineering Drawing. Luzadder W. J. & Duff J. M. 11th Ed. PHI. 1995.
6. Engineering Drawing and Graphics. Venugopal K. 3rd Ed. New Age International. 1998.

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Semester - I

(Departmental Core Subject)

ME-152 L-T-P-C
Manufacturing Practices 0-0-1-1

Objective: *This course is intended to impart basic knowledge of various hand tools & their usage in different sections of manufacturing; including Carpentry, Fitting, House wiring, Black smithy, Tin smithy.*

List of Experiments

1. Demonstration of the manufacturing practices, workshop safety, trades, tools, experiments
2. Measurement of the dimensions of a given job using precision instruments
3. Fabrication of a fitting job with drilling & tapping of a hole
4. Preparation of a funnel with spout as per drawing from 30 SWG. G.I sheet. Joints to be soldered with the soldering iron
5. Fabrication of a T-half lap joint & T-bridle joint
6. Preparation of a wooden patterns as per given drawings
7. Preparation of a mould for a given wooden pattern
8. Preparation of an aluminum casting with the help of a given wooden pattern

Text/Reference Books

1. Elements of Workshop Technology-Vol. I. Choudhury H. Asia Publishing House. 1986.
2. All About Machine Tools. Gerling H. New Age International. 1995.
3. Workshop Technology. Chapman W. A. J. Oxford IBH. 1975.
4. Lab Manual on Manufacturing Practice Lab. Dept. of Mech. Engg. SPSU.

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Semester - I

(Humanities & Basic Sciences Subject)

HU-153	L-T-P-C
Professional Communication - I	2-0-0-2

Objective: *To develop communicative competence.*

Course Content

Communication: Importance of effective communication skills, Objectives & Process of communication; Types of communication: Verbal & non-verbal; Channels of communication, Media of communication; Barriers to communication: Physical, Psychological, Mechanical, Linguistic & Cultural; Types of listening, Principles of effective listening

Word Power: Words often misspelt, One word substitute, Use of idiomatic expressions & phrases

Time & Stress Management: Planning, Scheduling & Prioritizing, Multitasking, Delegating; Saying no assertively; Stress & its causes, Barriers to stress management & Handling stress

Text/Reference Books

1. Technical Communication. Raman M. & Sharma S. Oxford University Press. 2004.
2. Essentials of Business Communication. Pal R. & Korlahalli J. Sultan Chand & Sons. 2011.
3. Word Power Made Easy. Lewis N. 2nd Ed. Goyal Publisher. 2011.

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Semester - I

(Humanities & Basic Sciences Subject)

CH-154	L-T-P-C
Chemistry - I	3-0-1-4

Objective: *The subject deal with the concepts related to Physical chemistry & develops a scientific attitude by means of distinguishing, analyzing & solving various engineering problems. It also provides in-depth knowledge of thermodynamics, quantum chemistry, chemical kinetic, corrosion & colloids.*

Course Content

Concept of Thermodynamic system: Definition with example of di thermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. Heat Capacity**:** Definition, Classification of Heat Capacity (Cp & Cv): Definition & General expression of Cp - Cv. Expression of Cp - Cv for ideal gas. Reversible & Irreversible processes: Definition, Work done in Isothermal Reversible & Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V& T), slope of P-V curve in adiabatic & isothermal process. Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier & Laplace, Hess's law of constant heat summation, Kirchhoff's law.2nd law of thermodynamics: Statement,

Mathematical form of 2nd law of thermodynamics (Carnot cycle).Joule Thomson & throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature. Evaluation of entropy: characteristics & expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. Work function & free energy: Definition, characteristics, physical significance, mathematical expression of ΔA & ΔG for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation. Condition of spontaneity & equilibrium reaction, Chemical potential, Real gas, Real Solution, Cell EMF & its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell, quinhydrone half-cell & calomel half-cell (construction, representation, cell reaction, expression of potential, Discussion, Application)Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application).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. Corrosion - basics & impacts, Reaction laws: rate & order; molecularity; zero, first & second order kinetics. Pseudounimolecular reaction, Arrhenius equation. Mechanism & theories of reaction rates (Transition state theory, Collison theory: Steady state approximation, Rate determining state approximations, Bohr's theory & its limitations, de-Broglie relation, Heisenberg Uncertainty principle, Schrodinger equation, Schrodinger equation for hydrogen atom in Cartesian coordinate & polar coordinates, Significance of four quantum numbers, shape of s, p & d atomic orbitals, discovery of spin, spin quantum number & magnetic quantum number. Rules for filling electrons in orbitals, stability of half & completely filled orbitals, relative energies of atomic orbitals, anomalous electronic configurations, The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physio sorption, & chemisorption.

List of Experiments

1. Determination of water hardness by complexometric titration.
2. Determination of total alkalinity of water sample.
3. Determination of chloride ion in water sample by Argentometric method.

4. Determination of total dissolved oxygen content in water sample by Wrinkler's method.
5. Copper sulfate estimation by iodometric titration.
6. Potassium dichromate estimation by iodometric titration.
7. Redox titration: Estimation of FAS by internal & external indicators.
8. Gravimetric analysis: Estimation of Ba as $BaSO_4$
9. Gravimetric analysis: Estimation of Ag as AgCl
10. pH metric measurements: Determination of strength of unknown HCl solution by pH metric titration.

Text/Reference Books

1. Physical Chemistry. Atkins P. W.5th Ed. ELBS. 1994.
2. Physical Chemistry. Levine I. A. 4th Ed. McGraw-Hill.1995.
3. Quantum Chemistry. Levine I. A. 2nd Ed. Prentice Hall. 1995.
4. Introductory Quantum Chemistry. Chandra A.K.4th Ed. Tata McGraw-Hill. 1994

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Semester - I

(Humanities & Basic Sciences Subject)

MA-151	L-T-P-C
Mathematics - I	3-1-0-4

Objective: *To develop an understanding of the fundamental concepts of the calculus, differential equations & linear algebra to connect them with real world problems from other disciplines along with the development of mathematical reasoning & problem solving abilities.*

Course Content

Differential Calculus (Functions of one variable): Taylor's & Maclaurin's theorems with remainders, concavity & convexity of a curve, points of inflexion, asymptotes & curvature.

Differential Calculus (Functions of several variables): Partial derivatives & their geometrical interpretation, derivatives of composite & implicit functions, Euler's theorem on homogeneous functions, harmonic functions, Taylor's expansion of functions of several variables, maxima & minima - Lagrange's method of multipliers.

Integral Calculus**:** application to length, area, volume & surface area of revolution. Multiple integrals with applications to: volume, surface area & moments of inertia.

Ordinary Differential Equations**:** Solution of dy/dx = f(x, y); linear differential operator L, higher order ordinary differential equations with constant coefficients.

Matrix Algebra**:** Rank & inverse of a matrix, consistency of linear system of equations; Eigen values, Eigen vectors & their applications to system of ordinary differential equations; Cayley-Hamilton theorem; Diagonalization of matrices.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Calculus and Analytic Geometry. Thomas G. B. & Finney R. L. 9th Ed. Addison-Wesley. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2010.
5. Calculus - Vol.2. Apostol T. M. 2nd Ed. Wiley .2003.
6. Higher Engineering Mathematics. Grewal B.S. 42ndEd.Khanna Publishers. 2012.

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Semester - I

(Humanities & Basic Sciences Subject)

PH-151	L-T-P-C
Physics - I	3-0-1-4

Objective: *Objective of this course is to introduce concepts of electrostatics & magnetostatics leading to the Maxwell's electromagnetic waves & understanding the wave nature of light using various optical phenomena like interference, diffraction & polarization. The particle nature of electromagnetic wave will also be introduced*.

Course Content

Gauss law & its applications in electrostatics in vector form, electric polarization, permittivity, energy density in an electric field, Ampere's law, charged particle motion in E & B fields, magnetization, Faraday's law of electromagnetic induction; Equation of continuity, generalized Ampere's law, Maxwell's equations, wave equation, plane wave solutions, electromagnetic wave propagation in dielectrics & conductors, reflection/refraction, polarization, interference, diffraction of EM waves Origin of quantum hypothesis, de Broglie's hypothesis of matter waves, Uncertainty principle, Wave function & wave mechanics, Schrodinger equation, QM operators, Expectation value, one-dimensional solutions: zero potential, step potential, potential barrier & potential well.

List of Experiments

1. Determination of wavelength of sodium light source using Newton's Ring Method
2. Determination of wavelength of monochromatic light source using Fresnel's Biprism

3. Determination of the wavelength of monochromatic light using Michelson Interferometer
4. Determination of wavelength of laser using single slit diffraction
5. Determination of the wavelength of prominent lines of mercury using plane transmission grating
6. Determination of specific rotation of sugar solution using Polarimeter
7. Determination of Refractive index & dispersive power of prism material using spectrometer
8. Verification of the Biot Savart's law
9. Study of variation of magnetic field along the axis of a circular coil & determination of the radius of the coil
10. Determination of frequency of AC mains using Sonometer
11. Determination of the characteristic constant or ballistic constant of a ballistic galvanometer

Text/Reference Books

1. Elements of Electromagnetics. Sadiku M. N. O. 6th Ed. Oxford. 2014.
2. Optics. Ghatak A. Tata McGraw-Hill Publishing Company Ltd. 2005.
3. Electromagnetics. Laud B.B. 2nd Ed. New Age International (P) Ltd. 1987.
4. Classical Electrodynamics. Jackson J.D.3rd Ed. Wiley. 1998.
5. Foundations of Electromagnetic Theory. Reitz J.R., Milford F.J. & Christy R. W. 4th Ed. Narosa Pub. House. 2008.
6. Fundamentals of Optics. Jenkins F. A. & White H. E. 4th Ed. McGraw-Hill International Editions. 2001.

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Semester - II

(Departmental Core Subject)

CS-152 L-T-P-C
Introduction to Computers & Programming 2-0-2-4

Objective: *This course is an introductory course of computer science. It provides basic insight into the building blocks of a modern day computer & the newest peripherals attached with it. In addition to this, the students will be delved into the basic programming concepts of a high level language.*

Course Content

Introduction to computer architecture: memory, ALU, CPU, I/O devices. Introduction to system software: operating systems, compilers & multi-user environments. Concept of an algorithm. Introduction to the design & implementation of correct, efficient & maintainable programs. Use of high level programming language for the systematic development of programs.

List of Experiments

1. Basic & calculation based programs
2. Conversion based programs
3. Decision making statement & operator based programs
4. Loop based programs
5. Multi way decision making statement based programs
6. Array based programs
7. Strings based programs
8. Function based programs

9. Structure based programs
10. Pointers based programs
11. File handling based programs

Text/Reference Books

1. A Book on C. Kelly A. & Pohl I. 4th Ed. Pearson Education. 1999.
2. The C Programming Language. Kernighan B. & Ritchie D. 2nd Ed. Prentice Hall of India. 1988.
3. C: The Complete Reference. Schildt H. 4th Ed. Tata McGraw-Hill. 2000.

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Semester - I

(Departmental Core Subject)

EC-152 L-T-P-C
Basics of Electrical & Electronics Engineering 3-0-1-4

Objective: *The aim of this course is to develop an understanding of the basics of electrical & electronics components, circuits & systems, operation of transformers & other electrical machines.*

Course Content

Circuit Analysis Techniques: Circuit elements, Simple RL & RC Circuits, Ohm's law, Kirchoff's laws, Nodal Analysis, Mesh Analysis, Linearity & Superposition, Source Transformations, Thevnin's & Norton's Theorems, Phasor Relationship for R, L & C, Impedance & Admittance, Phasor Diagrams, Response as a function of ω.

Diodes & Transistors: Semiconductor Diode, Zener Diodes, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors, Field-Effect Transistors.

Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer.

Logic Gates: Number Systems & Codes, Logic Gates, Boolean Theorems, De Morgan's Theorems, Sum-of Product Form, Algebraic Simplification, Karnaugh Map Method.

Introduction to Transformers & AC Machines: Ideal Transformer, Circuit Model of Transformer, Efficiency, Three Phase Induction Motor.

Introduction to Fractional-kW Motors & DC Machines: Single Phase Induction Motors, DC Generator & DC Motor.

List of Experiments

1. Study & Verification of Kirchoff ’s Current Law
2. Study & Verification of Kirchoff ’s Voltage Law
3. Study & Verification of Thevenin’s Theorem for dc network
4. Study & Verification of Norton’s Theorem for dc network
5. Study & Verification of R-C series circuit & determination of phase angle
6. Study of the volt-ampere (V-I) characteristics for Silicon P-N Junction diode
7. Study of the volt-ampere (V-I) characteristics for a Zener diode
8. Study of the input & output characteristics for a transistor in common base configuration
9. Verification of Truth Table for basic & universal logic gates
10. Determination of copper loss & core loss for a single phase transformer through O/C-S/C Test

Text/Reference Books

1. Engineering Circuit Analysis. Hayt W.H. & Kemmerly J.E. McGraw-Hill. 1993.
2. Circuits, Devices and Systems. Smith R.J. & Dorf R.C., John Wiley & Sons.1992.
3. Electronic Devices and Circuit Theory. Boylestad R.L. & Nasheisky L. 6th Ed. PHI. 2001.
4. Digital Systems. Tocci R.J. 6th Ed. PHI. 2001.
5. Electrical Engineering Fundamentals. Del T. V. PHI. 1994.
6. Circuit Theory (Analysis and Synthesis). Chakrabarti A. Dhanpat Rai & Co. 2001.
7. Network Analysis. Valkenburg M. E. V. 3rd Ed. Prentice Hall of India, 2003.

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Semester - II

(Humanities & Basic Sciences Subject)

HU-154 L-T-P-C
Professional Communication - II 1-1-0-2

Objective: *To build interpersonal skills & communicate effectively.*

Course Content

Business Meetings: Notice, Agenda, Minutes of Meeting

Group Discussions: Classification of GD topics; GD as a part of the selection process; GD phases; Non-verbal communication in GD, Do's & don'ts of GD.

Professional Mannnerisms & Grooming: Kinesics, Office etiquette; Telephone skills, Netiquette

SWOT, Résumé, Cover letter writing, Job Acceptance Letter.

Goal setting: Significance, Progressive steps to achieve goals; Anticipating career challenges & utilizing opportunities.

Text/Reference Books

1. Foundations of Business Communication: An Integrative Approach. Young, D. McGraw Hill Education. 2005.
2. How to Succeed in Group Discussions and Personal Interviews. Mandal S. Jaico Publishers. 2004.
3. Business Communication: Connecting in a Digital World (SIE). Lesikar, R. & Pande, N. McGraw Hill Education. 2015.

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Semester - II

(Humanities & Basic Sciences Subject)

CH-155 L-T-P-C
Chemistry - II 3-0-1-4

Objective: *This course aims at understanding various concepts of inorganic & organic chemistry, broad spectrum knowledge of chemical bonding, organic reaction mechanism, stereochemistry, spectroscopy, polymer science, green chemistry & environmental pollution studies.*

Course Content

Bonding Models in Inorganic Chemistry- Introduction, Ionic bonding: Introduction to stoichiometric defects (Schottky & Frenkel) & non – stoichiometric defects (Metal excess& metal deficiency).Role of silicon & germanium in the field of semiconductor. Valence shell Electron Repulsion Theory (VSEPR). Discussion of structures of IF_3, $SnCl_2$, CO_3^{2-}& Valence bond theory, Molecular orbital theory Linear combination of atomic orbitals (LCAO) method. Structures of simple heteronuclear diatomic molecules such as CO, NO, HF, Coordination numbers, Crystal field theory, Metal ions in Biological systems,Air Pollution Types of pollutants, source effects, sink & control of primary pollutants – CO, NOx, HC, SOx & particulates, effects of pollutants on man & environment – photochemical smog & acid rain. Greenhouse effect, ozone layer depletion,Water Pollution: Classification of pollutants, their sources, effects of water pollutions on human & plant life, waste water treatment – domestic & industrial. Pollution due to Oil & grease in water.Thermal pollution:Sources,effects of thermal pollution on plant & animal life, control techniques,radioactive pollution:sources, effects, treatment& disposal,Solid Waste Management, Weapons of mass destruction,

biological weapons, chemical weapons, disarmament & peaceful uses of chemistry in day to day life. Green Chemistry, 12 principles of green chemistry, application of green chemistry in industrial processes, Renewable & Non-renewable energy resources & Primary & Secondary energy resources, Polymers, Organic Reaction Mechanism, Stereochemistry of Carbon Compounds, Basic concepts of spectroscopy, UV-VIS spectroscopy, applications, Fundamentals of Microwave & IR spectroscopy & its applications, determination of molecular structure.

List of Experiments

1. Inorganic qualitative analysis: Detection of acid radicals.
2. Inorganic qualitative analysis: Detection of basic radicals.
3. Estimation of available chlorine in bleaching powder sample.
4. Thin layer chromatography: Separation of given amino acids by TLC method.
5. Determination of rate constant of a first order reaction by titrimetric method.
6. Spectrophotometry: Verification of Beer's law.
7. Conductometric measurements:Determination of strength of unknown HCl solution by conductometric titration.
8. Qualitative analysis of single solid organic compounds: Detection of characteristic elements (N, Cl,Br & I) by chemical tests.
9. Qualitative analysis of single solid organic compounds:Detection of functional groups by systematic chemical tests.
10. Flame photometry: Determination of Na & K in water sample.

Text/Reference Books

1. Environmental Sciences towards sustainable future. Wright R. Prentice Hall of India. 2007.
2. Essentials of Ecology and Environmental sciences. Rana S.V.S. 3rd Ed. Prentice Hall of India. 2007.
3. Ecology. Subrahmanyam S & SambamurtyS.S. 2nd Ed. Narosa Publishing House. 2007.
4. Concepts of Ecology. KormondyE. J. 4th Ed. Prentice Hall of India Pvt. Ltd. 2007.
5. Textbook of Environmental Studies for Undergraduate Courses. Bharucha E. 2nd Ed. University Grants Commission. New Delhi. 2004.

6. Advanced Inorganic Chemistry. Cotton F. A. & Wilkinson G. 3rd Ed. Wiley Eastern Ltd.1972.
7. Inorganic Chemistry. Shriver D. J. Atkins P. W. & Langford C. H. 2nd Ed. ELBS. 1994.
8. Organic Chemistry. Pine S. H. 5th Ed. McGraw-Hill. 1987.
9. Fundamentals of Molecular Spectroscopy. Banwell C. N. & McCash E. M.4th Ed. McGraw-Hill. 1962.
10. Introduction to Molecular Spectroscopy. Barrow G. M. 5th Ed. McGraw-Hill 1962.
11. Green Chemistry Engineering. Doble M. & Kruthiventi A.K. Academic press.2007.

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Semester - II

(Humanities & Basic Sciences Subject)

MA-152	L-T-P-C
Mathematics - II	3-1-0-4

Objective: *The objective of the course is to make the students familiar with certain important mathematical techniques involving complex analysis & transforms which have applications in various disciplines of Engineering & Technology.*

Course Content

Complex Analysis**:** Complex Variables: Limit, continuity, differentiability & analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros & singularities, Residue theorem, evaluation of real integrals.

Transform Calculus: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First & second shifting properties, Laplace Transform of derivatives & integrals, unit step functions, Dirac delta-function, error function. Differentiation & integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial & boundary value problems. Fourier Transform, Fourier sine & cosine transforms. Linearity, scaling, frequency shifting & time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Brief Introduction of Z-Transform, Mellin transform & Wavelet Transform.

Fourier Series : Periodic functions, Fourier series representation of a function, half range series, sine & cosine series, Fourier integral formula, Parseval's identity.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Complex Analysis for Mathematics and Engineering. Mathews J. H. & Howell R. W. 3rd Ed. Narosa. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2009.
5. Complex Variables- Introduction and Applications. Ablowitz M.J. & Fokas A.S. Cambridge University Press. 1998.
6. Complex Variables and Applications. Brown J.W. & Churchill R.V. 7th Ed. McGraw-Hill. 2004.

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Semester - II

(Humanities & Basic Sciences Subject)

PH-152	L-T-P-C
Physics - II	3-0-1-4

Objective: *The objective of this course to introduce the notion of quantum physics & its applications in understanding the electrical, thermal & magnetic properties of various materials, band theory of solids, nanostructures, lasers, superconductivity & its applications.*

Course Content

Nature of waves & particles, Wave-packets & uncertainty, Wave particle duality, Wave mechanics & its mathematical tools, Classical & quantum statistics, Statistics of discrete energy levels, Black body spectral density, Bose condensation; Free electrons, density of states, Kronig-Penny model, Effective mass, Band structure, Electrons in various types of solids, Particle in quantum well, Harmonic oscillator & Hydrogen atom problems, Application to semiconductor doping, Nonperiodic materials; Tunneling of particles & examples, Tunneling through multiple barriers & semiconductor junctions; Interaction among quantum wells: materials under electric & magnetic fields, magnetic resonance effects; Nanostructures – Concepts of electrons in low dimensional confinement, Quantum wells & Super-lattices leading to new device concepts; Lasers – Einstein coefficients, Population inversion, Light amplification, Optical resonators, Characteristics of lasers; Superconductors –Vortex, Flux quantization, SQUID, Levitation & its applications.

List of Experiments

1. Determination of Planck's constant using Light Emitting Diode
2. Determination of temperature coefficient, reverse saturation current & energy band gap of a P-N junction
3. Determination of the energy band gap of semiconductor using four-probe method
4. Determination of the charge carrier concentration & Hall coefficient of a given semiconductor using Hall experiment setup
5. Determination of the ratio of e/m for the electron using the helical method
6. Determination of electronic charge by Millikan's oil drop method
7. Determination of velocity of ultrasonic waves using quartz crystal
8. Determination of wavelength of He-Ne laser using millimeter scale as a grating
9. Determination of wavelength of Diode laser using single slit / double slit & obtain diffraction patterns of different apertures
10. Determination of numerical aperture of an optical fibre cable
11. Determination of capacitance of a parallel plate capacitor with & without dielectric material
12. Determination of the height of a distant object/building with the help of sextant

Text/Reference Books

1. Concepts of Modern Physics. Beiser A. 5th Ed. McGraw-Hill.1995.
2. Modern Physics. Krane K.S. 2nd Ed. John-Wiley. 1995.
3. Quantum Physics of Atoms, Molecules, Solids, Nuclei & Particles. Eisberg R. & Resnick R. 2nd Ed. John-Wiley. 1985.
4. Introduction to Solid State Physics. Kittel C. 7th Ed. John-Wiley Pvt. Ltd. 1995.
5. Solid State Physics. Pillai S. O. 6th Ed. New Age International Publishers Ltd. 2009.
6. Semiconductor physics and devices. Neamen D. 4th Ed. McGraw Hill. 2011.

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EP-199/EP-299/EP-399/EP-499	L-T-P-C
Endeavour Project (Beyond the Syllabus)	0-0-0-3

Our University is continuously looking at innovative ways to deliver knowledge to our students, making learning & delivery mechanism innovative, interesting & easy with truly 'out of the box' teaching-learning process. This beyond the syllabus initiative uses all working second Saturdays as class days.

Endeavour is a compulsory interdisciplinary project for all students of the University. Respective Heads of the Department shall select students & form groups. Each project shall be supervised by a faculty member.

The faculty of SPSU will select a contemporary topic, which is preferably industry relevant & associate a company or professional who can provide application-oriented perspective. The topic chosen may be from wide range of subjects. For example: - Biodiversity, Social subjects, Media & advertisement, Environment, Scientific, Technical, Management, Architecture, Tourism or any other subject or their combination.

The project is evaluated in two phases: Internal Evaluation & External Evaluation. This ensures descriptive assessment of the projects performance & challenges faced during the implementation of the project. The project will be spread over two semesters beginning from the odd semester (July to November) & ending in the even semester (December to May) every year. The grade obtained in this course may be used to improve the student's semester grade point average.

The final report should include the reasons for the choice of the title, the concept, the structure, the results with working models/drawings etc. & its practicality. The role & responsibility of every individual of the group should be indicated clearly. The report should be written in the prescribed format/guidelines, certified by the faculty member & presented as a seminar.

The project is evaluated as per the approved procedure & marks obtained are computed in the even semester.

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Semester - III

(Departmental Core Subject)

EE-251 L-T-P-C
Signals & Networks 3-1-1-5

Objective: *This course discusses continuous/discrete time signals & systems, which are the basic tools, used in analysis of the frequency & transform domain methods.*

Course Content

Objective & overview, signal & system types & classifications, step response, impulse response & convolution integral; Periodic signal analysis: Fourier series & properties; A periodic signal analysis : Fourier Transform - its properties & sinusoidal steady state analysis of systems; Elements of electrical network : dependent & independent sources, active & passive components; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral & Bilateral Laplace Transforms & properties; Transient solutions of networks using Laplace Transform; Network functions: poles, zeros, transfer function, Bode plot; One & two port network parameters & functions : Z, Y & ABCD parameters, driving point & transfer impedances & admittances; Network Theorems & Formulation of Network equations: generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen & Reciprocity Theorems; Graph theory: Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network; Analog filter design: Butterworth, Sallen Key, frequency transformation & scaling.

List of Experiments

1. Analysis of voltage and current divider networks and verification of Kirchhoff's

laws

2. Verification of Thevenin & Norton theorem
3. Verification of Superposition theorem
4. Verification of Maximum Power Transfer theorem & to find the value of the load resistor for maximum power transfer
5. Analysis of the step response of RC, RL & RLC circuit
6. Evaluation of the frequency response of RLC series circuit & analyze series circuit resonance along with the computation of BW & Q factor
7. Evaluation of the frequency response of RLC Parallel circuit & analyze parallel circuit resonance along with the computation of BW & Q factor
8. Determination of the impedance (Z) parameter of a two-port resistive network
9. Determination of the admittance(Y) parameters of a two-port resistive network
10. Calculation & verification of ABCD parameters of the two-port network
11. Determination of the hybrid parameters of a two-port resistive network
12. Plotting of the frequency responses of Low Pass & High Pass Filters

Text/Reference Books

1. Fundamentals of Signals and Systems. Roberts M. J. 1st Ed. Tata McGraw Hill. 2007.
2. Network Analysis. Valkenburg M. E. V. 3rd Ed. Prentice Hall of India, 2003.

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Semester - III

(Departmental Core Subject)

EE-252 L-T-P-C
Electrical Technology 3-1-1-5

Objective: *To introduce about power system & expose the construction, working Principle & performance of the D.C.Machines & Transformers (Single Phase & Polyphase)*

Course Content

Introduction: Sources of energy; General structure of electrical power systems, Power transmission & distribution via overhead lines & underground cables, Steam, Hydel, Gas & Nuclear power generation.

D.C Machines: Constructional features, armature windings - simple lap & wave winding; armature voltage & torque equations. D.C generators: Classifications, performance characteristics; Losses, efficiency & power flow diagram. D.C motors: Classifications, torque/speed characteristics of different types; Losses, efficiency & power flow diagram. Starting, speed control & braking. Testing & efficiency.

Transformers: Constructional features; Ideal transformer & practical transformer, name plate rating, phasor diagrams, equivalent circuit & determination of its parameters from O.C & S.C tests; Per unit parameter values & its importance; EMF equation Regulation, efficiency & all day efficiency & expressions & calculations. Sumpner Test. 3-phase Transformer: As a single unit with name plate rating & as a bank of three single phase transformers; Vector groups for various connections; Per phase analysis; Qualitative explanation for origin of harmonic current & voltage & its suppression tertiary winding. Parallel operation conditions & load sharing. Autotransformer: Basic constructional

features; VA conducted magnetically & electrically. Comparative study with two winding transformer. Three phase AC Circuits: Three phase EMF generation, delta & Y – connections, line & phase quantities, solution of three phase circuits, balanced supply voltage & balanced load, phasor diagram.

List of Experiments

1. Determination of the efficiency of two identical D.C. Machine by Hopkinson's regenerative test
2. Determination of the efficiency of D.C. shunt motor by loss summation (Swinburne's) method
3. Speed control of D.C. shunt motor by (a) field current control method & plot the curve for speed Vs field current. (b) armature voltage control method & plot the curve for speed Vs armature voltage
4. Speed control of a D.C. motor by Ward Leonard method & to plot the curve for speed Vs applied armature voltage
5. Determination of the core losses & copper losses by O.C. & S.C. test on a 1-phase transformer & also find the parameters of its equivalent circuit, voltage regulation & efficiency
6. Performance of the back-to-back test on two identical 1-phase transformers & find their efficiency & parameters of the equivalent circuit
7. Performance of parallel operation of two 1-phase transformers & determine their load sharing
8. Determination of the efficiency & voltage regulation of a single-phase transformer by direct loading
9. Performance of the OC & SC test on a 3-phase transformer & find its efficiency & parameters of its equivalent circuit
10. Performance of the parallel operation of two 3-phase transformers & determine their load sharing
11. Study of the performance of 3-phase transformer for its various connections, i.e. star/star or star/delta delta/star & delta/delta & find the magnitude of 3rd harmonic current

Text/Reference Books

1. Electrical and Electronic Technology. Hughes Edward, Hiley John, Smith Ian McKenzie, Brown Keith. 9th Ed. Pearson Prentice Hall. 2005.
2. Problems in Electrical Engineering: Power Engineering and Electronics with Answers Partly Solved in S.I. Units. Smith P. 9th Ed. 2003.
3. Principles of Power System. Mehta V.K. & Mehta Rohit. 4th Ed. S Chand & Company. 2009.
4. Electrical Machinery. Bimbhra P. S. 1st Ed. Khanna Publishers. 2003.
5. Electric Machines. Kothari D.P. & Nagrath I.J. 3rd Ed. Tata McGraw Hill.2007.

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Semester - III

(Departmental Core Subject)

EC-262 L-T-P-C
Electronics Devices & Circuits 3-1-1- 5

Objective: *To equip the students with a sound understanding of fundamental concepts of analog electronic circuits & to know the diversity of operations that the op amp can perform in a wide range of applications along with study of the different types of ICs & its applications.*

Course Content

Band structure of p-n junction & current components, Quantitative theory of P-N junction diode, Volt-ampere characteristics & its temperature dependence Narrow-base diode, Transition & diffusion capacitance of P-N junction Diodes, Break down of junctions on reverse bias, Zener & Avalanche breakdowns, Tunnel diode & its V-I characteristics, Use of diodes in rectification circuits, Clipping & clamping circuits, PNP & NPN junction transistors, Characteristics of the current flow across the base regions, Minority & majority carrier profiles, Transistor as a device in CB & their characteristics, Transistor as a device in CE & CC their characteristics, Transistor biasing: DC bias & stabilization, Various stabilization circuits, Thermal runaway & thermal Stability, Bias compensation Techniques, JFET & its characteristics. Pinch off voltage & drain saturation current, MOSFET- enhancement, depletion modes, FET biasing, Equivalent ckt of FET, low frequency FET Amplifiers, Transistor hybrid model using 'h' parameters, Analysis of CB,CC,CE configuration, Miller's theorem, Darlington Emitter follower, Boot strapping Darlington pair, Cascaded BJT amplifier & RC coupled amplifier, Effect of bypass & coupling capacitors on the low frequency response of the amplifier, Transistorized

Differential amplifier, Class A & small signal analysis, Class B & small signal analysis, Class C & small signal analysis, Class AB push pull amplifier, collector efficiency of each, cross over distortion.

List of Experiments

1. Frequency response of CE amplifier
2. Frequency response of CC amplifier
3. H-parameters of CE configuration
4. Frequency response of common source FET amplifier
5. RC coupled single stage amplifier & determination of the gain frequency response, input & output impedances
6. Testing of diode clipping (single / double ended) circuits for peak clipping
7. Testing of clamping circuits: positive clamping/negative clamping
8. Testing the performance of BJT - RC phase shift oscillator for f0 ≤ 10 KHz
9. Testing the performance of BJT – Hartley & Colpitts oscillators for RF range f0≥100 KHz
10. Testing the performance of BJT – Colpitts oscillators for RF range f0≥100 KHz

Text/Reference Books

1. Electronics -Circuits and Systems. Bishop Owen, 4th Ed. Elsevier Ltd. 2011.
2. Intuitive Analog Circuit Design. Thompson Marc T. Elsevier Inc. 2006.
3. Electronic Devices and Circuit Theory, Boylestad Robert & Nashelsky Louis. 7th Ed. Prentice Hall.1998.

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Semester - III

(Departmental Core Subject)

CS-261 L-T-P-C
Fundamentals of JAVA Programming 3-0-2-5

Objective: *This course is designed to provide knowledge of the essential features of Java. This course also provides the skills required to use Java libraries in order to develop efficient applications.*

Course Content

Fundamentals of Java technology, modelling concepts: abstraction, encapsulation& packages, code reusability, define class, member, attribute, method, constructor& package, API online documentation Identifiers, Keywords, Types & Flow Control, Arrays: comments, valid & invalid identifiers, keywords, eight primitive types, literals, primitive variable & reference variable, variable declaration, Object creation, initialization, reference variables, instance & local variables, initialization of an instance variables, operators, legal & illegal assignments of primitive types, Boolean expressions & their requirements in control constructs, assignment compatibility & required casts in fundamental types, use if, switch, for, while& do constructions & the labeled forms of break & continue as flow control structures in a program. Declare & create arrays of primitive, class, or array types, array initialization, multidimensional array, copying one array to another.

Classes & inheritance: Class fundamentals, declaring objects, assigning object reference variables, constructor & method overloading, static variables, methods&

initializers, final classes, final methods& final variables, enumerated types, abstract classes &methods, the this keyword, garbage collection, using objects as parameters, argument passing, returning objects, recursion, Inheritance basics, using super, creating a multi level hierarchy, method overriding, dynamic method dispatch, using abstract, using final with inheritance, the object class. Packages, Interfaces, Exceptions & Assertions: Packages, access protection, importing packages, interfaces, define exceptions, use of try, catch& finally statements, exception categories, common exceptions, defining own exceptions, assertions, appropriate &inappropriate uses of assertions, enable assertions at runtime

Multithreading: Define a thread, creating separate threads, controlling the code & data that are used by that thread, thread execution, difficulties when multiple threads share data, inter thread communication, synchronization. Console I/O & File I/O Collections & Generics Framework, GUIs Using the Swing API & Events, Networking: Code to set up the network connection, TCP/IP, use of Server Socket & Socket classes to implement TCP/IP clients & servers

List of Experiments

1. Programs related to class, objects, command line argument, polymorphism, inheritance & function overriding
2. Programs related to super keyword
3. Programs related to constructors, this keyword, abstract class & final keyword
4. Programs related to packages, sub packages & interface
5. Programs related to following access controls w.r.t. to class: private, no modifier, protected, public
6. Programs related to following exception handlers: try-catch, try-finally, try-catch-finally, throws & throw
7. Programs related to different String & String Buffer/String Builder methods
8. Programs related to various I/O classes, interfaces & functions
9. Programs related to serializable & transient
10. Programs related to different methods of URL & Inlet Address class
11. Programs related to TCP & UDP

12. Programs related to various AWT & Swing components
13. Programs related to multithreading using Thread class & Runnable interface
14. Programs related to synchronization

Text/Reference Books

1. Core Java(TM), Volume I & II (Sun Core Series). Horstmann C. S. & Cornell G. 9th Ed. 2012.
2. Java How to Program.Deitel H. M &Deitel P. J. 7th Ed. Prentice Hall. 2007.
3. The Complete Reference: Java. Schieldt H. 9th Ed. Tata McGraw-Hill. 2014.

Detailed Syllabus for B.Tech. Degree Programme
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Semester - III

(Humanities & Basic Sciences Subject)

HU-251	L-T-P-C
Business & Technical Communication	1-1-0- 2

Objective - *To develop persuasive & professional communicative competence*

Course Content

Presentation Skills: Types of presentation; Effective strategies for oral presentations - audience analysis; organizing contents & use of media; Awareness of body language, time & space; Tone, variety of pitch, rate, volume & Articulation.

Letter Writing: Essentials of an effective business letter, Types of business letters: Sales Letter, Complaint Letter, Claim & Adjustment Letters

Technical Report Writing: Characteristics & structure of a formal report; Classification & types of reports; Organization, Analysis & Interpretation of data; Revising & Editing especially in areas like abstracting/ summarizing as well as citations, references & bibliographies, check list for reports.

Text/Reference Books

1. How to Prepare, Stage and Deliver Winning Presentations. Leech T. 2nd Ed. Prentice Hall. 2004.
2. Business Communication Today. Boove C & Thill J. 11th Ed. Prentice Hall. 2011.
3. Effective Technical Communication. Rizvi A. 11th Ed. Tata McGraw-Hill Publishing Company Ltd. 2005.

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Semester - III

(Humanities & Basic Sciences Subject)

MA-251 L-T-P-C
Mathematics - III 3-1-0-4

Objective: *In this course the student is familiarized with some important Mathematical techniques used in various branches of engineering.*

Course Content

Ordinary Differential Equations: higher-order linear differential equations - solutions of homogeneous & non homogeneous equations, method of variation of parameters, operator method; series solutions of linear differential equations, Legendre equation & Legendre polynomials, Bessel equation & Bessel functions of first & second kinds; systems of first-order equations, phase plane, critical points, stability. Numerical solutions of IVP - Difference equations, stability, error & convergence analysis. Single step methods – Taylor's series method, Euler's method, Picard's method of successive approximation, Runge Kutta Method. Multi step methods - Predictor-Corrector method, Euler PC method, Milne & Adams Moulton PC method.

Partial Differential Equations: First order partial differential equations; solutions of linear & nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary & initial value problems (Dirichlet & Neumann type) involving wave equation, heat conduction equation, Laplace's equations & solutions by method of separation of variables (Cartesian coordinates); initial boundary value problems in non-rectangular coordinates.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Elements of Partial Differential Equations. Sneddon I.N. McGraw Hill.1957.
3. Differential Equations. Ross S. L. 3rd Ed. Wiley .1984.
4. Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem. Haberman R. 4th Ed. PH. 1998.
5. Applied Numerical Analysis. Gerald C. F. & Wheatley P. O. 6th Ed., Wesley.1999.
6. Elementary Differential Equations and Boundary Value Problems. Boyce W. E. & DiPrima R.C. 9th Ed. Wiley. 2009.
7. An Introduction to Ordinary Differential Equations. Codington E. A. 2nd Ed. PHI. 1995.

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Semester - IV

(Departmental Core Subject)

EE-253 L-T-P-C
Measurements & Electronic Instrumentation 3-1-1-5

Objective: *To get acquainted with construction & working of various types of electrical & electronic measuring instruments used to measure various quantities.*

Course Content

Sensitivity of DC bridge, measurement of low & high resistances, DC potentiometer, principles of AC bridges for measurement of L & C; Instrument specifications & error analysis; Extension of Instrument range: CT & PT. d-Arsonval Galvanometer, moving coil meters, dynamometer type wattmeter & induction type energy meter. Electronic voltmeter, precision rectifiers, true r.m.s voltmeter; basics of digital measurements: A/D & D/A converters, programmable gain amplifier- auto-ranging; comparators & function generators; elements of digital multimeter; Hall effect sensor, clamp-on meter; solid state energy meter, frequency, phase angle & time period measurement. Cathode Ray Oscilloscope, Digital Storage Oscilloscope. Sample & Hold circuits, Data Acquisition Systems.

List of Experiments

1. Measurement of capacitance using De- Sauty Bridge
2. Measurement of self-inductance using Anderson's bridge
3. Measurement of low resistance by Crompton potentiometer
4. Calibration of a voltmeter using Crompton potentiometer
5. Calibration of an ammeter using DC slide wire potentiometer

6. Measurement of Low resistance using Kelvin’s Double Bridge
7. Component Testing using CRO i.e. R, L & C
8. Measurement of a frequency using Wein's bridge
9. Analysis of different waveforms using Function Generator
10. Measurement of Frequency & Phase using CRO

Text/Reference Books

1. Measurement Systems: Application and Design. Deobelin E. O. 4th Ed. McGraw-Hill. 1990.
2. Electronic Instruments and Instrumentation Technology. Anand M. M. S. 1st Ed. Prentice Hall India Learning Pvt. Ltd. 2004.
3. Modern Electronic Instrumentation and Measuring Techniques. Helfrick A. D. & Cooper W. D. 1st Ed. Prentice Hall PTR. 1990.
4. Electronic Test Instruments. Witte R. A. 2nd Ed. Pearson Education. 2004.

Detailed Syllabus for B.Tech. Degree Programme
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Semester - IV

(Departmental Core Subject)

EE-254	L-T-P-C
Electrical Machines	3-1-1-5

Objective: *To expose the construction, working Principle & performance of the various A.C. Machines.*

Course Content

Three phase Induction machines: Constructional features & types; 3-phase distributed winding production of rotating magnetic field. Concept of slip; Phasor diagram & Development of equivalent circuit & derivation of torque equation, power flow diagram; Typical torque-slip characteristic & influence of different parameters on it; Methods of starting & speed control; Different types of braking circuit arrangement & qualitative explanation. No load & blocked rotor tests.

Synchronous machines: Constructional features & types; Operation of synchronous generators & motors connected to bus & phasor diagrams for normal, under & over excited conditions; Power & torque characteristics & capability curves. Parallel operation. Salient pole synchronous machine - phasor diagram & determination of synchronous reactances; starting & speed control of synchronous motors.

Single Phase AC motors: Single Phase induction motor: Double revolving field theory & development of equivalent circuit. Methods of starting using auxiliary winding; selection of capacitor value during starting & running. Universal series motor: constructional features & performance characteristics.

List of Experiments

1. Evaluation of parameters related to equivalent circuits using no load & blocked rotor test on a 3 phase induction motor. Drawing of the circle diagram & computing the following: (i) max. Torque (ii) current (iii) slip (iv) p.f. (v) efficiency
2. Performance of the load test on a 3-phase induction motor along with its characteristics: (i) speed vs load curve (ii) p.f. vs load curve (iii) efficiency vs load curve (iv) speed vs torque curve
3. Separation of transformer core losses & determination of the hysteresis & eddy current losses at rated voltage & frequency
4. Performance for the heat run test on a delta/delta connected 3-phase transformer & determination of the parameters for its equivalent circuit
5. Performance of Sumpner's back-to-back test on 3 phase transformers, finding its efficiency & parameters for its equivalent circuits
6. Plotting of the O.C.C. & S.C.C. of an alternator & determination of its regulation by synchronous impedance method
7. Determination of losses & efficiency of an alternator
8. Plotting of the V-curve for a synchronous motor for different values of loads
9. Evaluation of X_d & X_q of a salient pole synchronous machine by slip test
10. Synchronization of an alternator across the infinite bus (RSEB) & summarization of the effects of variation of excitation on load sharing

Text/Reference Books

1. Electric Machinery Fundamentals. Chapman S. 4th Ed. McGraw-Hill. 2003.
2. Electrical Machines. Rajput R. K. 3rd Ed. Laxmi Publications (P) Ltd. 2003.
3. Electrical Machinery. Bimbhra P. S. Khanna Publishers.2003
4. Electrical Machinery and Transformers. Kosow I. L. 2nd Ed. Prentice Hall India. 2003.
5. Electrical Machinery and Transformers. Guru B. S. & Hiziroglu H. R. 3rd Ed. Oxford University Press. 2003.
6. Electric Machines. Kothari D.P. & Nagrath I.J. 3rd Ed. Tata McGraw Hill.2007.

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Semester - IV

(Departmental Core Subject)

EE-255 L-T-P-C
Industrial Instrumentation 3-0-1-4

Objective: *This course is to create awareness among students about measurement techniques & the use of industrial instruments.*

Course Content

Introduction to Instrumentation system, Static & Dynamic characteristics of Instrument. Displacement & proximity gauges. Linear Variable Differential Transformer (LVDT). Measurement Temperature, Flow & Pressure. Temperature: Thermocouple, Resistance Temperature Detector (RTD), Thermistor, Radiation Pyrometer. Flow: Differential Pressure flowmeter, Variable area flowmeter, Variable reluctance transducer, Turbine flowmeter, Ultrasonic flowmeter (Both transit time & Doppler Shift), electromagnetic flowmeter & Mass flow meter. Pressure: Elastic transducers(Bourdon Gauge, Bellow & Diaphragm Gauge). Low pressure measurement: McLeod & ionization gauge. Measurement of level: Capacitance based & Float based method. Measurement of strain: Strain Gauge, unbalanced Wheatstone bridge, Load cell, Torque Cell. pH probe & viscosity measurement. Basics of Data transmission: Synchro & Servo motor. IEEE-488 bus, RS 232 & RS 485 interface. Pneumatic & Hydraulic Instrumentation system.

List of Experiments

1. Analyzing the characteristics of LDR with the distance of light source
2. Analyzing the characteristics of thermistor resistance with temperature

3. Determination of the speed (digital) with the help of photoelectric speed transducer
4. Analyzing the performance of digital to analog (D/A) converter
5. Analyzing the LVDT operation & its characteristics
6. Analyzing the angular displacement measurement using capacitive transducer
7. Analyzing the load measurement using strain gauge transducer
8. Analyzing the inductive pick up transducer
9. Analyzing the performance of piezo electric transducer
10. Analyzing the characteristics of thermocouple using Thermocouple Kit

Text/Reference Books

1. Electronic Instruments & Instrumentation Technology. Anand M. M. S. 2nd Ed. Prentice-Hall India. 2006.
2. Modern Electronic Instrumentation and Measuring Techniques. Helfrick A. D. & Cooper W. D. 2nd Ed. Pearson Education, 2008.
3. Electronic Test Instruments. Witte R.A. 1st Ed. Pearson Education. 2002.
4. Instrumentation, Measurement and Feedback. Jones B.E. Tata McGraw-Hill, 2000.
5. Electronic Instruments Handbook. Coombs C.F. McGraw-Hill, 2000.

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Semester - IV

(Departmental Core Subject)

EC-257 L-T-P-C
Signals & Systems 3-1-0- 4

Objective: *This course discusses continuous/discrete time signals & systems which are the basic tools used in analysis of the frequency & transform domain method.*

Course Content

Introduction to signals & systems; Review of Fourier & Laplace Transforms; LTI system: Causality, stability, region of convergence; Classification & representation of signals, Concepts of linear vector space & orthogonal signal representation; Discrete signals: Sampling, digitization & reconstruction of analog signals; Fourier transform of discrete signals: DFT, z-transforms; Discrete systems, transfer functions & convolution; Random variables & processes: stationarity, ergodicity, correlation functions, power density spectra, Wiener-Khinchin theorem; functions of random signals; System response to random signals: Filtered random process a low pass & band pass; Basic concept of optimum filtering: Wiener Hopf filter.

Text/Reference Books

1. Fundamentals of Signals and Systems. Roberts M. J. Tata McGraw Hill 2007.
2. Network Analysis. Valkenburg M. E. Van 3rd Ed. Prentice Hall of India. 2003.
3. Signals and Systems. Oppenheim A.V. Willsky A.S. & Nawab H.S. Prentice Hall of India. 2003.
4. Signal Processing and Linear Systems. Lathi B. P. Oxford University Press. 1998.
5. Signals and Systems - Continuous & Discrete. Ziemer R. F., Tranter W.H. & Fannin D.R. 4th Ed. Prentice Hall. 1998.
6. Signals and Systems. Haykin Simon and Veen Barry van John Wiley & Sons 1998.
7. Network Analysis and Synthesis. Kuo F. F, 2nd Ed. Wiley India. 2007.

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Semester - IV

(Departmental Core Subject)

EC-258 L-T-P-C
Digital Electronic Circuits & Applications 3-1-1- 5

Objective: *This course is designed to develop the skill & knowledge required for designing digital circuits that are used in low cost, high speed, innovative & programmable devices for real time embedded applications*

Course Content

Boolean Algebra & Logic Gates: Introduction to Boolean algebra, Binary connectives, Basic Logic Gates, Evaluation of truth functions, Function calculus as Boolean algebra, Duality, Fundamental theorems of Boolean algebra & simplification of Boolean expressions, Standard forms of Boolean Functions, Minterm & Maxterm.

Minimization Techniques: The K Map Method, Three, Four & Five-Variable Map, Product-of-Sums Simplification, Don't-Care Conditions, Quine Mc cluskey Method NAND & NOR Implementation, Other Two-Level Implementations.

Combinational Logic Circuits: Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers & Demultiplexers.

Sequential Logic Circuits: Classifications & model of sequential circuits, latches, Flip-Flops, Level & edge triggering, Master-slave configuration , Analysis of Clocked Sequential Circuits, State Reduction & Assignment, Design Procedure, Registers & Counters, Registers-Shift Registers, Ripple Counters, Synchronous Counters, Other Counters.

Analysis & Designing of Synchronous & Asynchronous Machines: Basic models of sequential machines, Concept of state, state diagram, state reduction through

partitioning & implementation of synchronous sequential circuits, Asynchronous Sequential Logic Design.

Digital Logic Families & Programmable Logic: Characteristics of Digital ICs, TTL,ECL,MOS & CMOS digital IC families Characteristics, Comparison of Performances, Interfacing TTL & CMOS ICs, Display Drivers, Basic Concepts of Programmable Logic – PROM, EPROM, PAL, PLA.

List of Experiments

1. Verification of basic & universal logic gates
2. Designing of the half adder, full adder & verify the truth tables using logic gates
3. Designing of the half subtractor, full subtractor, & verifying the truth tables using logic gates
4. Designing & implementation of the code converter-I
5. Designing & implementation of the code converter-II
6. Designing of the 4-bit adder & subtractor & verifying the truth tables
7. Designing & implementation of the magnitude comparator & verifying the truth tables
8. Designing & implementation of the multiplexer, & verifying the truth tables
9. Designing & implementation of the demultiplexer, & verifying the truth tables
10. Designing & implementation of the encoder, & verifying the truth tables

Text/Reference Books

1. Art of Electronics. Horowitz P. & Hill W. 2nd Ed. Cambridge University Press. 1989.
2. Digital Design. Mano M. M. Pearson Education. 2002.
3. The ARRL Handbook for Radio Communications- American Radio Relay League. 2008.
4. Electronic Instruments Handbook. Coombs C. F. McGraw-Hill. 2000.
5. The Circuit Designer's Companion. Williams T. Newnes. 2005.
6. Troubleshooting Analog Circuits. Pease R. Newnes. 1991.

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Semester - V

(Departmental Core Subject)

EE-351 L-T-P-C
Control Systems Engineering 3-1-1-5

Objective: *This course discusses the basic concepts of linear control systems, their analysis & design.*

Course Content

Modeling of physical systems: time-domain, frequency-domain & state-variable models; block diagram, signal flow graph & Mason's gain formula; time & frequency response of first & second order systems; control system characteristics: stability, sensitivity, disturbance rejection & steady-state accuracy; stability analysis: Routh-Hurwitz test, relative stability, root locus, Bode & Nyquist plots; controller types: lag, lead, lag-lead, PID & variants of PID; controller design based on root-locus & frequency response plots; modern design techniques: canonical state-variable models, equivalence between frequency & time-domain representations, diagonalisation, controllability & observability, pole placement by state feedback, state feedback with integral control, observer & observer based state feedback control.

List of Experiments

1. Performance characteristics of a synchro transmitter-receiver pair & use these as a torque synchro & angular error detector
2. Performance characteristics of an angular position error detector using two potentiometers
3. Performance characteristics of a dc motor angular position control system

4. Performance of various types of controllers used to control the temperature of an oven
5. Performance characteristics of an analogue PID controller using simulated systems
6. Designing, implementation & determination of the effects of different cascade compensation networks for a given system
7. Performance characteristics of a small AC servomotor & determination its transfer function
8. Time response of a variety of simulated linear systems & their correlation of with theoretical results
9. Determination of the poles & zeros from the given transfer function & showing the pole zero configuration in s-plane
10. Plotting of the root locus for given transfer function
11. Determination of % unit step response of the system whose close loop transfer function is given
12. Determination of undamped natural frequency & %damping ratio, % overshoot of the response of a system whose open loop transfer function with unity feedback is given to a unit step input
13. Plotting of the bode plot for the given transfer function

Text/Reference Books

1. Modern Control Engineering. Ogata K. 1st Ed. Prentice Hall. 2010.
2. Feedback Control of Dynamic Systems. Franklin G. F. Powell J. D. & Emami-Naeini A. E. 7th Ed. Prentice Hall. 2015.
3. Control Systems. Gopal M. 3rd Ed. Tata McGraw-Hill. 2008.
4. Automatic Control Systems, Kuo B. C. 8th Ed. Wiley. 2002.

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Semester - V

(Departmental Core Subject)

EE-352 L-T-P-C
Power Systems 3-0-1-4

Objective: *This course gives the knowledge about the Power System Components & their principles, working & protection.*

Course Content

Introduction to Power systems: Generation, Transmission & distribution system. Single line diagram & per unit system. Restructuring of power utility & its implications. Power system components: Circuit model of synchronous generators & Transformers. Transmission lines lumped & distributed parameter models. Steady state operation, Short, medium & long line models of transmission lines. ABCD parameters. Real & reactive power flow on a transmission line & line load ability. Power Flow Analysis. Power flow equations & solution methods. Gauss-Seidel, Newton-Raphson & Fast decoupled load flow algorithms. Faults in Power System, Short circuits & open circuits. Symmetrical & Unsymmetrical faults. Symmetrical components & sequence networks. Analysis of symmetrical & unsymmetrical faults. Power System Protection: Protective relays & their characteristics. Over-current, distance & differential protection schemes. Circuit breakers. Power System Controls: Generator voltage control. Turbine-governor control. Load Frequency control. Economic dispatch & optimal power flow. Power System Stability: " Swing equation. Equal area criterion & numerical integration of swing equation.

List of Experiments

1. Electromechanical under voltage relay using the under voltage relay demonstration panel & verification of the PSM & TSM settings of it
2. Electromechanical over voltage relay using the over voltage relay demonstration panel & verification of the PSM & TSM settings of it
3. Electromechanical over current relay using the over current IDMT relay demonstration panel & verification of the PSM & TSM settings of it
4. Operation of microcontroller based over current relay using VPL-01 module
5. Operation of microcontroller based unbiased 1- ph differential protection on transformer secondary relay using VPL-83 module
6. Characteristics of normal fuse, HRC fuse & MCB, MCB characteristics Trainer (VPL-03)
7. Earth fault relay during balanced condition & line to earth fault relay during balanced conditions
8. Operations of electro mechanical type an inverse time over current relay

Text/Reference Books

1. Electrical Power Distribution and Transmission. Faulkenberry L. M. & Coffer W. 2nd Ed. Pearson Education Inc. 2007.
2. Power System Analysis and Design. Glover J. D. Sarma M. S. & Overbye T. J. 4th Ed. Thomson Learning Inc. 2007.
3. Control and Automation of Electric Power Distribution System. Green J. & Wolson R. Taylor & Francis. 2006.
4. Electric Power Distribution System. Gonen T. McGraw-Hill. 1986.
5. Elements of Power System Analysis. Stevenson W. D. 4th Ed. McGraw-Hill. 1982.
6. Modern Power System Analysis. Kothari D. P. & Nagrath I. J. McGraw-Hill. 2006.
7. Electric Power Generation, Transmission and Distribution. Singh S. N. 1st Ed. Prentice-Hall India learning Pvt. Ltd. 2004.

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Semester - V

(Departmental Core Subject)

EE-353 L-T-P-C
Power Electronics 3-1-1-5

Objective: *This course deals with different semiconducting devices, their characteristics & applications for various power applications.*

Course Content

Introduction: need for power conversion with efficient, high frequency, lightweight converters; Power electronic converters classifications & scope; Power semiconductor switches: power/fast diodes, SCR, & transistors(BJT, MOSFET & IGBT) Ratings, static & dynamic characteristics, drive & switching aid circuits & cooling; isolation; protection; DC to DC conversion: Choppers: non-isolated: Buck, Boost & Buck-Boost converters; circuit configuration & analysis with; continuous & discontinuous loads; H-bridge converter multi-quadrant operation; isolated: forward, fly-back converters; example of a typical drive circuit; AC to DC conversion: Rectifiers: controlled/half-controlled/uncontrolled: single phase & three phase operation, Operation with R, R-L, back emf load; power factor, harmonics & effect of source inductance; Cascade operation; dual converters; a typical trigger / drive circuit; DC to AC conversion: Inverters: current source & voltage source inverters, active & reactive power handling; single phase & three phase voltage source & PWM inverters; PWM techniques; active front-end rectifier; a typical trigger / drive circuit; AC to AC conversion: Single phase AC static switches; transient-free switching of inductive loads; voltage regulators; cycloconverter.

List of Experiments

1. V-I characteristics of S.C.R. & determination of the Break over Voltage, Holding current & Latching current
2. V-I characteristics of a TRIAC in both directions & in different (1, 2, 3 & 4) modes of operation & determination of Break over voltages, Holding current & Latching current Characteristics of DIAC
3. R triggering circuit of SCR– synchronized pulses to turn on SCR in Full Wave Rectifier with Resistive Load, to show load voltage & Triggering Pulse Waveform & to plot Average DC Voltage v/s Delay Angle
4. RC triggering circuit of SCR– synchronized pulses to turn on SCR in Full Wave Rectifier with Resistive & inductive Load, to show load voltage & Triggering Pulse Waveform & to plot Average DC Voltage v/s Delay Angle
5. UJT triggering circuit of SCR - performance & waveforms of U.J.T triggering of SCR
6. Single Phase Half wave Controlled Rectifier - performance & waveforms of Single Phase Half wave Controlled Rectifier
7. Single Phase Fully Controlled Bridge Rectifier - performance & waveforms of Single Phase Fully Controlled Bridge Rectifier
8. Simulation of problems on Buck Converters
9. Simulation of problems on Boost Converters
10. Simulation of problems on Buck-Boost Converters

Text/Reference Books

1. Power Electronics- Converters, Applications and Design. Mohan N. 3rd Ed. John Wiley & Sons. 2003.
2. Fundamentals of Electrical Drives. Dubey G. K. 1st Ed. Narosa Publishing House. 2003.
3. Power Electronics-Circuits, Devices and Applications. Rashid M. 3rd Ed. Prentice Hall. 2004.
4. Modern Power Electronics and AC Drives. Bose B. K. 1st Ed. Pearson Education. 2003.
5. Introduction to Modern Power Electronics. Trzynadlowski A. M. John Wiley & Sons. 1998.
6. Power Electronics Handbook. Rashid. M. Academic Press-Elsevier. 2001.

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Semester - V

(Departmental Core Subject)

EE-354 L-T-P-C
Utilization of Electrical Power 3-0-0-3

Objective: *This subject deals with various areas of industrial utilization of electrical energy such as illumination, electric heating, welding, traction system etc.*

Course Content

Tariff: one part, two part; Availability based tariff: rate, objective, implementation; Perspective of industrial energy conservation; Illumination: sources of light, electronic control of light, illumination of interiors, exteriors, special areas(sports complex, airport etc.), laws of illumination, design of illumination systems by point-to-point method, average method; Electric drives: review of motor & load characteristics, four quadrant drives, mechanical coupling, referred inertia & torque, steady state stability, selection of motor rating; Industrial drive application examples: pump drives, rolling mill drives, types(VSI, CSI & cyclo converter based), basic principle of operation, torque speed characteristics, closed loop control; Traction drives: basic traction requirements, specifications, different configurations & components of electric traction drives, rating calculations, economic aspects; Electric vehicle drives: pure & hybrid electric vehicles, series & parallel hybrid configurations, range & power, battery storage calculations, battery, motor & drive selections, IC engine power calculations, power splitting devices, control techniques; Industrial heating: different methods of heating-comparison; Application areas: resistive, induction, microwave(dielectric), infrared, representative details of each type.

Text/Reference Books

1. Utilization of Electrical Energy. Taylor E. O. 1st Ed. Orient Long Man Pvt. Ltd.1971.
2. Utilization of Electrical Power. Rajput R. K. 1st Ed. New Age India.2000.

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Semester - V

(Departmental Core Subject)

EC-352 L-T-P-C
Digital Signal Processing 3-1-1-5

Objective: *This course discusses the methods of analyzing discrete time signals & systems, & the methods required for transforming & processing digital signals used in high speed speech & image processing*

Course Content

Short introduction -Discrete time systems & signals; Z-transform, Difference equation. Filter design by transformation - Impulse & step Invariant, Bi-linear Z-transform, matched Z-transform. Signal Model-AR, MA, ARMA, State Variable model, Lattice structures.FIR filter design, Frequency windowing technique, Equi ripple Chebyshev & Butterworth criterion. Filter performance & design in presence of noise, FIR filters banks-sub band decomposition. Inverse filtering-Deconvolution & equalization techniques-Weiner, Linear prediction etc., Signal reconstruction. Time frequency Analysis - STFT, WT, DSP hardware - Design methodologies, Popular architectures & overview of programming Application notes. Filter implementation: Topology, Scaling, Coefficient quantization, Signal quantization, & Sensitivity analysis.

List of Experiments

1. Verification of the sampling theorem
2. Impulse response of a given system
3. Linear convolution of two given sequences
4. Circular convolution of two given sequences

5. Autocorrelation of a given sequence & verification of its properties
6. Cross correlation of given sequences & verification of its properties
7. Solving a given difference equation
8. Computation of N point DFT of a given sequence & plotting of the magnitude & phase spectrum
9. Linear & circular convolution of two sequences using DFT & IDFT
10. Implementation of FIR & IIR filter to meet given specifications

Text/Reference Books

1. Discrete-Time Signal Processing. Oppenheim A. V. & Shafer R. W. 2nd Ed. Prentice Hall India. 2004.
2. Digital Signal Processing: Principles, Algorithms and Applications. Proakis J. G. & Manolakis D. G. 4th Ed. Pearson Education. 2007.
3. Digital signal processing with MATLAB. Ingle V.K. & Proakis J.G. Cengage. 2008.
4. Digital Signal Processing: A computer-Based Approach. Mitra S. K. 3rd Ed. Tata McGraw Hill. 2006.
5. Digital Signal and Image Processing. Bose T. John Wiley & Sons Inc. 2004.
6. Theory and Application of Digital Signal Processing. Rabiner L. R. & Gold B. Prentice Hall India. 2005.
7. Digital Filters: Analysis, Design and Applications. Antoniou A. Tata McGraw-Hill. 2003.
8. Digital Signal Processing. Cavicchi T. J. John Wiley & Sons Inc. 2002.
9. Digital Signal Processing. Ifeachor E. C. & Jervis B. W. Pearson Education. 2006.

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Semester - VI

(Departmental Core Subject)

EE-355 L-T-P-C
Advanced Electrical Machines 3-1-0-4

Objective: *This course discusses dynamic & steady state performance analysis of various electrical machines.*

Course Content

Transformer: Three winding transformer; Unbalanced operation of three phase transformer; Switching-in transients & mechanical forces. Electromechanical energy conversion: Field energy- energy & co-energy; Torque/force in a singly excited & multiple excited electromechanical systems & applications, AC windings. Circuit analysis of electrical machines: Development of circuit models from dc machine & synchronous machine. Impedance matrix; instantaneous & phasor variables; real-coil & pseudo-stationary coil, expressions for torque & power, transformation of variables with power invariance, examples; general two-axis machine. Extension of two-axis models to different machines. D.C machines: Flux & mmf waves; Commutation & armature reaction; Dynamic equations, block diagrams & transfer functions. Induction machines: Deep-bar & double-cage construction; Machine equations in stationary reference frame (d-q axis model), dynamic & steady state performance, behavior under asymmetrical supply voltages. Synchronous machines: Winding inductances; Machine equations in rotor reference frame (d-q axis model); Sudden three phase short circuit & transient circuit model; Steady state operation; Synchronous machine dynamics. Reluctance Machines: Synchronous reluctance, stepping motors & switched reluctance machines,

principles of operation & models for operating characteristics. Steady-state & dynamic performance.PM machines: Permanent magnet material, Basic analysis of magnetic circuit with permanent magnets, Steady-state & dynamic performance of PM synchronous machines & Brushless DC machines.

Text/Reference Books

1. Electric Machines. Sarma M.S. & Pathak M.K. 2nd Ed. Cengage Learning. 1985.
2. Advanced Electrical Technology. Cotton H. Pitman. London. 1967.
3. Electrical Technology. Hughes E. Longmans. 3rd Ed. London 1967
4. Generalized Theory of Electrical Machinery. Dr. Bimbhra P. S. 5th Ed. Khanna Publishers. 1995
5. Electrical Machines. Kothari D.P. Nagrath I. J. 3rd Ed. Tata McGraw-Hill. 2004

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Semester - VI

(Departmental Core Subject)

EE-356 L-T-P-C
Electrical Drives 3-0-1-4

Objective: *This course deals with study of various AC & DC industrial drives, their application & control.*

Course Content

Drive concept, four quadrant drive & load characteristics, selection of motor, control & stability of electric drives, feed back control of drives, thermal effects in electrical machines; DC motor drive: Dynamical model of separately excited dc motor, control of a separately excited dc motor, current, flux & speed controller design; control loop containing an electronic power converter: dc drive with line-commutated converter, dc drive with high frequency PWM converter.

3-phase induction motor drive: Scalar control: Stator voltage control, V/f control, VSI & its PWM strategy for motor control: sine triangle, space-vector; Limitation of scalar control. Basic operation of vector Control: Dynamical control of motor torque & motor flux using ideal CSI. Doubly fed induction motor drives: Basic philosophy of operation of this drive, different quadrant of operations, applications. Permanent magnet motor drive: Basic brushless dc motor drive with position encoder. Basic principle of 3-phase PMSM drive with rotor position encoder. Switched Reluctance motor drive: Principle of torque production, low speed & high speed controller with rotor position sensor. Industrial drives: Different components of standard industrial drives, design of each component; practical issues of interconnections between motors & inverters.

List of Experiments

1. DC motor speed controller for open & close loop
2. Single phase fully controlled bridge converter fed DC motor
3. Speed control of single phase induction motor using microcontroller
4. Single phase half controlled bridge converter fed DC motor
5. MOSFET based chopper Dc motor controller
6. Speed control of three phase slip ring motor using static rotor resistance control through rectifier & chopper
7. Performance of single phase dual converter in non-circulating mode as well as in circulating mode using microcontroller
8. Speed control of separately excited DC motor using chopper
9. Speed control of slip ring induction motor by scherbius slip-power recovery scheme

Text/Reference Books

1. Power Electronics- Converters: Applications and Design. Mohan N. 3rd Ed. John Wiley & Sons. 2003.
2. Fundamentals of Electrical Drives. G. K. Dubey. 3rd Ed. Narosa Publishing House. 2003.
3. Power Electronics Circuits Devices and Applications. Rashid M. 3rd Ed. Prentice Hall. 2004.
4. Modern Power Electronics and AC Drives. Bose B. K. Pearson Education. 2003.
5. Introduction to Modern Power Electronics. Trzynadlowski A. M. 2nd Ed. John Wiley & Sons. 1998.

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Semester - VI

(Departmental Core Subject)

EE-357 L-T-P-C
Power System Analysis & Operation 3-1-0-4

Objective: *This course deal with study & analysis of power flow for security & reliability consideration.*

Course Content

Power System Load Flow – Sparse Matrix Techniques. AC/DC power flow studies. Optimal power flow analysis. State Estimation - static as well as dynamic. Generation operation-load forecasting, Economic operation, Unit Commitment. Operational security & reliability considerations. Transmission & Distribution operation deregulation.

Text/Reference Books

1. Modern Power System Analysis. Kothari D. P. & Nagrath I. J. 3rd Ed. Tata McGraw-Hill. 2003.
2. Power System Stability and Control. Kundur P. Tata McGraw-Hill. 1995.
3. Power Generation Operation and Control. Wood A. J. & Wollenberg B. F. 2nd Ed. John Wiley & Sons. 1996.
4. Electrical Power system protection. Wright A. & Christopoulos. C. 1st Ed. Chapman & Hall. 1993.

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Semester - VI

(Departmental Core Subject)

EE-358 L-T-P-C
Control & Electronic System Design 0-0-2-2

Objective: *This course deal with practice of designing various kind of electronic & electrical system.*

Course Content

Design assignments to be provided by teacher on broad areas listed below.

Design of a practical control system including aspects such as: Aspects of plant, actuator, sensor & disturbance modeling; Controller design from specifications & including typical factors, such as control limit & rate constraints.

Design of the feedback subsystem including electronic signal conditioning. Design of electrical actuation systems such as ones based on Power Electronic Circuits. Simulation of such systems on software.

Design of signal processing systems including aspects such as: Development of Filter specifications from practical considerations, Design of Filter transfer function & analog circuit realization Realization of digital filter algorithms & associated circuit designs such as amplifiers, ADC, Sample & hold circuit, Anti-aliasing filter etc. Development of the digital filter code on a suitable embedded hardware platform such as microcontroller,DSP. Design of measurement systems including aspects such as :

Development of specifications from practical considerations of the measurement application Design of interface subsystem for achieving measurement accuracy, Noise related issues, such as shielding, guarding, grounding ii. Compensation issues related to power supply & temperature effects, nonlinearity iii. Calibration, zero & sensitivity

adjustment Computing system measurement related specifications based on component level specifications available in electronic data sheets

Data Acquisition system for PCs. Microprocessor-based Industrial Automation including aspects of Industrial grade single-loop PID controller realization with features to address integral wind-ups, auto-manual transfers, auto-tuning etc. PLC based system design including RLL programming Simple embedded controllers with features such as remote wireless command for applications such as home automation.

List of Experiments

1. Designing of an automatic street light control system using LDR & transistor BC-548
2. Designing of a water level indicator alarm using PCB & various sensors
3. Designing of a portable mobile charger on PCB using transistor PNP 7805
4. Designing of a power supply using PCB & various components
5. Designing of a fire alarm on PCB
6. Designing of occupancy light indicator system using transistor C1815
7. Designing of clap switch using transistor BC547
8. Designing of electricity detector using IC VW64
9. Designing of air flow detector circuit using IC7805 & LM339
10. Designing of rain alarm using transistor BC548 & TL188

Text/Reference Books

1. Process Control Instrumentation Technology. Johnson. C. D. 8th Ed. Prentice Hall India. 2006.
2. Sensor and Signal Conditioning. Areny R. P. & Webster T. G. Wiley-Interscience. 2000.
3. Electronic Instruments Handbook. Coombs. C. F. 2nd Ed. Tata McGraw-Hill. 2000.
4. Modern Control Engineering. Ogata K. 4th Ed. Prentice Hall India. 2006.
5. Feedback Control of Dynamic Systems. Franklin G. F. Powell J. D. & Emami-Naeini A. E. 5th Ed. Prentice Hall. 2006.

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Semester - VI

(Departmental Core Subject)

EC-357 L-T-P-C
Embedded Systems 3-0-1-4

Objective: *Embedded system provides cost effective solution for industrial, consumer & space applications. The objective of teaching this course to the student is to train them to learn all aspects of hardware & software development to design embedded system for various applications*

Course Content

Introduction to embedded systems with examples, embedded system design & modeling with unified markup language (UML). ARM processor fundamentals: Introduction to microprocessors & microcontrollers, 8-bit & 16- bit, von Neumann & Harvard architectures, CISC & RISC architectures, open source core (LEOX), ARM versions, ARM instruction set: programming model, assembly language, Thumb instruction set, memory organization, data operations & flow control. CPUs: Input/output mechanisms, isolated & memory mapped IO; interrupts & real time operations, ARM interrupts vectors, priorities & latency; supervisor modes, exceptions, traps, co-processors; cache memory & memory management. Embedded Platforms: CPUs: bus protocols, system bus configuration, USB & SPI buses, DMA, ARM bus; memory devices: memory device configuration, ROM, RAM, DRAM; I/O devices: timers, counters, ADC & DAC, keyboards, displays & touch screens. Processes & Operating Systems: multiple tasks & multiple processes; process abstraction; context switching: cooperative multitasking, preemptive multitasking, process & object-oriented design; operating systems & RTOS; scheduling polices; inter-process communication.

Networks: distributed embedded architectures: networks abstractions, hardware & software architectures; networks for embedded systems: I2C bus, CAN bus; examples. Case studies: Inkjet printer, telephone exchange, etc.

List of Experiments

1. ARM7 LPC2148 Trainer kit
2. Keil IDE overview – Project creation, downloading & debugging
3. Writing an assembly language program for Using assembler directives & Factorial calculations
4. Writing an assembly language program for Swapping Register Contents, Compare & Loop & Shifting of data
5. Writing an assembly language program for addition of two 32-bit numbers use of subroutine
6. Writing an assembly language program for copy block
7. Writing an assembly language program for Hex to ASCII conversion
8. Writing an assembly language program for Larger of two numbers
9. Writing an assembly language program for GPIO programming
10. Writing an assembly language program for Copy word &Stack operation
11. Writing programs for examples on the ARM LPC2148 trainer kit.

Text/Reference Books

1. Computers as Components: Principles of Embedded Computing System Design. Wolf W. 2nd Ed. Elsevier. 2008.
2. ARM system developer's guide: Designing and Optimizing System Software. Sloss A. N., Symes D. & Wright C. Elsevier. 2008.
3. Product Data Sheet LPC 2141/42/44/46/48. NXP Semiconductors.
4. ARM7TDMI Technical Reference Manual. ARM Limited.
5. The Art of Designing Embedded Systems. Ganssle Jack, 2nd Ed. Elsevier 2008.
6. Programming Embedded Systems in C and C++. Barr Michael O'Really. 1999.
7. C Programming for Embedded Systems. Zurell Kirk. CMP Books. 2000.

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Semester - VII

(Departmental Core Subject)

EE-451	L-T-P-C
Power Apparatus & System Design	3-0-1-4

Objective: *This course deal with electrical & mechanical design & analysis of power system & transmission system planning & in-depth analysis of balanced & unbalanced faults, construction of overhead lines & factors affecting transmission line route selection.*

Course Content

Design of Electrical Transmission System for transmitting bulk amount of power. Design considerations for DC or AC transmission. Design of rural & urban distribution systems & design of electrical substation. Power System Grounding Design. Lightning.

List of Experiments

1. String efficiency mathematical calculation & program
2. Sag mathematical calculation for same level supports & program
3. Sag mathematical calculation for different level supports & program
4. Inductance mathematical calculation for single circuit 3 ph line & program
5. Inductance mathematical calculation for double circuit 3 ph line & program
6. Self GMD mathematical calculation & program
7. Mutual GMD mathematical calculation & program
8. Voltage regulation mathematical calculation & program
9. Capacitance mathematical calculation & program
10. Transmission efficiency mathematical calculation & program

Text/Reference Books

1. Electrical Power Transmission System Engineering Analysis and Design. Gonen Turan. 2nd Ed. Taylor & Francis Publisher. 2009.
2. Power System Analysis and Design. Gupta B. R. 6th Ed. S. Chand & Co. Ltd. New Delhi.2011.
3. Principles of Power System. Mehta V.K. & Mehta Rohit. 1st Ed. S. Chand & Co. Ltd. New Delhi.2009.

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Semester - VII

(Departmental Core Subject)

EE-452 L-T-P-C
HVDC & FACTS 3-0-1-4

Objective: *This course deals with typical configuration of HVDC converter stations, various links & about FACTS technology used for high voltage transmission.*

Course Content

Introduction to HVDC: Overview & advantages. Basic power conversion principle, Rectifier & inverter operation, Commutation. Control of HVDC for stable operation. Harmonic Generation, analysis & elimination on DC systems. Protection of HVDC system with focus on commutation failure. Interaction with AC system. New concepts: Voltage sourced converter based HVDC, Introduction to multilevel converters for high voltage power transmission system, Multi-terminal FACTS Introduction to FACTS □ " Compensation of transmission systems. Series & Shunt FACTS controllers - variable impedance type & switched converter type. Unified Power Flow Controller & other types of FACTS devices. Application of FACTS controllers in improvement of power system operation & stability.

List of Experiments

1. Simulating a simple circuit with software
2. Simulating different types of fault occurs in three phase transmission line
3. Simulating the 1-phase half controlled rectifier circuit with R & RL load & obtaining the corresponding waveforms using software

4. Simulating the 1-phase full controlled rectifier circuit with R & RL load & obtaining the corresponding waveforms using software
5. Simulating the 3-phase full controlled rectifier circuit with R load & obtaining the corresponding waveforms using software
6. Simulating the operation of buck & boost converter with software
7. Simulating the simple Voltage Source Inverter & obtaining the corresponding waveforms using software
8. Analyzing the power quality of diode bridge rectifier using software
9. Simulating the 3-phase full controlled converter for analyses of harmonics generated by it using software
10. Analyzing the power flow & power factor in 3-phase AC circuit using software

Text/Reference Books

1. High Voltage Direct Current Transmission. Arrillaga J. The Institution of Electrical Engineers. London. UK. 1998.
2. Direct Current Transmission. Kimbark E. W. Wiley-Interscience. 1971
3. Understanding FACTS: concepts and technology of flexible AC transmission systems. Hingorani N. G. Wiley-IEEE Press. 2001.
4. Power Transmission by Direct Current. Uhlmann E. 1st Ed. Springer-Verlag.1975
5. HVDC Power Transmission Systems: Technology and System Interactions. Padiyar K. R. 1st Ed. New Age International (P) Limited & Publishers. 1990
6. Power electronic control in electrical systems. Acha E. Agelidis V.G. Anaya-Lara O. Vassilios G. Newnes Technology. 2002.

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Semester - VII

(Departmental Core Subject)

CS-463 L-T-P-C
Programming Concepts 0-0-1-1

Objective: *This course is designed to provide knowledge of the essential features of C, C++, Java & Excel.*

Course content

Decision making statement & operator based programs, Loop based programs, Multi way decision making statement based programs, Array, String, Function, Structures, Pointers, Files,Imperative Languages, Functional programming, data abstraction, polymorphism, semantics, implementation issues, Declarative programming, Object-oriented programming with objects, classes & instances, Programming concepts in JAVA , advanced applications in Excel

List of Experiments

1. Decision making statement and operator based programs
2. Loop based programs
3. Multi way decision making statement based programs
4. Array and string based programs
5. Function based programs
6. Structure based programs
7. Pointers based programs
8. File handling based programs
9. Programs related to classes &objects
10. Programs related to constructors & destructors

11. Programs related to operator overloading & type conversion
12. Programs related to Inheritance
13. Programs related to virtual functions & polymorphism
14. Programs related to managing data files
15. Programs related to exception handling
16. Programs related to class, objects, command line argument, polymorphism, inheritance & function overriding
17. Programs related to following access controls w.r.t. to class: private, no modifier, protected, public
18. Programs related to various I/O classes, interfaces & functions
19. Programs related to synchronization
20. Hands on practical in Excel

Text/Reference Books

1. A Book on C. Kelly A. & Pohl I. 4th Ed. Pearson Education. 1999.
2. The C Programming Language. Kernighan B. & Ritchie D. 2nd Ed. Prentice Hall of India. 1988.
3. C: The Complete Reference. Schildt H. 4th Ed. Tata McGraw-Hill. 2000.
4. Programming Languages Concept and Paradigms. Watt D.A. Prentice-Hall. 1990.
5. Programming Language Design Concepts. Watt D.A. Wiley. 2004.
6. Core Java(TM), Volume I & II (Sun Core Series). Horstmann C. S. & Cornell G. 9th Ed. 2012.
7. Java How to Program. Deitel H. M &Deitel P. J. 7th Ed. Prentice Hall. 2007.
8. The Complete Reference: Java. Schieldt H. 9th Ed. Tata McGraw-Hill. 2014.

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Semester - VII

(Departmental Core Subject)

EE-450	L-T-P-C
Summer Internship	0-0-0-3

Summer Internships offer students personal & real world spirits & exposes to an actual working life, an experiential foundation to their career choices & the chance to build valuable business networks. Under this programme each student undergoes training in an Industry for a minimum period of six weeks during the summer vacation after VI Semester. Through the internship students are exposed with the various processes involved at any typical industrial unit such as, operating procedure, construction processes, management procedures etc. & have the opportunity to relate with the knowledge they acquired in the classroom. Students execute a small project based on any of the above mentioned aspects under the supervision of competent personnel in the industry & a faculty member of the university.

After completion of the Internship, students are required to prepare a report, based on the activities performed during the internship, as per the prescribed format/ guidelines. The report should be certified by the Supervisors, & presented in the form of a seminar in the VII Semester.

Evaluation of the Summer Internship will be done as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

EE-455	L-T-P-C
Comprehensive Viva Voce	0-0-0-2

The knowledge gained by the students during their B.Tech programme will be evaluated through a Comprehensive Viva Voce Test in the VII Semester. The test will cover the entire syllabi of the B.Tech degree programme. Preparation for the Comprehensive Viva Voce Test will also help the students in their placement activities. The evaluation will be done as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

EE-460 L-T-P-C
Minor Project 0-0-3-3

Students undertake project work to develop the skill & aptitude of problem-solving. The project work is divided into two parts: Minor & Major. The Minor project is to be undertaken in the VII Semester.

Students will choose an area of their interest in consultation with a faculty member of the department, who will act as the Supervisor. The area of interest could be confined to his/her discipline or may be interdisciplinary.

The project work will involve all or some of the following processes: identification of problem, study of related literature, data collection & analysis, theoretical formulation, fabrication, experimentation & result analysis.

The preliminary work such as problem identification through literature survey, field survey etc. & preparation of plan of execution should be complied in the form of a report, in the prescribed format/ guidelines. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by students will be continuously monitored & evaluated as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

IN-454	L-T-P-C
Internet of Things	0-0-3-3

Objective: *The explosive growth of the "Internet of Things (IoT)" is changing our world & the rapid drop in price for typical IoT components is allowing people to innovate new designs & products at home & office environment. This course provides an overview of key concepts & challenges related to digital transformation. The course examines the evolution of the Internet & how the interconnection of people, processes, data & things is transforming every industry. In this course, the importance of IoT in society, the current components of typical IoT devices & trends for the future, IoT design considerations, constraints & interfacing between the physical world & IoT devices will be covered. The course all covers how to make design trade-offs between hardware & software, key components of networking to ensure that students understand how to connect their device to the Internet. This course helps students to understand the concepts of Internet of Things so that they can be able to build IoT applications.*

Course Content

Introduction – Concepts & Technologies behind Internet of Things (IOT), Welcome to IoT, Elements of IoT, Introduction to the IoT Systems, Introduction to configuring things, Network of physical objects embedded with sensing, Programming in IoT, Prototyping, systems & interconnection, Prototyping ideas for IoT & study with case studies, Embedded Systems, Computer Networks, M2M (Machine to Machine Communication, Internet of Everything (IOE), Concepts & Definitions: Identification, localization, wireless protocols, data storage & security; Collecting, communicating, coordinating, &

leveraging the data from connected devices; Understand how to develop & Implement IOT technologies, solutions, & applications. Machine Learning, Distributed Computing, Artificial Intelligence, Transitioning to the IoT, IoT connections, Implementing an IoT solution, security in IoT, Modeling an IoT solution, M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain & global information monopolies, A use case example, Differing Characteristics.

IOT Reference Architecture – Internet of Things computing & communication capabilities, State of the art Architecture, Reference Model & architecture, IoT reference Model, IoT Reference Architecture, Design & develop IOT devices, IOT Network Architecture, IOT Device Architecture, IOT Application Architecture, Client Server vs Publish Subscribe Architecture, Internet of Things (IoT) & Web of Things (WoT), Internet & Web Layering, Business Aspects of the Internet of Things, Functional View, Information View, Deployment & Operational View, Other Relevant architectural views, M2M to IoT – An Architectural Overview– Building an architecture, Main design principles & needed capabilities, An IoT architecture outline, standards considerations, M2M & IoT Technology Fundamentals- Devices & gateways, Local & wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M & IoT Analytics, Knowledge Management

IOT Device Design– Embedded systems design constraints, Energy, Sensors: Classification & selection criteria based on nature, frequency & amplitude of signal. Embedded Development Boards: Arduino, Raspberry Pi, Intel Galileo, ESP8266, Beagle Bone black, NodeMCU, mBed, UDOO Neo. Interfacing peripherals & Programming GPIOs: Input/output peripherals, Sensor modules, Design Considerations: Cost, Performance & Power Consumption tradeoffs, Real-World Design Constraints, Technical Design constraints, Data representation & visualization, Interaction & remote control.

IOT Communication Protocols– Protocols for IOT devices, WiFi, Bluetooth, ZigBee & 2G/3G/4G cellular, Wired Communication Protocols: UART, USART, I2C, SPI, Industrial Automation, Service-oriented architecture-based device integration, Wireless

Communication Protocols: Bluetooth, Zigbee, 6lowPAN, WiFi, Networking Protocols: OSI Reference Model, TCP/IP, Ethernet. Application Protocols: HTTP, Web sockets, MQTT, CoAP.

Programming Languages & IDEs– Java interfacing, Python for IOT implementations. Assembly, C/C++, Python / IDLE, Pycharm, Micropython, LUA. Cloud Computing, Cloud computing for IoT, Computing & storage capabilities, Concept & Architecture of Cloud, Role of Cloud Computing in IOT, Tools, API & Platform for integration of IOT devices with Cloud, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things.

Optimizing power consumption of IOT Devices– Power consumption of IoT, hardware components, application & communication protocols, configuring extended battery life, Performance & power consumption, Selections of MCUs & communication interfaces, Power management plan of the IOT device addressing complexities at various level, Application's complexities, Computing system's complexities – Microprocessor architecture, Communication system's complexities.

IOT Analytics– IoT real-time data analytics, IOT data streams & databases, Tracking & managing of IoT assets, Representational State Transfer (REST) & Activity Streams, Making Things Smart: Getting Things onto the Internet, Business Cases & Concepts, Business Issues & Models, Persuasive Technologies & Behavioral Change, Big Data & Semantic Technologies. Data Analytics, Data Visualization & tools in IOT, Predictive modeling & analysis, Machine learning & Virtual Reality Systems (VRS), Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two-commercial building automation in the future.

List of Experiments

1. Introduction to IoT devices
2. Characteristics of IoT devices
3. Physical design of IoT devices
4. Logical design of IoT
5. Functional blocks of IoT devices
6. Communication models & APIs

7. Bay Area Rapid Transit (BART) API using Python, JavaScript & jQuery
8. Introduction to Python
9. Introduction to Software define Network (SDN)
10. Network & Communication aspects of IoT
11. Wireless medium access issues of IoT
12. MAC protocol survey & Survey routing protocols
13. Sensor deployment & Node discovery of IoT
14. Data aggregation & dissemination of IoT
15. Design challenges in IoT
16. Development challenges in IoT
17. Security challenges in IoT
18. Domain specific applications of IoT
19. Home automation using IoT
20. Industry applications using IoT
21. Surveillance applications using IoT
22. Developing IoT devices using visual programming & python
23. Introduction to different IoT tools
24. Developing applications through IoT tools
25. Developing sensor based application through embedded system platform
26. Implementing IoT concepts with python
27. Analyze IoT Process using controlled system
28. Open & closed loop control system
29. Process diagram of IoT using sensors, actuators & Microcontrollers
30. PL-App with Arduino & Raspberry Pi
31. Introduction to Cisco Meraki - Cloud-Managed Security
32. Power plant Earthquake Emergency Shutdown System - Case study on IoT
33. Record sunrise & sunset using IFTTT - case study on IoT application development
34. Representational State Transfer (REST) & Activity Streams
35. Project work on IoT

Text/Reference Books

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence. Jan Holler, Vlasios T siatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. Internet of Things (A Hands on Approach). Vijay Madisetti & Arshdeep Bahga, 1stEdition, VPT, 2014.
3. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything. Francis da Costa, 1st Edition, A press Publications, 2013.
4. Fundamentals of Wireless Sensor Networks: Theory & Practice. Waltenegus Dargie, Christian Poellabauer.

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Semester - VII

(Humanities & Basic Sciences Subject)

HU-451	L-T-P-C
Interview Skills	0-0-1-1

Objective: *To understand the intricacies of interview & develop skills to perform satisfactorily.*

Course Content

SWOT Analysis.

Significance of Etiquette, Grooming, Kinesics, Paralanguage & Proxemics in interviews.

Résumé, Cover letter, Thank you Letter, Job Acceptance Letter.

Interview types, Open-ended, Behavioural & Hypothetical questions, FAQs.

Group Discussion & Interview sessions.

Text/Reference Books

1. How to Succeed in Group Discussions & Personal Interviews. Mandal S. Jaico Publishers. 2004.
2. Cover Letters. Fein R. Jaico Publishers. 2005.
3. The Definitive Book of Body Language. Barbara P. Manjul Publishing House Pvt. Ltd. 2013.

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Semester - VII

(Humanities & Basic Sciences Subject)

MA -454 L-T-P-C
Quantitative Aptitude 0-1-0-1

Objective: *To introduce certain topics from quantitative aptitude with emphasis on analytical ability & computational skills needed in competitive examinations. This module would also train the students to solve quantitative aptitude problems during the placement drives.*

Course Content

Problems on Alligation or mixture.

Problems on Ages.

Problems on Clock.

Problems on Calendar.

Problems on Speed, Time & distance.

Problems on Time & Work.

Problems on Heights & distances.

Problems on Trains.

Problems on Boats & Streams.

Problems on Pipes & Cisterns.

Text/Reference Books

1. Quantitative aptitude. Aggarwal R. S. S. Chand. 2012.
2. Quantitative aptitude. Trishna Knowledge Systems, Pearson. 2014.

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Semester - VII

(Management Subject)

BM-451 L-T-P-C
Ethics & IPR 2-0-0-2

Objective: *The aim of this course is to sensitize students towards professional ethics, values, & associated aspects. It initially addresses concerns relating to product & service quality & then moves on to ethical aspects of organizational functioning. The course throws light on ethical issues & crimes that are likely to remain at the core of corporate concerns & discusses intellectual property related issues that are the need of modern industrial & business enterprises.*

Course Content

Role of Corporations: Some big changes in the world in last 60 years (WW II, GATT, WTO) & impact on business, Need for strategic planning & process management, Business strategies & challenges in leading global organizations.

Quality Management: Quality as a strategic imperative, Evolution of quality management, Distinction between quality control, quality assurance & quality management, International standards (ISO family of standards) & International models for quality management, quality in services, enhanced focus on accreditation, the accreditation process, standards for key services (food processing: HACCP & education: NAAC).

Ethics & Human Values: Ethics & morals values, Ethical theories, Common features of unethical companies & leaders, Professional ethics, Professional Codes of Ethics,

Benefits & limitations of code of ethics, Corporate social responsibility & its business implications.

Intellectual Property Issues: Protecting the intangible, Evolution of knowledge as property, What are Intellectual property rights, Classification of intellectual property, Role of WTO & WIPO, The patenting process, Patent infringement, Copyrights, Requirements for registration of a copyright, Copyright infringement. Fair use of copyrighted material, Trade secrets, Reverse engineering, Protecting software.

Environmental & Health Concerns: Introduction, Manufacturing in the 21st century, Resource conservation, the social costs of environmental destruction (land, water & air pollution), ISO 14000 standards & approaches to environmentally friendly technology, carbon trading, international treaties & their limitations.

Texts/Reference Books

1. Managing intellectual Capital: Organizational, Strategic & Policy Dimensions. Teece D.J. Oxford University Press. 2000.
2. Profiting from Intellectual Capital: Extracting Value from Innovation. Sullivan P.H. John Wiley. 1998.
3. Intellectual property law in India. Narang P.S. Georgia Law Agency. 2001.
4. ISO 9000 Quality systems Handbook. Hoyle D. 6th Ed. A Butterworth-Heinemann Title. 2009.
5. Implementing ISO 9000: 2015. Purushothama B. Edited. WPI Publishing. 2014.

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Semester - VIII

(Departmental Core Subject)

EE-470	L-T-P-C
Major Project	0- 0-4-4

After completion of the Minor Project, students shall undertake the Major Project in the VIII Semester. The idea conceived in the Minor Project shall be executed in this semester under the supervision of the faculty member. Students shall complete the practical aspect of the project. Thereafter they will prepare a report, as per the prescribed format/ guidelines, incorporating the results, their analysis & interpretation. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by the student will be continuously monitored & evaluated as per the approved procedure.

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Semester - VI

(Departmental Elective - I)

EE-365 L-T-P-C
Power Systems Transients & Protection 3-0-0-3

Objective: *To analyze the various type of transients in power system & about protection schemes.*

Course Content

Transients in lumped parameter & distributed parameter circuits-wave equations; Multi-conductor systems, switching surge studies –Dommels method, EMTP. Frequency domain approach. Surge response of transformers. Overvoltage mitigation. Surge Arresters. Insulation co-ordination. Philosophy of power system protection, Relaying Instrumentation-characteristics of CT & PT. Overview of computer relaying, hardware organization, Algorithm development, Applications, Integration to substation function, Adaptive protection philosophy.

Text/Reference Books

1. Power System Transients: A Statistical Approach. Indulkar C. S. Kothari D. P. Ramalingam K. 2nd Ed. Prentice Hall India.
2. Power System Analysis: Operation & Control. Chakrabarti Abhijit. Halder Sunita. 3rd Ed. Prentice Hall India. 2010.

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Semester - VI

(Departmental Elective - I)

EE-366 L-T-P-C
High Voltage & Insulation Engineering 3-0-0-3

Objective: *This course deal with production & measurement of high voltages in power system.*

Course Content

Production & measurements of high A. C. voltages, high DC voltages, impulse voltages & impulse currents. Breakdown phenomena in solid, liquid & gaseous dielectrics. Breakdown phenomena in vacuum.

Text/Reference Books

1. High Voltage Engineering. Wadhwa C.L. 4th Ed. New Age International publication. June 2007
2. High Voltage Engineering. Naidu M. S. Kamaraj V. Tata McGraw-Hill. 2001

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Semester - VI

(Departmental Elective - I)

EE-367	L-T-P-C
Machines Analysis	3-0-0-3
Pre-requisite	EE-254

Objective: *This course deal with principle, modeling, equivalent circuit & performance analysis of various electrical machines.*

Course Content

Principles of electromagnetic energy conversion: General expression of stored magnetic energy, co-energy & force/torque, example using single & doubly excited system; Calculation of air gap mmf & per phase machine inductance using physical machine data; Voltage & torque equation of dc machine, three phase symmetrical induction machine & salient pole synchronous machines in phase variable form; Introduction to reference frame theory: static & rotating reference frames, transformation relationships, examples using static symmetrical three phase R, R-L, R-L-M & R-L-C circuits, application of reference frame theory to three phase symmetrical induction & synchronous machines, dynamic direct & quadrature axis model in arbitrarily rotating reference frames, voltage & torque equations, derivation of steady state phasor relationship from dynamic model, generalized theory of rotating electrical machine & Kron's primitive machine; Determination of synchronous machine dynamic equivalent circuit parameters: standard & derived machine time constants, frequency response test; Analysis & dynamic modeling of two phase asymmetrical induction machine &

single phase induction machine; Permanent magnet synchronous machine: Surface permanent magnet (square & sinusoidal back emf type) & interior permanent magnet machines , construction, operating principle & true synchronous characteristics, dynamic modeling & self controlled operation; Analysis of Switch Reluctance Motors: design trade-off & basic operating characteristics.

Text/Reference Books

1. Analysis of Electric Machinery and Drive Systems. Paul C. Krause. Wasynczuk Oleg. Scott D. & Sudhoff. 2nd Ed. Wiley-IEEE Press. March 2002.
2. Analysis of Electric Machinery. Paul C. Krause. Tata McGraw-Hill. 1987.

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Semester - VI

(Departmental Elective - II)

EE-368 L-T-P-C
Industrial Application of High Voltage Engineering 3-0-0-3

Objective: *This course is about various applications of high voltage engineering used in the industries like electrostatic separation, hardening of materials etc.*

Course Content

Electrostatic applications: Electrostatic separation, electro-static coating of materials, electro-static precipitation, electro-static copying. Plasma-based applications: Ion Beam accelerators, Ion nitriding for surface hardening of materials, Ion thrusters for space applications. Nuclear electro-magnetic Pulse simulation. Pulsed Power Engineering: Capacitive & inductive energy storage, pulse forming lines, switches for pulsed power. High voltage sources for Cathode ray oscilloscopes & electron microscopes.

Text/Reference Books

1. High Voltage Engineering Fundamentals. Kuffel E. Zaengl W.S. & Kuffel J. 2nd Ed. Newnes. 1984.
2. High Voltage Engineering Practice and Theory. Dr. Holtzhausen J.P. Dr. Vosloo W.L. 2nd Ed. Newnes. 2014.

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Semester - VI

(Departmental Elective - II)

EE-369	L-T-P-C
Control Theory	3-0-0-3
Pre-requisite	EE-351

Objective: *This course is about state space analysis of various systems with consideration of initial conditions of the system.*

Course Content

Introductory matrix algebra & linear vector space. State space representation of systems. Linearization. Solution of state equations. Evaluation of state transition matrix (STM). Simulation of state equation using software SIMULINK program. Similarity transformation & invariance of system properties due to similarity transformations. Minimal realization of SISO, SIMO, MISO transfer function. Discretization of a continuous time state space model. Convert state space model to transfer function model using Fadeeva algorithm. Fundamental theorem of feedback control. Controllability & Controllable canonical form. Pole assignment by state feedback using Ackermann's formula, controllable canonical form & numerically stable method based on controllable Hessenberg form. Eigenstructure assignment problem. Linear Quadratic Regulator (LQR) problem & solution of algebraic Riccati equation using eigenvalue & eigenvector methods, iterative method, & numerically stable algorithm. Controller design using output feedback. Observability & observable canonical forms. Design of full order observer using Ackermann's formula, observable canonical form, observable

Hessenberg canonical form, & Bass Gura algorithm. Duality. Observer based controller design. Reduced order observer design. Internal stability of a system. Stability in the sense of Lyapunov, asymptotic stability of linear time invariant continuous & discrete time systems. Solution of Lyapunov type equation. Model decomposition & Decoupling by state feedback. Disturbance rejection, sensitivity & complementary sensitivity functions, internal model control (IMC).

Text/Reference Books

1. Control Systems. Sinha N. K. 3rd Ed. New Age International Publisher. 1998.
2. Control Systems Engineering. Nagrath I.J. 4th Ed. New Age International Publisher. Jan 2006.
3. Control Systems Engineering. Norman S. Nise. 6th Ed. John Wiley & Sons. 2013.

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Semester - VI

(Departmental Elective - II)

EE-370	L-T-P-C
Advance Machine Drives	3-0-0-3
Pre-requisite	EE-356

Objective: *This course discusses the various advanced technologies of power electronics used for the controlling of electrical machines.*

Course Content

Drive Concept: different machine & load characteristics, equilibrium & steady state stability, four quadrant operation, referred inertia & load torque for different coupling mechanism, thermal selection of machines; Separately excited dc motor drive: operating limits using armature voltage control & field control techniques, dynamic model(armature voltage control only) of machine & converters (continuous conduction only), open-loop dynamic performance, starting & reversal time, energy consumption, closed loop control using single (speed) & two loops (speed, current), implementation using circulating current type three phase dual converter & four quadrant transistorized chopper. State feedback control & sliding mode control of separately excited dc machine, modeling & control of separately excited dc machine in field weakening region & discontinuous converter conduction mode, control of dc series machine; Review of variable frequency operation of three phase symmetrical induction machine: scalar control methods (constant volts/Hz & airgapflux control), vector control of induction

machine, methods of flux sensing/estimation, implementation of IRFO scheme using current controlled PWM VSI, implementation of DSFO scheme using GTO CSI, effect of machine parameter variation on the performance of vector controlled induction motor drive, speed sensorless control, flux observation, Direct Torque Control; Speed control of wound rotor induction motors: static rotor resistance control, static scherbius drive using line commutated converter cascade, harmonics & power factor, vector control of wound rotor induction machine using self commutated converter cascade & improvement in power factor, introduction to variable speed constant frequency (VSCF) generation; Control of wound field synchronous machine: constant volts/Hz control, scalar self control (commutatorless motor), vector control; Control of permanent magnet synchronous machine: Brushless dc machine, surface permanent magnet machine & interior permanent magnet machine control; Introduction to speed control of Switched Reluctance machine.

Text/Reference Books

1. Control Systems. Sinha N. K. 5th Ed. New Age International Publisher. 2007.
2. Electric Vehicle Machines and Drives: Design Analysis & Application. Chau K. T. Wiley-IEEE Press. August 2015.
3. Control of Synchronous Machine Drives. Prof. Dr. Doncker Rik De. Dr. Duco W. J. Pulle. Dr. Andre Veltman. Springer. 2011.

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Semester - VIII

(Departmental Elective - III)

EE-456	L-T-P-C
Advanced Power Electronic Converters	3-0-0-3
Pre-requisite	EE-353

Objective: *This course discusses operating principle, waveform, switching trajectory losses & control of various converters.*

Course Content

Switched Mode Power Supply: Forward & flyback converter circuit, operation, waveforms & design, transformer design for power supplies, small signal analysis of DC-DC converters & closed loop control; Resonant DC-DC converters: operating principle, waveforms, switching trajectory & losses & control; PWM inverter modulation strategies: sine wave with third harmonic, space vector modulation & predictive current control techniques, Dynamic braking circuit, input side bidirectional power flow requirement for regeneration, Dual thyristor bridge & PWM rectifier; Three level inverter: basic topology & waveform, improvement in harmonics & high voltage application; Resonant ac link/dc link inverters; Cycloconverters: Circuit, operating principle, control, harmonics , power factor & applications; Non-drive application of power electronic converters: back to back HVDC transmission, induction heating, electronic ballast, UPS, static var compensators & active filters. Industrial PWM driver chips for power supplies

such as UC 3843, 3825 or equivalent; Industrial gate driver chips for PWM voltage source inverters with isolation & protection circuits. Intelligent power modules.

Text/Reference Books

1. Power Electronics. Singh M. D. & Khanchandani K. B. Tata McGraw-Hill Education. 2008.
2. Power Electronics: Converters Applications and Design. Mohan Ned. Undeland Tore M. & Robbins William P. 3rd Ed. Wiley.1989.

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Semester - VIII

(Departmental Elective - III)

EE-457	L-T-P-C
Advanced Power System	3-0-0-3
Pre-requisite	EE-352

Objective: *This course discusses the power system dynamic study of small signal & large signal stability. Optimal operation of power system & modeling of synchronous machine.*

Course Content

Power system restructuring & its implications Modeling of synchronous machine & turbine-governor system. Load flow study, sparse matrix methods. Balanced & Unbalanced fault analysis using matrix methods. Power system dynamic study- small signal & large signal stability. Optimal operation of power system, Power system monitoring & protection, wide area measurements. Application of artificial intelligence in power system studies.

Text/Reference Books

1. Advanced Power System Analysis and Dynamics. Singh L.P. 4th Ed. New Age International Publishers. 2006
2. Power System Analysis. Grainger. Grainger John J. & Stevenson Jr. W.D. 3rd Ed. Tata McGraw-Hill. 2011

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Semester - VIII

(Departmental Elective - III)

EE-458 L-T-P-C
Non Linear Control 3-0-0-3

Objective: This course is about causes, analysis, stability theories & design of non linear system.

Course Content

Linear versus nonlinear systems. Describing function analysis: Fundamentals, common nonlinearities (saturation, dead-zone, on-off non-linearity, backlash, hysteresis) & their describing functions. Describing function analysis of nonlinear systems. Reliability of describing method analysis. Compensation & design of nonlinear system using describing function method. Phase plane analysis: Phase portraits, Singular points characterization. Analysis of non-linear systems using phase plane technique, Existence of limit cycles. Linearization: Exact linearization, input-state linearization, input-output linearization.Concept of stability, Stability in the sense of Lyapunov & absolute stability. Zero-input & BIBO stability. Second (or direct) method of Lyapunov stability theory for continuous & discrete time systems. Aizermans & Kalmans conjecture. Construction of Lyapunov function-Methods of Aizerman, Zubov; variable gradient method. Lure problem. Popovs stability criterion, generalized circle criterion, Kalman-Yakubovich-Popov Lemma. Popovs hyperstability theorem. Disturbance issues

in nonlinear control, non-linear control system design problem. Concept of variable-structure controller & sliding control, reaching condition & reaching mode, implementation of switching control laws. Reduction of chattering in sliding & steady state mode. Some design examples of nonlinear systems such as the ball & beam, flight control, magnetic levitation & robotic manipular etc. Approximate solution of nonlinear system using the perturbation method & averaging method.

Text/Reference Books

1. Nonlinear Control Systems. Isidori. Alberto. Springer. 1999
2. Modern Control Engineering. Ogata Katsuhiko. 4th Ed. Prentice Hall. 2003

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Semester - IV

(Open Elective - I)

HU -252 L-T-P-C
Language through Literature & Films 0-2-0-2

Objective: *To introduce the nuances of English Literature & develop reflective, creative & literary abilities.*

Course Content

The Eyes Have It - Ruskin Bond

Appro JRD – Sudha Murthy

Bacon - Of Study; Of Youth & Age

Douglas Malloch - Be the best of whatever you are

Rabindranath Tagore - Where the mind is without fear

Enhancement of emotional, creative & social quotient through viewing & discussions on selected films

Text/Reference Books

1. Literature and Language Teaching: A Guide for Teachers & Trainers. Lazar G. Cambridge University Press. 2008.

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Semester - IV

(Open Elective - I)

BM-270 L-T-P-C
Foundations of Economic Science 2-0-0-2

Objective: *The objective of this course is to teach basic principles of consumption production, exchange, distribution of remuneration to factors, pricing & public finance. Further, students are provided knowledge on completion of projects by optimizing production with limited resources & also to know infrastructure & development needs of a country to perform tasks accordingly.*

Course Content

Engineers & Economics: Meaning of economics, why engineers should know economics, important basics: consumption, production, exchange, distribution & public finance, cost of production & revenue through sales.

Consumption & Pricing: Cardinal & Ordinal approach to Utility, Laws of Diminishing Marginal Utility & Equi-marginal Utility, Demand: Meaning, Law, Types, Elasticity of Demand: Meaning & Degrees. Laws of Supply, Pricing of all products: Theory & practice.

Factors of Production & Markets: Land, Labour, Capital, Organization & Enterprise, Laws of Returns, Classification of Markets: Perfect & Imperfect competition including Monopoly, Discriminative Monopoly & Oligopoly.

Financial Aspects of Engineering: Money & Finance, An overview of Banking, Money Market, Capital Market, Public Finance & Private Finance, Direct & Indirect Taxes, Canons of Taxation, National Income.

Developmental Aspects of Engineering: Underdevelopment, Stages of economic development, Economic Growth, Growth Theories Economic Reforms: LPG. Application of financial accounting techniques for engineering projects.

Text/Reference Books

1. Textbook of Economic Theory. Stonier A.W. & Hague D.C.5th Ed. Longman Higher Education. 1980.
2. Introduction to Positive Economics. Lipsey R.G. & Chrystal K.A. 8th Ed. Oxford University Press. 1995.
3. Business Economics (Micro). Shankar G. Nirali Prakashan. 2014.
4. Micro Economic Theory. Jhingan ML. 7th Ed. Vrinda Publications Pvt. Limited. 2014.
5. Managerial Economics. Theory & Application. Mithani D.M. 7th Ed. Himalaya Publishing House Pvt. Ltd. 2013.
6. Micro economics. Pindyck R.S., Rubinfeld D.L. & Mehta P.L. 7th Ed. Pearson Education India. 2009.

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Semester - V

(Open Elective - II)

HU -351 L-T-P-C
Fun with Drama 0-2-0-2

Objective: *To stimulate imagination, cultural enrichment & explore multidimensional use of language through drama.*

Course Content

Script writing: Story, structure, character development, dialogue, visuals & language with emphasis on critical & analytical thinking, problem-solving & communication skills

Direction: Techniques & art of play direction with emphasis on methods of actor coaching, rehearsal procedures & presentation of several scenes of varying dramatic styles

Enactment: Controlled use of body & voice, analysis & interpretation of roles, characterization & emotional projection

Analysis: Insightful analysis of various aspects of translating a play from script to stage, director's concepts, visual composition, attention to character development & narrative structure & power of the unspoken word

Text/Reference Books

1. Drama Techniques in Language Learning. Maley A. & Duff A. 3rd Ed. Cambridge University Press. 2005.

2. Drama (Resource Book for Teachers). Wessels C. Oxford University Press. 1987.

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Semester - V

(Open Elective - II)

BM-370 L-T-P-C
Marketing Management 2-0-0-2

Objective: *Marketing is no longer a department charged with a limited number of tasks- it is a companywide undertaking. Marketing succeeds only when all departments work together to achieve goals. The syllabus is designed to serve as an introduction to the theory & practice of marketing to the engineering students. It will help them develop competencies in the use of the modern marketing techniques & their applications in design, development & commercialization of new products & services in the rapidly changing markets.*

Course Content

Introduction: Nature & scope of marketing; Importance of marketing as a business function; Marketing concepts – traditional & modern; Selling vs. marketing; Marketing mix & environment, Marketing Myopia.

Consumer Behaviour & Market Segmentation: Significance of consumer behavior; Market segmentation; concepts & importance; Bases for market segmentation,

Product: Concept of product, consumer & industrial goods; Product planning & development: Product life cycle concept, New Product Development, Product Differentiation & Positioning.

Branding: Role of brand & its Significance, Types of Brands, Challenges for Brands, Brand Equity

Price: Importance of price in the marketing mix; Factors affecting price of a product/service Distributions: Distribution channels; concept & role; Types of distribution channels; Factors affecting choice of a distribution channel.

Communications: Techniques of promotion; Integrated Marketing Communications; Advertising: Role & Significance. Media & their relative merits & limitations, Public Relations & Personal Selling.

E-marketing management: Overview of e-commerce, E-marketing: Role of IT in marketing, E-Marketing-mix, Emerging technology trends & their implications for marketing, Social media & marketing, E-CRM & building relationship.

Text/Reference Books

1. Marketing Management- A south Asian Perspective. Kotler P., Keller K., Koshy A. & Jha M. 12th Ed. Pearson Education. 2007
2. Marketing Management. Kotler P. & Keller K. Prentice Hall. 2003
3. Fundamentals of Marketing. Stanton W.J., Michael E.J. & Walker B.J. McGraw Hill International. 1997.
4. Principles of Marketing. Kotler P. & Armstrong G. Pearson Education. 2007.
5. Fundamentals of Marketing. Stanton W.J. 5th Ed. McGraw Hill, New York. 1978.
6. Marketing Environment: Planning, Implementation & Control, the Indian context. Ramaswamy V.S. & Namakumari S.Mcmillan. 1990.

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Semester - VII

(Open Elective - III)

BT-471 L-T-P-C
Bioprocess Technology 3-0-0-3

Objective: *A bioprocess is a specific process that uses complete living cells or their components to obtain desired products which is an importance part of biotechnology industry. This course is designed to make a learner efficient in bioprocess calculations & to impart knowledge of different technology used in bioprocess*

Course Content

Bioprocessing v/s chemical processing, Substrates for bioconversion processes Inoculum development. Process technology for production of primary metabolites: such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides & plastics, Microbial production of industrial enzymes such as glucose isomerase, cellulase, amylase, protease etc., Production of secondary metabolites: penicillin & cephalosporin etc.

Text/Reference Books

1. Encyclopedia of Bioprocess Technology. Flickinger Michael & Drew Stephen. John Wiley & Sons.1999.
2. Principles of Fermentation Technology. Stanbury PF, Whitaker A & Hall S J. 2nd Ed. Elsevier.1995
3. Microbial biotechnology: Fundamentals of Applied Microbiology. Glazer, A.N & Nikaido H. 2nd Ed. W.H. Freeman & Company.1995

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Semester - VII

(Open Electives - III)

CE-462 L-T-P-C
Air Pollution & Industrial Waste Management 3-0-0-3

Objective: *To give understanding of air pollution & its impact, modeling of dispersion of pollutant, control measures, types of waste from different industries & their management.*

Course Content

Air Pollutants, their sources & harmful effects on the environment; Meteorology as applied to air pollution & dispersion of air pollutants, Air quality & emission standards, Removal of gaseous & particulate matter. Sources & types of wastes; solid, liquid & gaseous wastes; Water use in industry, industrial water quality requirements; Control & removal of specific pollutants in industrial wastewaters from dairy, fertilizer, distillery, tannery, sugar, pulp & paper, iron & steel, metal plating etc.

Texts/Reference Books

1. Air Pollution-Its Origin and Control. Wark K. & Warner C. F. Harper & Row New York. 1981.
2. Air Pollution Control Engineering. Nevers N. D. Mc. Graw Hill International Ed. 1985.
3. Zero Pollution for Industry: Waste Minimization through Industrial Complexes. Nemerow N. L. John Wiley & Sons.1995.
4. Liquid Waste of Industry: Theoy, Practices and Treatment. Nemerow N L. Addison-Wesley. 1971.

5. Wastewater Treatment for Pollution Control. Arceivala S. J. Tata Mc. Graw Hill. 1999.
6. Industrial Water Pollution Control. Eckenfelder W. W. Mc. Graw Hill. 2000.

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Semester - VII

(Open Elective - III)

CS-462 L-T-P-C
Management Information Systems & E-Commerce 3-0-0-3

Objective: *The course aims at acquainting students with the fundamentals of Information Systems & their application in the various areas of business. It also provides an overview of the emerging domain of e-commerce, its concepts, issues & technologies.*

Course Content

Management Information Systems: Need, Purpose & Objectives- Contemporary Approaches to MIS: Business processes & Information Systems –Information systems function in Business-Use of Information Systems for competitive advantage - MIS as an instrument for the organizational change: Management issues – Types of Business Information Systems.

Enhancing Decision Making: Information, Management & Decision Making - Models of Decision Making - Classical, Administrative & Herbert Simon's Models - Attributes of information & its relevance to Decision Making - Types of information, Decision Support Systems - Group Decision Support Systems – Executive Support Systems

E-commerce: Introduction, Definition of e-commerce, emergence of Internet, commercial use of Internet, history of e-commerce, advantages & disadvantages of e-commerce

Business models for e-commerce: B2C, B2B, C2C, C2B, brokerage model, aggregator model, info-mediaries, communities, value-chain model, manufacturer model, advertising model, subscription & affiliate model.

Enabling technologies: Internet Client server applications, networks, Uniform Resource Locator (URL), search engines, software agents, Internet Service Providers(ISP), broadband technologies, Electronic Data Interchange(EDI).

E-marketing: characteristics, methods, e-marketing value-chain, site adhesion, browsing behavior model, e-advertising, e-branding, e-marketing strategies

E-security: Security risks, risk management issues, legal & ethical issues, security mechanisms, encryption, digital signature, digital certificates.

E-payment systems: token-based system, card-based system, e-cash. E-cheque, e-banking, risks, data protection.

Text/Reference Books

1. Management Information Systems. Laudon & Laudon, 7th Ed. Pearson Education Asia.
2. E-commerce: An Indian Perspective. Joseph P. T. 2nd Ed. Prentice Hall India. 2007.
3. Management Information Systems. Bagchi N. 1st Ed. Vikas Publishing. 2010.

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Semester - VII

(Open Elective - III)

EC-475	L-T-P-C
Computer Networks	3-0-0-3

Objectives: *To discuss the principles of data communication, the functions of different layers, IEEE standards employed in computer networking & the different protocols & network components.*

Course Contents

Fundamentals of Communications & Networking: Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols. Basic Concept of layering & connection oriented & connection less services, Network structure & architecture, the OSI reference model, TCP/IP Architecture, Networks topology, OSI NETWORK MANAGEMENT: OSI Network management model – Organizational model – Information model, communication model, OSI & TCP/IP Model design issues, Layers of OSI & TCP/IP Model, Data Link Layer & Data link layer protocols: Elementary data link protocols, Sliding windows protocols, Error handling, Parity Bit Check, CRC, Checksum, Hamming Code, Hamming Distance, Overview of High Level Data Link Control (HDLC) & Ethernet, Network Layer: IP Header (IPv4 & IPv6), IP addresses – Calculating IP address & design, TCP/IP packet, ICMP, ARP, RARP, IGMP. Interior Gateway routing Protocol: OSPF, Exterior Gateway Protocols: BGP.

Point-to-Point networks, Routing algorithms, congestion control algorithms, internetworking, Transport Layer: Design issues, connection management, User Datagram Protocol: UDP protocol & Header, Transmission Control Protocol: TCP protocol, TCP segment Header Format, TCP window Management, TCP Timer Management.

Application Layer (services & protocols): WWW, Hyper Text Transfer Protocol, Domain Name System (DNS), Electronic mail (SMTP, POP, IMAP), File Transfer Protocol (FTP, TFTP).

Text/Reference Books

1. Computer Networks. Tanenbaum A. S. 3rd Ed. PHI/PE 2011.
2. Data Communication and Networking. Forouzan B. A. 4th Ed. TMH 2007.

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Semester - VII

(Open Electives - III)

EE-465 L-T-P-C
Energy Conversion Process 3-0-0-3

Objective: *To get acquainted the students with various energy conversion processes used in non conventional energy sources.*

Course Content

Physics of photovoltaic energy conversion in P-N junctions. Effect of physical properties of photovoltaic converters; Performance characteristics of different types of photovoltaic devices; Design considerations & manufacturing processes; Regulations & efficiency of conversion. Charge carriers & thermoelectric phenomena; Thomson, Peltier, Seebech effect; Kelvin's relations; Thermoelectric energy conversion; Materials, size & capacity; Performance analysis & optimized design of thermoelectric devices. Physics of thermionic emission; Operation of high level vacuum & low pressure thermionic converters; Vacuum & gas-filled converters; Thermionic nuclear reactors; Heat pipes. Basic principles of Magnetohydrodynamic power generation; Hall effect; Ionization & seeding; Faraday, Segmented electrode, Hall & Cross-connected generators, Open & closed cycles; Liquid metal MHD. Fuel cells, Thermodynamics of Fuel Cells. Performance Analysis. Low, medium, high temperature Fuel Cells.

Text/Reference Books

1. Energy Conversion Systems. Begamudre R. D. 1st Ed. New Age Pub.2000

2. Solar PV and Wind Energy Conversion Systems: An Introduction Theory, Modeling with MATLAB/SIMULINK and the Role of Soft Computing Techniques (Green Energy and Technology) Sumathi S., L. Kumar Ashok & Surekha P. Springer. 2015.

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Semester - VII

(Open Elective - III)

MA-451 L-T-P-C
Probability Theory 3-0-0-3

Objective: *In this course the student is familiarized with the basics of probability & stochastic processes.*

Course Content

Introduction, Experiment, Events, Classical Definition Counting Techniques, Combinatorial Probability Algebra of events, Addition theorems Conditional probability, Independent events, Bayes Theorem, Discrete Random Variables, Probability Mass Function, Cumulative Distribution Function, Expectation, Variance, Discrete Uniform, Binomial, Geometric, Negative Binomial, Hyper geometric, Poisson Distributions. Continuous Random Variables, Probability Density Function, Cumulative Distribution Function, Expectation, Variance. Continuous Uniform Distribution, Normal, Exponential, Gamma, Chi-Square Distributions. Moment generating function, Characteristic function, Tchebysheff''s Theorem.

Bivariate Discrete Distribution, Joint Probability Mass Function, Marginal Probability Mass Function, Conditional Probability Mass Function, Independent Random Variables, Mean, Variance, Correlation Coefficient, Conditional Mean & Variance, Cumulative Distribution Function.

Bivariate Continuous Distribution, Joint Probability Density Function, Marginal Probability Density Function, Conditional Probability Density Function, Independent Random Variables, Mean, Variance, Correlation Coefficient, Conditional Mean & Variance, Cumulative Distribution Function. Transformation Of random Variables-Univariate & Bivariate Case. Stochastic Processes, Markov Chain, Poisson Process.

Text/Reference Books

1. Statistical methods (Vol. II). Das N.G. 1st Ed McGraw-Hill 2009.
2. Fundamentals of mathematical statistics. Gupta S.C. & Kapoor V. K. 11th Ed. S. Chand & Sons. 2002.
3. Statistical Inference Casella G. & Berger R.L., Mood, Graybill, & Boes, 2nd Ed Duxbury Press 2000.
4. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill. 2008.

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Semester - VII

(Open Elective - III)

ME-465 L-T-P-C
Solar Energy & Applications 3-0-0-3

Objective: *This course discusses solar energy as an important alternative to conventional sources of energy-its generation & utilization.*

Course Content

The energy crisis- causes & options, renewable & non-renewable forms of energy & their characteristics, solar energy option availability & land area requirements. Solar radiation outside the earth atmosphere & at the earth`s surface, instruments for measuring solar radiation, solar radiation geometry, basic earth-sun angles, flux on tilted surfaces. Liquid flat-plate collectors design & performance parameters, solar air heaters, concentrating collectors, solar ponds & energy storage. Solar thermal power generation: low, medium & high temperature cycles, solar cooling, drying & desalination, solar air & water heating, solar passive architecture. Solar photovoltaic power generation: monocrystalline, polycrystalline & amorphous cells, Fabrication & performance of SPV modules. Indirect methods of solar energy utilization: biomass, wind, wave & ocean thermal energy conversion technologies. Economic considerations.

Texts/Reference Books

1. Solar Energy principles of thermal collection & storage by Sukhatme,

Tata McGraw-Hill, 1996.
2. Solar Energy fundamentals and applications by Garg & Prakash, Tata McGraw-Hill, 1997.

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Semester - VII

(Open Elective - III)

PH-451 L-T-P-C
Nanotechnology 3-0-0-3

Objective: *The objective of this course is to discuss why & how changes occur in the properties of bulk materials when their size approaches a billionth of a meter & to understand the basics of nanostructures, nanotubes, nano-electronic devices, nanobiotechnology, nanomachines etc.*

Course Content

Basics of low dimensional (0D, 1D, 2D) structures, Quantum dots wires & wells, Nanoparicles-free & dispersed, Nanocrystalline & nanostructured films, Self-organized structures; Nanostructures for optical & electronic applications, Quantum dot diodes, lasers & detectors, Single electron devices & logic applications, Optical computing & Information processing; Carbon based nanostructures, Electrical, mechanical & chemical properties of carbon nanotubes, Sensors & drug delivery vehicles, Data processing; Bulk nanostructured material & Photonic crystals; Nanostructures for Magnetic applications, Giant & Colossal Magnetoresistance. Nanostructured ferromagnetism, Random Access Memories; Nanostructures for catalysis & hydrogen storage, Nanoclays, colloids & hydrogen storage nano materials. Organic & Biological nanostructures. Nanomachines & supra molecular devices.

Text/Reference Books

1. Introduction to Nanotechnology. Charles P. Poole Jr. & Frank J. Owens. 1st Ed. Wiley-India Edition. 2007.
2. Nanotechnology: Principles and Practices. Sulbha K. Kulkarni. 3rd Ed. Springer. 2014.
3. Introduction to nanoelectronics. Mitin V. V., Kochelap V. A. & Stroscio M. A. 1st Ed. Cambridge University Press. 2007.
4. Nanoelectronics and Nanosystems. Goser K., Glosekotter P. & Dienstuhl J. 2nd Ed. Springer. 2009.

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Semester - VII

(Open Elective - III)

PH-453 L-T-P-C
Chaos in Engineering System 3-0-0-3

Objective: *The objective of this course is to introduce the importance of nonlinearity & its ubiquity in engineering systems. The various techniques/tools used to understand the dynamics of nonlinear systems with examples from various engineering disciplines shall be discussed.*

Course Content

Introduction to chaos. Various examples of chaos in engineering systems, electrical systems (Van Der Pol oscillator); Fluid mechanical systems (Lorenz equations, Aeroelastic flutter), Vibration (Duffing equation),Chemical reactions (Belousov-Zhabotinski reaction) etc. Basic concepts in the mathematical treatment of non linear systems. Note: The emphasis in this course will be on developing a physical understanding of chaotic systems. There will be computer simulation demonstration.

Text/Reference Books

1. Chaos and Non-linear dynamics. Hilborn R. 2nd Ed. Oxford University Press. 2001.
2. Non-linear dynamics & chaos. Strogatz S. H. 1st Ed. Perseus books. 2001.
3. Non-linear dynamics. Lakshmanan M. & Rajsekar S. 1st Ed. Springer. 2003.

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Semester - VIII

(Open Elective - IV)

BT-475 L-T-P-C
Bioremediation Technology 3-0-0-3

Objective: *This course is designed to learn advance technology which use microorganisms & plants to remediate polluted & contaminated sites eg. Industrial waste water, sewage etc. as well as to make students learn about emerging technologies in this area.*

Course Content

General Introduction, toxic chemicals in the environment, Xenobiotic compounds, Properties, toxicity & types of toxicity, classification of toxicants in environment; atmospheric toxicants; Conventional remediation, thermal, chemical & physical processes, role of microorganisms in pollutant degradation, Bioremediation: process, classification: *In situ* & *Ex situ* bioremediation; constrains & priorities of bioremediation; evaluation of bioremediation; factors affecting process of bioremediation, methods in determining biodegradability; contaminant availability for biodegradation. Microbial remediation & phytoremediation, Impact of biotechnology on bioremediation & global application of bioremediation technologies & case studies, Emerging Environmental Biotechnologies: Bioleaching, Biosorption Biotransformation, Biomonitoring, Microbial fuel cells.

Text/Reference Books

1. Cell biology, Genetics, Molecular Biology Evolution & Ecology. Verma PS & Agarwal VK. S Chand publication. 2005
2. Environmental Biotechnology. Shrinivas T. New Age International (P) Limited . 2008
3. General Microbiology. Stanier RY, Doudoroff Michael & Adelberg Edward.2nd Ed. McMillan Publications. 1989
4. Environmental Biotechnology. Foster CF & Ware John. DA Ellis Horwood Ltd. 1987.
5. Biotechnology and Biodegradation: Advances in Applied Bitoechnology Series, Karrely D. Vol -4. Gulf Publications Co. 1989.
6. Bioremediation engineering; design & application. Cookson John.1st Ed. Mcgraw Hill.
7. Introduction to Envionmental Biotechnology. Chatterjee AK. 3rd Ed. PHI Learning Pvt. Ltd. 2011
8. Environmental Biotechnology. Joganand SN.4th Ed. Himalaya Publishing. 2015

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Semester - VIII

(Open Elective - IV)

CE-464 L-T-P-C
Environmental Management 3-0-0-3

Objective: *To develop the understanding of various environmental management techniques, legal procedure in India, development of environmental friendly industries, environmental audits & concept of green buildings.*

Course Content

The need for environmental awareness & protection in both natural & man-made systems – effects on atmosphere, water, ecological systems & quality of life. Environmental Impact Assessment & Integrated Environmental Management, Practical applications – cradle to grave concept, life cycle analysis, & clean technologies. Environmental Audit, Compliance Audit, Concept of ISO & ISO 14000. Needs of developing countries, Governmental standards for Environmental Protection. Emerging Global Environmental Issues, Environmental Legislation.

Text/Reference Books

1. Environmental Impact Analysis Handbook. John R. G. & David W. C. McGraw-Hill. 1980.
2. Environmental Management in South Africa, Fuggle R. F. & Rabie M. A. Juta & Co. Ltd., Johannesburg. 1991.
3. Pollution – Causes, Effects and Control. Harrison R. M. Whitstable Lithop Ltd. 1990.
4. Environmental Impact Assessment. Canter L. W. McGraw-Hill. 1996.

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Semester - VIII

(Open Elective - IV)

CS-459	L-T-P-C
Statistical Simulation & Data Analysis	3-0-0-3

Objective: *The course is designed to discuss the methods to simulate the statistical inferences obtained from the various datasets. The course discusses the various data analysis methods available & their usage in generating inference from the datasets.*

Course Content

Introduction to probability distributions. Basics of estimation & testing of hypothesis (frequentist approach, Bayesian approach).

Different censoring schemes: Type-I, Type-II, hybrid, progressive. Different models & EM algorithm: mixture model; bivariate distributions; cure rate model; competing risk model.

Generating random sample: discrete & continuous multivariate distributions (multinomial, multivariate normal, multivariate exponential); acceptance rejection principle; Monte Carlo markov chain (metropolis Hastings algorithm, Gibbs sampler); Convergence of MCMC: Harris irreducibility, recurrence, minorization, limit theory for Harris recurrent markov chains.

Resampling techniques: jackknife; bootstrap. Hidden Markov Model (forward-backward algorithm, Viterbi algorithm, Baum-welch algorithm). Artificial Neural Network: framework, topology (feed forward neural network, recurrent neural network), training of

ANN (supervised, unsupervised, reinforced learning), robustness. Genetic Algorithm: single objective GA, multi-objective NSGA.

Text/Reference Books

1. Simulation. Ross S.M., 4th Ed. Academic Press. 2006.
2. Data Analysis and Decision Making. Albright S.C., Winston W.L., Zappe C.J., Hinrichs C. & Rogove J. South-Western Publisher. 2002.
3. Data Analysis, Optimization and Simulation Modeling. Albright B. 4th Ed. Cengage. 2012.

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Semester - VIII

(Open Elective - IV)

EC-473	L-T-P-C
Robotics & Automation	3-0-0-3

Objectives: *To introduce the basic concepts, parts of robots & types of robots & to make the student familiar with the various drive systems for robot & various applications of robots, justification & implementation of robot.*

Course Content

Introductory Concepts: Introduction to robotics, robotics history & development, classification of robotics, robotics applications & current research trends in robotics. Basic Components of Robotics Systems: Robotics manipulators & mechanisms actuators-pneumatics, hydraulics & electrics, sensors classifications, internal & external sensors, Kinematics: Introduction to robotic manipulators, position & orientation of object space, robots coordinate transforms, Forward position analysis, Denavit-Hartenberg representation & parameter calculation, inverse position analysis & parameter calculation, Euler angles & computation of parameters for different robot configurations, Statics: Force & moment balance, recursive calculation, equivalent joint torque, Dynamics: Inertia properties, Euler-Lagrange formulation, Newton-Euler formulation, recursive Newton-Euler algorithm, dynamic algorithm, recursive robot dynamics, Control: control techniques, second order linear system, feedback control

system & performance of feedback control system, robotic joints & joint controller, non-linear trajectory control.

Motion planning: General consideration in path description & generation, Joint space planning, Cartesian space planning, position & orientation trajectory, point to point planning, continuous path generation, Introduction to robotic vision, image representation & analysis, template matching edge detection, space analysis, prospective transformation, camera calibration, image compression techniques.

Text/Reference Books

1. Introduction to Robotics. Saha S. K. 1st Ed. Tata McGraw Hill. 2008.
2. Introduction to robotics. Craig J. J. 3rd Ed. Pearson. 2008.
3. Introduction to Robotics Analysis, Control, Applications. Niku S. B. 2nd Ed. Wiley. 2011.
4. Robot Dynamics and Control. Spong M. W. & Vidyasagar M. 2nd Ed. Wiley. 2012.
5. Industrial Robotics: Technology, Programming and Applications. Groover M. P. 2nd Ed. McGraw Hill. 2012.

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Semester - VIII

(Open Elective - IV)

ME-466	L-T-P-C
Power Generation & Economics	3-0-0-3

Objective: *The goal of the course is to provide a fundamental understanding of the principles of hydro-electric, steam power, gas power, nuclear power & non-conventional power along with the economy associated with them as well as the present status, growth & developments of these power plants in India & across the world.*

Course Content

Introduction of power plants, Understanding of Hydro Electric Power Plant, Layout & Present status, Gas Turbine & Combined Cycle Power Plants, Thermal Power Plants, Nuclear Power Plants, Non Conventional Power Generation & direct energy conversion systems, Power Plant Economics, Major Electrical equipments in power plants, Instrumentation & control, Introduction to cogeneration principle & plants.

Texts/Reference Books

1. Power plant Engineering. Arora C.P. Domkundwar S., Dhanpat Rai & co 2014.
2. Power Plant Engineering. Raja A.K. Shrivastav A.P. Dwivedi M. New Age International Publication.
3. Power Plant Engineering. Nag P.K. Tata McGraw Hill
4. Non-conventional energy source. Rai G.D. Khanna Publication.
5. Power Plant Engineering. Black & Veatch, Springer.

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Electrical Engineering

Semester - VIII

(Open Elective - V)

BT-472 L-T-P-C
Bioelectronics & Biosensors 3-0-0-3

Objective: *This course imparts the knowledge of Biosensors, types of biosensors & their applications in online monitoring of bioprocesses.*

Course Content

Biosensors: components of biosensors, advantages & limitations; types of biosensors; biocatalysis based biosensors, bioaffinity based biosensors & microorganisms based biosensors, biologically active material & analyte. Types of membranes used in biosensor constructions. Design of enzyme electrodes & their applications as biosensors in industry such as health care & environment**.** Transducers in biosensors:piezoelectric, semiconductor, impedimetric, mechanical & molecular electronics based transducers. chemiluminiscene - based biosensors principles & applications; calorimetric, optical, potentiometric / amperometricconductrometric / resistormetric transducers; biosensors in clinical chemistry, medicine & health care, biosensors for veterinary, agriculture & food. Low cost- biosensor for online & environmental monitoring, Molecular electronics**,** assembly of photonic biomolecular memory store, information processing; commercial prospects for biomolecular computing systems.

Text/References Books

1. Biosensors for Environmental Monitoring. Bilitewski, U, Turner, A.P.F. Harwood. 2000
2. Biotechnology the Science and Business, Harwood. Moses, V & Cape, R.E. Academic Publisher London.1991
3. Biosensors for Analytical Monitoring Rogers, K.R. & Mascini M. EPA Biosensors Group. 2001.

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Semester - VIII

(Open Elective - V)

CS-461	L-T-P-C
Soft Computing	3-0-0-3

Objective: *This course deals with soft computing concepts, neural networks, fuzzy logic, use of heuristics based on human experience, Genetic algorithm & its applications to soft computing , Optimization problems to Text Analytics.*

Course Content

Introduction Soft Computing: Rationale & Basics of Learning: Neural Networks: Multi-layer Feed-forward Networks, Recurrent Networks, Self-organizing Networks; Fuzzy Logic: Basics, inference scheme, Neuro-Fuzzy systems; Evolutionary Algorithms: GA & Optimization, Evolutionary Systems, Genetic Programming; Introduction Rough Sets, Rough-Fuzzy representations, Belief Networks; Principles of SVM; Research based applications.

Text/Reference Books

1. Soft Computing: Fundamentals & Applications. Pratihar D.K. Narosa. 2015.
2. Neuro Fuzzy and Soft Computing. Jang J.S.R., Sun C.T. & Mizutani E. PHI. 2004.
3. Principles of Soft Computing. Sivanandam S.N. & Deepa S.N. 2nd Ed. Wiley. 2007.

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Electrical Engineering

Semester - VIII

(Open Elective - V)

EE- 466 L-T-P-C
Hydro Power Generation 3-0-0-3

Objective: *To get acquainted the students with various factors & control of hydro power plants.*

Course Content

Types of Hydro plants subsystems of hydro plant, turbines, hydro alternates hydro plant. Auxiliaries, control of hydro power, micro hydel systems, special problems in hydro plants.

Texts/Reference Books

1. Hydro Plant Electrical Systems. Clemen David M. 1st Ed.HCI Publications, 1999.
2. Hydro-electric and Pumped Storage Plants. Jog M G. 1st Ed. New Age Pub. 1989.

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Electrical Engineering

Semester - VIII

(Open Elective - V)

MA-453 L-T-P-C
Mathematical Statistics 3-0-0-3

Objective: *To introduce the fundamental techniques of Sampling, Estimation & Hypothesis testing & illustrate these techniques with applications.*

Course Content

Review of Random variables. Order Statistics. Random sampling**.** The Central Limit Theorem. Sampling Distribution related to normal distribution**.** Point estimation. Bais & mean square errors of point estimators. Properties of point estimation & Methods of estimation. Confidence intervals. Large sample & small sample confidence intervals. Hypothesis testing. Common large sample tests p values. Small sample hypothesis tests. Power of tests & Neyman-Pearson Lemma.

Text/Reference Books

1. Statistical methods (Vol. II). Das N.G. 1st Ed McGraw-Hill 2009.
2. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill Education.. 2008.
3. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
4. Fundamentals of Mathematical Statistics. Gupta S.C. & Kapoor V. K. 11th Ed. S. Chand & Sons 2002.

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Semester - VIII

(Open Elective - V)

ME-467 L-T-P-C
Total Quality Management 3-0-0-3

Objective: *This course discusses total quality is a description of the culture, attitude & organization of a company that aims to provide, & continue to provide its customers with products & services to satisfy the needs.*

Course Content

Quality Concepts: Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods & Techniques for manufacture, Inspection & control of product, Quality in sales & services, Guarantee, analysis of claims.

Quality Management: Organization structure & design, Quality function, decentralization, Designing & fitting organization for different types products & company, Economics of quality value & contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality: Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error & corrective methods.Control Charts: Theory of control charts, measurement range, construction & analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts: Defects, construction & analysis off-chart, improvement by control chart, variable sample size, construction & analysis of C-chart. Defects

Diagnosis & Prevention : Defect study, identification & analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. IS0-9000 & its concept of Quality Management: ISO 9000 series, Taguchi method, JIT in some details

Texts/Reference Books

1. Total Quality management. LaI H. Wiley Eastern Limited, 1990
2. Beyond Total Quality Management. Bounds G. McGraw Hill, 1994
3. TQM in New Product manufacturing. Menon, H.G. McGraw Hill 1992

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Electrical Engineering

Semester - VIII

(Open Elective - V)

PH-455 L-T-P-C
Electromagnetic theory & Application 3-0-0-3

Objective: *Objective of this course to introduce the concepts of electromagnetic wave propagation in various media & their applications in various communication systems: waveguides, transmission lines, antenna etc.*

Course Content

Static fields: Coulomb's & Gauss' laws for electrostatics, Poisson's & Laplace's equations, Method of images & boundary value problems; Equation of continuity, Kirchoff's voltage & current laws, Boundary conditions for current density; Biot-Savart's law, Gauss's & Ampere's laws for magnetostatics, Magnetic vector potential; Magnetic dipoles, Magnetization & behavior of magnetic materials. Maxwell's equations: Faraday's law of electromagnetic induction, Maxwell's discovery, Maxwell's equations & boundary conditions, Time-harmonic fields. Wave equation & plane waves: Helmholtz wave equation, Solution to wave equations & plane waves, Wave polarization, Poynting vector & power flow in EM fields. Plane waves at a media interface: Plane wave in different media, Plane wave reflection from a media interface, Plane wave reflection from a complex media interface. Finite-difference time-domain method: 1-, 2- & 3-dimensional simulations, absorbing boundary conditions & perfectly matched layer, Applications. Antennas & radiating systems: Radiation fundamentals, Antenna patterns & parameters, Hertz dipole, Wire antennas, Loop antennas, Antenna arrays. Method of

moments: Introductory example from electrostatics, Basic steps of the method of moments, Linear operator equation, Applications.

Text/Reference Books

1. Elements of Electromagnetics. Sadiku M. N. O. 6th Ed. Oxford University Press. 2014.
2. Field and Wave Electromagnetics. Cheng D. K. 2nd Ed. Pearson. 2001.
3. The Finite-difference time-domain method for Electromagnetics with MATLAB Simulations. Elsherbeni A. & Demir V. 1st Ed. Scitech. 2009.
4. Antenna Theory: Analysis and Design. Balanis C. A. 3rd Ed. John-Wiley. 2005.
5. Electromagnetic Waves. Shevgaonkar R. K. 1st Ed. McGraw Hill. 2005.
6. Time-Harmonic Electromagnetic Fields. Harrington R. F. 2nd Ed. Wiley-IEEE. 2001.
7. Engineering Electromagnetics. Ida N. 2nd Ed. Springer. 2007.
8. Electromagnetic Simulation using the FDTD Method. Sullivan D. M. 1st Ed. Wiley-IEEE. 2000.