FIRST SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1.	HSS11101	English for Science and Technology	3	1	0	7
2.	AMC11101	Mathematics I	3	1	0	7
3.	APC11101	Physics I	4	0	0	8
4.	ACC11101	Chemistry	4	0	0	8
5.	FMD11101	Engineering Materials (Section A)	2	0	0	6
	ACD11102	Engineering Materials (Section B)	1	0	0	
6.	MMC11101	Engineering Graphics	1	6	0	8
7.	CMC11301	Environmental Studies	3	0	0	6
8.	MMC11201	Workshop Practice I	0	0	2	2
9.	ACC11251	Chemistry Practical	0	0	2/2	1
10.	APC11201	Physics I Practical	0	0	2/2	1
		Total	**21**	**8**	**4**	**54**

SECOND SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Credit Hrs.
1.	AMC12101	Mathematics II	3	1	0	7
2.	APC12101	Physics II	3	0	0	6
3.	AMD12101	Computer Programming & Information	3	0	0	9
	CSD12101	Technology	1	1	0	
4.	EEC12121	Electrical Technology	3	0	0	6
5.	EIC12101	Electronics & Instrumentation	3	0	0	6
6.	MMC12102	Engineering Mechanics	3	0	0	6
7.	HSC12301	Value Education, HR Environment	1	1	0	3
8.	MMC12201	Workshop Practice II	0	0	2	2
9.	APC12201	Physics Practical II	0	0	2/2	1
10.	MAT 253	Computer Programming Practical	0	0	2/2	1
11.	EEC12221	Electrical Technology Practical	0	0	2/2	1
12.	MMC12203	Engineering Mechanics Practical	0	0	2/2	1
13.	EIC12201	Electronics & Instrumentation Practical	0	0	2/2	1
14.	SWC12701	Co-curricular Activity	0	0	0	(3)
		Total	**20**	**3**	**7**	**53**

NOTE: The Course Structure & the Syllabi of I & II Semesters are common for all B.Tech courses and are already finalized by the Core Committee of the ISM University.

CORE COURSE STRUCTURE
(I & II SEMESTER)

Sl. No.	Course offering Department	Name of the Course	L	T	P	Credit Hrs.
1.	AM	Mathematics-I (Only for 1st Semester)	3	1	0	7
2.	AM	Mathematics-II (Only for 2nd Semester)	3	1	0	7
3.	AP/AC	Physics/Chemistry	3	1	0	7
4.	ME & MME	Engineering Graphics/Manufacturing Process	1	3	0	5
5.	EE/EAI	Electrical Technology/Electronics Engineering	3	1	0	7
6.	ME & MME /HSS	Engineering Mechanics /English for Science and Technology	3	1	0	7
7.	AGL & CME /FME & CME	Earth system Science (S)* /Global Energy Scenario & Energy Security of India (S)*	3	0	0	6
8.	HSS/CSE	Value Education, Human Right and Legislative Procedure (S) /Computer Programme (S)	3	0	0	6
		Practical				
9.	AP/AC	Physics / Chemistry	0	0	3	3
10.	EE / EAI	Electrical Technology / Electronics Engineering	0	0	3	3
11.	DSW	Counseling, Special Classes (Only for 1st Semester)	0	0	0	(3)
12.	DSW	Co-Curricular Activities (Only for 2nd Semester)	0	0	0	(3)
TOTAL			**19**	**7**	**6**	**51 + (3)**

NOTE: The Course Structure & the Syllabi of I & II Semesters are common for all B.Tech courses and are already finalized by the Core Committee of the ISM University.

REVISED COURSE STRUCTURE OF IIIrd & IVth SEMESTER OF
B.TECH COURSE IN ELECTRICAL ENGINEERING

THIRD SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC13111	Circuit Theory	3	1	0	7
2.	EEC13112	Analog Electronics	3	1	0	7
3.	EEC13113	Signals & Systems	3	1	0	7
4.	CSR13101	Data Structures	3	0	0	6
5.	AMR13101	Methods of Applied Mathematics I	4	1	0	9
6.	EEC13311	Field Theory (S)	4	0	0	8
7.	EEC13211	Circuit Theory Practical	0	0	3/2	1.5
8.	EEC13212	Analog Electronics Practical	0	0	3/2	1.5
		Total	**20**	**4**	**3**	**47**

FOURTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC14111	Electrical Measurements	4	0	0	8
2.	EEC14112	Electrical Machines I	3	1	0	7
3.	EEC14113	Digital Electronics	3	1	0	7
4.	AMR14101	Numerical and Statistical Methods	4	0	0	8
5.	MMR14101	Mechanical Engineering - II	3	1	0	7
6.	EEC14211	Electrical Measurements Practical	0	0	3/2	1.5
7.	EEC14212	Electrical Machines I Practical	0	0	3/2	1.5
8.	AMR14201	Numerical and Statistical Methods Practical	0	0	3	3
9.	EEC14213	Digital Electronics Practical	0	0	3/2	1.5
10.	EEC14511	Composite Viva-Voce	0	0	0	4
11.	SWC	Co-Curricular Activity	0	0	0	0
		Total	**17**	**3**	**7. 5**	**48.5**

FIFTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC15111	Electrical Machines II	3	1	0	7
2.	EEC15112	Control Systems I	3	1	0	7
3.	EEC15113	Power Systems I	3	1	0	7
4.	EEC15114	Microprocessor & Microcontroller	3	1	0	7
5.	EEC15115	Digital Signal Processing	3	1	0	7
6.	EEC15311	Electrical Machines & Power System Design (S)	3	0	0	6
7.	EEC15211	Electrical Machines II Practical	0	0	3/2	1.5
8.	EEC15212	Control Systems I Practical	0	0	3/2	1.5
9.	EEC15213	Power Systems I Practical	0	0	3/2	1.5
10.	EEC15214	Microprocessor & Microcontroller Practical	0	0	3/2	1.5
		Total	**18**	**5**	**6**	**47**

SIXTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC16111	Power Electronics	3	1	0	7
2.	EEC16112	Power Systems II	3	1	0	7
3.	EEC16113	Instrumentation & Process Control	4	0	0	8
4.	EEC16114	Control Systems II	3	1	0	7
5.	CSR16101	Computer Networks	3	0	0	6
6.	EEC16211	Power Electronics Practical	0	0	3/2	1.5
7.	EEC16212	Power Systems II Practical	0	0	3/2	1.5
8.	EEC16213	Instrumentation & Process Control Practical	0	0	3/2	1.5
9.	EEC16214	Control Systems II Practical	0	0	3/2	1.5
10.	EEC16511	Composite Viva-Voce	0	0	0	4
11.	SWC	Co-curricular Activity	0	0	0	0
		Total	**16**	**3**	**6**	**45**

SEVENTH SEMESTER

Sl. No	Course No.	Name of the course	L	T	P	Cr. Hr.
1.	EEC17111	Electrical Drives	3	1	0	7
2.	EEC17112	Switchgear and Protection	3	1	0	7
3.	MSC17152	Industrial Engineering and Management	3	0	0	6
4,5.		**Electives (Any Two)**	2 · (4 - 0 - 0)			16
(i)	EEE17111	Advanced Power Electronics				
(ii)	EEE17112	Material Science				
(iii)	EEE17113	Mine Electrical Technology				
(iv)	EEE17114	Communication Engineering				
(v)	EEE17115	Computer Application in Power System				
(vi)	EEE17116	Illumination & Utility Services				
(vii)	EEE17117	Power Plant Instrumentation and Control				
(viii)	EEE17118	Systems Modelling & Simulation				
(ix)	EEE17119	Soft Computing Techniques				
(x)	EEE17120	Filter Design & Synthesis				
(xi)	EEE17121	Bio-medical Instrumentation				
(xii)	EEE17122	Robotics				
(xiii)	CSE17113	Information & Coding Theory				
6.	EEC17211	Electrical Drives Practical	0	0	3/2	1.5
7.	EEC17212	Switchgear and Protection Practical	0	0	3/2	1.5
8.	EEC17411	Project and Seminar	0	0	6	6
9.	EEC17011	Vocational Training	0	0	0	5
		Total	**17**	**2**	**9**	**50**

Note: Vocational Training taken at the end of VI-th Semester is credited in VII-th Semester.

EIGHTH SEMESTER

Sl.No	Course No	Name of the course	L	T	P	Cr.Hr
1.	EEC18111	Utilization of Electrical Power	3	1	0	7
2.	EEC18112	Industrial Automation and Control	4	0	0	8
3.	EEC18113	Electrical Energy Systems	4	0	0	8
4, 5.		**Electives (Any Two)**	2 · (4 - 0 - 0)			16
(i)	EEE18121	Special Purpose Electrical Machines				
(ii)	EEE18122	Static Relays				
(iii)	EEE18123	Opto - Electronics				
(iv)	EEE18124	Digital Instrumentation				
(v)	EEE18125	HVAC & HVDC Transmission Techniques				
(vi)	EEE18126	Flexible AC Transmission System				
(vii)	EEE18127	Power System Dynamics and Control				
(viii)	EEE18128	High Voltage Engineering				
(ix)	EEE181289	Optimal Control				
(x)	EEE18130	Pattern Recognition				
(xi)	EEE18131	Mine Instrumentation				
6.	EEC18411	Project and Seminar	0	0	6	6
7.	EEC18411	Composite Viva-Voce	0	0	0	4
8.	SWC	Co-curricular Activity	0	0	0	0
		Total	**19**	**1**	**6**	**49**

CORE COURSE STRUCTURE
(I & II SEMESTER)

Sl. No.	Course offering Department	Name of the Course	L	T	P	Credit Hrs.
1.	AM	Mathematics-I (Only for 1st Semester)	3	1	0	7
2.	AM	Mathematics-II (Only for 2nd Semester)	3	1	0	7
3.	AP/AC	Physics/Chemistry	3	1	0	7
4.	ME & MME	Engineering Graphics/Manufacturing Process	1	3	0	5
5.	EE/EAI	Electrical Technology/Electronics Engineering	3	1	0	7
6.	ME & MME /HSS	Engineering Mechanics /English for Science and Technology	3	1	0	7
7.	AGL & CME /FME & CME	Earth system Science (S)* /Global Energy Scenario & Energy Security of India (S)*	3	0	0	6
8.	HSS/CSE	Value Education, Human Right and Legislative Procedure (S) /Computer Programme (S)	3	0	0	6
		Practical				
9.	AP/AC	Physics / Chemistry	0	0	3	3
10.	EE / EAI	Electrical Technology / Electronics Engineering	0	0	3	3
11.	DSW	Counseling, Special Classes (Only for 1st Semester)	0	0	0	(3)
12.	DSW	Co-Curricular Activities (Only for 2nd Semester)	0	0	0	(3)
TOTAL			**19**	**7**	**6**	**51 + (3)**

NOTE: The Course Structure & the Syllabi of I & II Semesters are common for all B.Tech courses and are already finalized by the Core Committee of the ISM University.

L T P
3 1 0

MATHEMATICS-I

Calculus-I: Successive differentiation of one variable and Leibnitz theorem. Taylor's and Maclaurin's expansion of functions of single variable. Functions of several variables, partial derivatives, Euler's theorem,derivatives of composite and implicit functions, total derivatives, Jacobian's, Taylor's and Maclaurin's expansion of functions of several variables, mamixa and minima of functions of several variables, Lagrange'smethod of undetermined multipliers. Curvature and asymptotes, concavity, convexity and point of inflection. Curve tracing.

Calculus-II: Improper integrals, convergence of improper integrals, test of convergence, Beta and Gamma functions and its properties, Differentiation under integral sign; differentiation of integrals with constant and variable limits; Leibnitz rule.
Evaluation of double integrals, change of order of integration, change of coordinates, evaluation of area using double integrals, Evaluation of triple integrals, change of coordinates, evaluation of volumes of solids and curved surfaces using double and triple integrals. Mass, center of gravity, moment of intertia and product of intertia of two and three-dimensional bodies and principal axes.

Trigonometry of complex Number, 3D Geometry and Algebra: Function of complex arguments, Hyperbolic functions and summation of trigonometry series.

3-D Geometry: Cones, cylinders and conicoids; Central conicoids, normals and conjugate diameters.
Algebra: Convergency and divergency of Infinite series. Comparison test, D' Alembert's ratio test, Raabe's test, logarithmic test, Cauchy's root test. Alternating series; Leibnitz test, absolute and conditional convergence, power series, uniform convergence.

Reference Books:

1. Differential Calculus by B.C. Das and B.N Mukherjee
2. Integral Calculus by B.C. Das and B.N. Mukherjee.
3. Integral Calculus by R.K. Ghosh and K.C Maity.
4. Analytical Solid Geometry by Shanti Narayan.
5. Textbook of Engineering Mathematics by Debashish Dutta.

L T P
3 1 0

MATHEMATICS - II

Vector Calculus and Fourier Series:
Vector Calculus: Scalar and vector fields, Level surfaces, Differentiation of vectors,
Directional derivatives, gradient, divergence and curl and their physical meaning, vector operators and expansion formulae, Line, surface and volume integrations, Theorems of Green, Stokes and Gauss, Application of vector calculus in engineering problems, orthogonal curvilinear coordinates, expressions of gradient, divergence and curl in linear coordinates.
Fourier Series: Periodic functions, Euler's formulae, Dirichlet's conditions, expansion of and odd functions, half range Fourier series, Perseval's formula complex form of Fourier series.

Matrix Theory: Orthogonal, Hemitian, skew-Hermitian and unitary matrices, Elementary row and column transformations, rank and consistency conditions and solution of simultaneous equations, linear dependence and- independence of vectors, linear and orthogonal transformations. Eigen values and Eigen vectors, properties of Eigen values, Cayley-Hamilton theorem, reduction to normal forms, quadratic forms, reduction of quadratic forms to canonical forms, index, signature, Matrix .calculus & its applications in solving differential equations.

Differential Equations: Differential equations of first order and higher degree, Linear independence and dependence of functions. Higher order differential equations with constant coefficient, Rules for finding C.F. and P.1., Method of variation of parameter, and method of undermined coefficients, Cauchy and Legendre's linear equations.
Linear differential equations of second order with variable coefficients; change of dependent variable, change of independent variable, linear equations of special types; dependent variable absent, independent variable absent. Simultaneous linear equations with constant coefficients.
Various applications of higher order differential equations in solution of engineering problems.

Partial Differential Equations: Formation of P .D.E, Equations solvable by direct integration, Linear and non-linear equations of first order, Lagrange's equations, and Charpit's method. Homogeneous and non-homogeneous linear P.D.E. with constant coefficients. Rules for finding C.F. & P.I.

Reference Books :

1. Vector Analysis by Lalji Prasad
2. Theory and· Problems of Advanced Calculus by M.R. Spiegel (Schaum Series)
3. Theory and Problems of Laplace Transfoml by M.R Spiegel (Schaum Series)
4. Higher Engineering Mathematics by B.V. Raman ..
5. Advanced Engineering Mathematics by R.K.Jain & S.R K. Iyenger.
6. A Text Book of Matrices by Shanti Narayan

L T P
3 1 0

PHYSICS

Thermal Physics:
Concepts of distribution of molecular velocities; Distribution laws and statistics MB, FD and BE, mean free path; Transport phenomena-viscosity, diffusion; thermal conductivity, measurement of thermal

conductivity; periodic and aperiodic flow of heat; Wiedemann-Franz law.
Heat radiation; black body and black body radiation; Planck's distribution law and its application to classical distribution (Rayleigh-Jeans and Wiens) and total radiation (Stefan-Boltzmann) laws.

Modern Physics:
Brief idea of molecular spectra; Rigid rotator, 'spectra of simple molecules, rotation and rotation-vibration spectra.
Brief idea of wave packet and wave function, Shrodinger equation, Particle in a Box.
Free electron theory; qualitative idea of band theory of solids and 'Hall effect, Laser and laser systems (He-Ne and Ruby Lasers).

Electromagnetics and Electrical Phenomena in Rocks:
Maxwell's field equation, Equation of electromagnetic field, Propagation of electromagnetic waves in different istropic media, energy of electromagnetic waves, Poynting's theorem & Poyting's vector.
Rocks and minerals as dielectrics, electrical conductivity and electrical phenomena- in rocks, Piezo-, ferro-, tribo-, and pyro-electricity.

L T P
0 0 3

PHYSICS PRACTICAL

Measurement of thermal conductivity of bad conductors, Optical experiments on Diffraction using diffraction grating. Experiments on Semi-conductors - measurement of band gap and Hall effect Experiments using He- Ne Laser - Diffraction Experiments to measure Brewster's angle & find refractive index.

Reference Books :

1. "A Treatise on Heat"- Saha and Srivastava'·
2. "Engineering Physics"-B.L.Theraja
3. "Physics of Rock and Minerals"-Rzhevsky & Novic
4. Lasers-Ghatak & Thyagarajan
5. "Solid State Physics"-C Kittel
6. "Elements of Elel;tromagnetic theory" -M NO Sadiku

LT P
3 1 0

CHEMISTRY

Cement: Manufacturing, composition, setting and hardening of cement.

Glass : Types of Glasses, Manufacturing & properties of Glasses.

Polymers:Classification,structure-property relationship,conductive polymers.

Solid Fuels: Structure of coal, classification of coal, Effect of heat on coal, carbonization and pyrolysis. Recovery and purification of by-products obtained from coke ovens; Distillation of coal tar; coal chemicals.

Liquid Fuels: Composition of crude oil, processing of crude oil, distillation, sweetening and cracking (basic concepts), octane number, Cetane number. Additives to improve to improve the quality of diesel and petrol, bio-diesel.

Gaseous Fuels: Characteristics of good fuel; calorific value, theoretical calculations of calorific value of a fuel, natural gas and hydrogen gas.

Phase rule and phase equilibrium diagram: Phase rule; degree of freedom, one and two component systems, temperature and composition diagrams, liquid-liquid and liquid-solid phase diagrams.

Lubricants: General characteristics of lubricants, chemistry of lube oil and greases. Reclamation of lubricants.

Equilibrium: Electrochemistry; Electric potentials at interfaces, electrodes, batteries. electrochemical cells and their applications.

Corrosion: Chemical and electrochemical corrosion, classification, factors affecting corrosion, Form of corrosion and general methods of corrosion prevention.

L T P
0 0 3

CHEMISTRY PRACTICAL

List of Experiments

1. Standards of HCl by Standard Sodium Carbonate solution
2. Determination of Temporary Hardness of tap water.
3. Estimation of Total Hardness of water.
4. Determination of Iron in Ferrous Ammonium Sulphate solution (Redox titration).
5. Determination of Copper in crystallized Copper-Sulphate.
6. Estimation of available Chlorine in Bleaching Powder.
7. Determination of Molecular Weight of Organic Acid by Titration method.
8. Estimation of Sodium Carbonate and bicarbonate in a mixture.
9. To determine the saponification number of an oil.
10. To determine the rate of hydrolysis of methyl /ethyl acetate.
11. To prepare Chrome Alum.

Reference Books:

1. A Textbook of Engineering Chemistry-Sashi Chawla

2. Applied Chemistry: A Textbook for Engineers and Technologists - H.D.Gesser.
3. Engineering Chemistry - P.C.Jain & Monika Jain
4. Engineering Materials - K.G. Budinski & M K Budinski
5. Engineering Chemistry - B K Sharma

L T P
1 3 0

ENGINEERING GRAPHICS

Drawing instruments and their uses; Indian standards for drawing.
Lettering; Types of lines used in engineering graphics: full lines hidden lines, dimension lines, centerlines, section lines construction lines etc.
Scales: representative fractions, reducing and enlarging scales, plain scales, diagonal scales and vernier scales.
Curves used in engineering practice: conic sections, ellipse, parabola, hyperbola, cycloid,
epicycloid, hypocycloid, involutes and spira1.
Orthographic projections: First angle and third angle projections, conventions used, orthographic projection of simple solids; Conversion of three-dimensional views to orthographic views.
Isometric projections: of simple solids, isometric views, conversion of orthographic views to isometric views; free hand sketching.

Reference Books:

1. Engineering Drawing - N D Bhatt
2. Engineering Graphics - S C Sharma & Naveen Kumar
3. Engineering Drawing -P S Gill
4. Engineering Drawing with Auto-CAD - Parvez, Khan & Khalique

LT P
1 3 0

MANUFACTURING PROCESSES

Carpentry: Classification of timber, seasoning and preservation of wood, description and applications of the various tools used in carpentry, different joints arid their practical uses.
Forging: Introduction to Forging, types of tools' and their uses, colour representations of different temperature levels, recrysta1lisation, workability of metals at elevated temperature, safety rules.
Casting: Introduction to foundry, Pattern making, types of casting processes, purpose of runner & riser, applications of casting, defects in casting.
Fitting: Introduction to fitting jobs, fitting tools and their uses, safety rules.
Welding: Welding types, accessories, weldments, safety rules
Machine Tools: Types of tools, Types of Machine Tools and their

specifications, safety rules.
Measurement: Use of vernier etc for product measurement.

Reference Books:
1. Workshop Technology Part I, II & III - W A J Chapman
2. Worksliop Technology Part I & II - Hazra Chowdhury.
3. Workshop Technology Part I & II - Raghubanshi

L T P
3 1 0

ELECTRICAL TECHNOLOGY

Network theorems (KCL, KVL, Thevenin, Norton, Maximum power transfer) applied to steady-state DC circuit. Single-phase AC circuit and phasor diagrams, series and parallel resonance. Three-phase AC circuits with: balanced and unbalanced loads, phasor presentation, measurement of three-phase power by two-wattmeter method.
Single-phase transformer: Construction, types, EMF equation, equivalent circuit, phasor diagram, regulation, efficiency, OC and SC tests.
DC Machines: Construction, types, principle of operation, EMF and torque equation.
DC generator: OCC and external characteristics curves and efficiency.
DC motors: speed-torque characteristics, starting, 3-point starter, speed control and efficiency.
Three-phase induction motor: Construction, types, principle of operation, torque-slip characteristics, starting methods.
Introduction to three-phase synchronous motor.

L T P
0 0 3

ELECTRICAL TECHNOLOGY PRACTICAL

Experiments on Thevenin's theorem, R-L-C series. circuit, Single phase power measurement Characteristics of fluorescent lamp and incandescent lamp, OC and SC tests of single phase transformer, Open-circuit characteristics of DC separately excited generator, External Characteristics of separately excited DC generator, Three-point starter of DC shunt motor, Speed control of DC motor.

Reference books:
1. Electrical Engineering Fundamentals - V Del Toro
2. Basic Electrical Engineering (Special Indian Edition) - J J Cathey, S A Nasar, P Kumar.
3. Hughes Electrical and Electronic Technology - E Hughes, I M Smith, J Hiley, K Brown.
4. Basic Electrical Engineering - D P Kothari and I J Nagrath.
5. Electric Machinery - A E Fitzgerald, C Kingsley, S D Umans.

L T P
3 1 0

ELECTRONICS ENGINEERING

Semiconductor Diodes and Applications - Introduction Characteristics, dc and ac resistances of a diode. Half wave and Full wave rectification. Zener Diodes and then use as regulators, Clippers and Clampers.
Bipolar Junction Transistor - Introduction, Transistor operation CB, CE and CC configuration, dc Biasing, Operating Point, Fixed Bias Circuit, Emitter - Stabilized Bias Circuit. Voltage Divider Bias.
BJT Transistor - Amplification in ac domain, Equivalent transistor model. Hybrid Equivalent model, RC coupled amplifier and its frequency response.
Operational Amplifiers - Introduction, Differential and Common Mode Operation, OPAMP Basics, Practical OPMAP Circuits.
Introduction to Field Effect Transistors and their applications.
Digital Electronics - Review of Basic Gates and Boolean Algebra, Introduction to Combinational Logic Design. Standard Representations of Logical Functions and their simplification. Combinational Logic Design, Half Adder and Full Adders.
Sequential Circuits-Flip flops S-R, J-K and D Application in Ripple Counters.

L T P
0 0 3

ELECTRONICS ENGINEERING PRACTICAL

1. Study of Electronic Equipment & Components.
2. Study of diode characteristics.
3. Study of regulated power supply.
4. Study of BJT characteristics.
5. Study of op-amp characteristics.
6. Implementation of Boolean algebra using logic gates.
7. Adder Circuits.
8. Flip Flops.

Reference Books:

1. Electronic Device and Circuit Theory - Boylestad & Nashlesky
2. Digital Principles & Applications - Malvino & Leach

L T P
3 1 0

ENGINEERING MECHANICS

Fundamentals of Mechanics: Equivalent force system, Equation of equilibrium,
Introduction to Structural mechanics: Force analysis of Frames, Trusses, Shear force, bending moment analysis of Beams.
Friction force analysis: Laws, Sliding and Rolling, friction, Screw Jack, Wedge, Belt friction, Collar friction.
Properties of surfaces: First moment of area and the centroid, Second moment and product of areas, Transfer theorem, Polar moment of inertia.
Introduction of variational mechanics,

Kinematics of particles: Velocity and acceleration calculations, Relative motion.
Particle dynamics: Rectilinear translation, Rectangular and cylindrical coordinates.
Energy methods: Conservation of mechanical energy, work-energy equations.
Linear momentum and moment of momentum: Impulse and momentum relations for a particle, Moment of momentum equations for a single particle and for a system of particles.
Introduction to kinematics and kinetics of rigid bodies.
Mechanical vibration of single degree of freedom system.

Reference Books:

1. Vector Mechanics for Engineers - Statics & Dynamics: Beer, Johnston.
2. Engineering Mechanics - Statics & Dynamics: Nelson, Best, McLean.
3. Engineering Mechanics - Statics & Dynamics: Shames, Rao, Pearson.
4. Engineering Mechanics - K.L.Kumar.
5. Engineering Mechanics - Statics & Dynamics: A. K. Tayal.

L T P
3 1 0

ENGLISH FOR SCIENCE AND TECHNOLOGY

Language Resource Development: Using appropriate grammatical lexical forms to express meaning-accuracy, range and appropriacy grammatical lexical exercises.
Reading, Interpreting and Using Written, and Graphic Information: Using (reading and writing) academic texts, articles in technical journals, instruction manuals/laboratory instruction sheets, safety manuals and regulations, and reports; Using maps, graphs, plan diagrams, flow-charts, sketches, tabulated and' statistical data.
Writing Appropriately in a Range of Rhetorical Styles i.e. Formal and Informal: Writing instructions, describing objects and processes; defining, narrating, classifying exemplifying, comparing, contrasting, hypothesizing, predicting, concluding, generalizing, restating and reporting; Note making (from books/journals); Writing assignments; summarizing, expanding, paraphrasing; Answering examination questions; Correspondence skills; Interpreting, expressing and negotiating meaning; Creating coherent written texts according to the conventions.
Receiving and Interpreting the Spoken Word: Listening to lectures and speeches, listening to discussions and explanations in tutorials; Note taking (from lectures); Interacting orally in academic, professional and social situation; Understanding interlocutor, creating coherent discourse, and taking appropriate turns in conversation; Negotiating meanings with other

(in class room, workshop laboratory, seminar, conference, discussion, interview etc.).

Reference Books:

1. Using English in Science and Technology - R K Singh
2. Practicing English in Science and Technology - R K Singh
3. Communication in English: Grammer and Composition-R K Singh
4. Communication in English for Technical Studies - William, Ray; Ray Rabindranath; and Swales, John-Orient Longman

L T P
3 0 0

EARTH SYSTEM SCIENCE

A G L (2 0 0)

Space Science: Solar System, Age of the Earth, Origin of Solar system. Meteors and Meteorites.

Earth Dynamics: Interior of the Earth, Composition of the Earth, Seismic waves, Seismograph, Plate Tectonics, Basics of Earthquake, Landslides, Volcanoes.

Geological Oceanography: Sea waves, Tides, Ocean currents, Geological work of seas and oceans, Tsunami and its causes, Warning system and mitigation.

Hydrogeology: Water table, Aquifer, Groundwater fluctuations and groundwater composition, Hydrologic cycle.

Glaciology: Glacier types, Different type of glaciers, Landforms formed by glacier.

Geological bodies and their structures: Rock, Mineral, Batholith, Dyke, Sill, Fold, Fault, Joint, Unconformity

CME (1 0 0)

Earth's Atmosphere: Structure and composition of atmosphere, Atmospheric circulation, Geological work of wina, Greenhouse effect and global warming, Carbon dioxide sequestration. Steps to maintain clean and pollution free atmosphere with governing laws,

Precautionary measures against disasters.

Biosphere: Origin of life, Evolution of life through ages, Geological time scale, Biodiversity and its conservation.

Natural Resources: Renewable and non-renewable resources, Mineral and fossil fuel resources and their geological setting; Mining of Minerals and conservation, Effect of mining on surface environment.

Reference Books:

1. Earth System Science from biogchemical cycles to global changes: Jacobson, M., Charison, R.J., Rodhe, H., and Orians, G.H., 2002,
2. Fundamentals of Geophysics - Lowrie, W
3. Earth System Science Education for the 21st Century: (http://esse21.usra.edu)

4. Earth's Dynamic Systems - W.Kenneth and Eric H.Christiansen.
5. Exploring Earth: An introduction to Physical Geology John P.Davidson,
6. S. Holmes Principles of Physical Geology - A. Holmes
7. A Textbook of Geology - P.K. Mukherjee.
8. A Textbook of Environmental Studies for Undergraduate Courses - Erach Bharucha.

L T P
3 0 0

GLOBAL ENERGY SCENARIO AND ENERGY SECURITY OF-INDIA

Definition of Energy; Primary and Secondary Energy; Difference between Energy. Power and Electricity;
Renewable and Non-Renewable Sources of Energy; The concept and Significance of Renewablity;
Social, Economic, Political and Environmental Dimension of Energy;
Major Types and Sources of Energy at the Global and at the National Level;
Global and Indian Reserves and Resources of Natural Oil and Gas, Coal and Nuclear Minerals:
Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based Power and Energy: Globally and in India;
Energy Sources and Power Generation: Thermal, Nuclear, Hydroelectric, Solar, Wind and Wave; General Principles; Relative Merits and Demerits including, Conversion Efficiency, Generation Cost and Environmental Impact: Concepts of Open and Combined Cycles, Co-generation: Clean Coal Initiatives;
Power Transmission and Distribution: General Principles; Demand Side management; Social, Political, Economic and Legal Issues Involved in the Generation Transmission Distribution of Power in India: Current Scenario and Future Prospects of Carbon Sequestration, Coal Gasification, and CBM;
Current Scenario and Future Prospects of Solar Power. Hydrogen Power and Fuel Cells;
Energy cum Power Scenario of India vis-à-vis China, South Africa and the USA; Global Energy Politics.

Reference Books:

1. Non-Conventional Energy Sources, G.D. Rai
2. A Textbook of Power Plant Engineering,: R.K. Rajpur
3. World Coal Institute Website.
4. Uranium Information Center Website.
5. World Energy Council Website.
6. Integrated Energy Policy, GOI.

L T P
3 0 0

VALUE EDUCATION HUMAN RIGHTS AND LEGISLATIVE PROCEDURE

Social Values and Individual Attitudes, Work Ethic, Indians Vision of Humanism, Moral and Non-moral Valuation, Standards and Principle Value Judgments.
Rural Development in India, Co-operative: Movement and Rural Development.
Human Rights, UN declaration, Role of various agencies in protection and promotion of Rights.
Indian Constitution, Philosophy of Constitution, Fundamental Rights and Fundamental Duties, Legislature, Executive, and Judiciary: Their Composition, Scope and Activities.
The Legislature: Function of Parliament, Constitution of Parliament, Composition of the Council of the States, Composition of the House of the People, Speaker,
Legislative Procedure: Ordinary Bills, Money Bills, Private Members Bills; Drafting Bills; Moving the Bills, Debate, Voting; Approval of the President/Governor.
Vigilance: Lokpal and Functionaries.

Reference Books :

1. An Introduction to Ethics - Robert E. Dewey and Robert H. Hurlbutt III
2. Introduction to the Constitution of India - Durga Das Basu
3. Essay and Reflections - Sarvapalli Radhakrishan, Mahatma Gandhi
4. An Autobiography: The story of My Experiments with Truth - M.K.Gandhi,
5. Human Rights: Questions and Answers - Leah Levin

L T P
3 0 0

COMPUTER PROGRAMMING

Introduction to Computer Software.
Introduction to Programming, Data Types, Variables, Operators and Expressions, Assignments, Input/Output, Control statements and iterations, Arrays and subscripted variables, String manipulation, Functions, Recursions, Structures and unions, Pointers, Dynamic memory allocation, Linked structure, File handling, Language preprocessor and Command line arguments.
Introduction to Object Oriented Programming in C++.

Reference Books:

1. “The C Programming Language” - Brain W. Keringhan and Dennis M.Ritchi
2. “Programming in ANSI C” - E. Balaguruswmny .
3. “Schaum's Outline of Programming with C' - Byron Gottifried
4. 'Fundamentals of Data Structures in C' - Ellis Horowitz; Satraj Sahni and Susan Anderson-Freed
5. 'Object Oriented Programming in C++' - E. Balaguruswamy 'Object Oriented Programming in C++' - Robert Lafore

THIRD SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC13111	Circuit Theory	3	1	0	7
2.	EEC13112	Analog Electronics	3	1	0	7
3.	EEC13113	Signals & Systems	3	1	0	7
4.	CSR13101	Data Structures	3	0	0	6
5.	AMR13101	Methods of Applied Mathematics I	4	1	0	9
6.	EEC13311	Field Theory (S)	4	0	0	8
7.	EEC13211	Circuit Theory Practical	0	0	3/2	1.5
8.	EEC13212	Analog Electronics Practical	0	0	3/2	1.5
		Total	**20**	**4**	**3**	**47**

THIRD SEMESTER

EEC13111 CIRCUIT THEORY
(3 1 0)

Networks theorems, Formulation of network equations, Source transformation, Loop analysis, nodal analysis, Coupled circuits.
Graph of network, Tree, Incidence matrix, Loop matrix, Cut-set and cut-set matrix, Tie-set matrix, Formulation of equilibrium equation on loop and node basis.
Two port networks, short-circuit admittance parameter, open-circuit impedance parameters, Transmission parameters, hybrid parameters, series, parallel and cascade connection of two-port networks.
Laplace transformation of standard test signals, Synthesis of different waveforms using Laplace transform technique, Inverse Laplace transform, transient solution of RL, RC, LC, RLC circuits.
Network functions: Driving point impedance and Transfer functions, concept of Poles and Zeros.
Introduction to filters, Characteristics impedance, Constant-k filters, m-derived filters, Introduction to filter design.
Networks Synthesis: Positive real function, Hurwitz Polynomial, Reactance function, Foster and Cauer method of realization.

References:

[1] Introduction to modern Network Synthesis M. E. Van Valkenburg.
[2] Network Analysis M. E. Van Valkenburg.
[3] Fundamentals of Electric Circuits C. K. Alexander, M. N. O. Sadiku.
[4] Network and systems D. Roy Choudhary.
[5] Circiut Theory: Analysis and Synthsis A. Chakraborti

EEC13112 ANALOG ELECTRONICS

(3 1 0)

Biasing of Discrete Devices & Integrated Circuits.

Thermal Stability Transistor heat dissipation, Significance of Q-point in thermal runaway, Junction to case thermal resistance, Conditions for thermal Stability, Selection of heat sink size.

High frequency effect in transistor, Darlington connection, h-parameter equivalent circuit for transistor, UJT, Relaxation Oscillator using UJT.

Low frequency amplifiers, Feedback amplifiers, Frequency response.

Operational Amplifiers, Ideal and practical Op-Amp, Inverting amplifier, Noninverting amplifier, Voltage Follower, Summing amplifier, Differential Amplifier, Controlled voltage and current sources, level shifter, Comparator, Hysteresis and Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Precision Rectifier.

Active filters, Oscillators, Power amplifiers.

Timer, Monostable and astable operation using 555 timers.

Voltage regulator Series and shunt voltage regulators, Switching regulator.

References:

[1] Electronic Principles - Malvino

[2] Millman's Electronic Devices & Circuits - Jacob Millman, Halkias & Satyabratajit

[3] Electronic Devices & Circuits - Allen Mottershead

[4] OpAmps and Linear integrated Circuits - Gayakwad

[5] Electronic Devices & Circuits, Pearson Education by Bogart, Beasley & Rico

EEC13113 SIGNALS AND SYSTEMS

(3 - 1 - 0)

Classification of signals and systems: Systems modeling in terms of differential equations, Periodic signal analysis Fourier series, Aperiodic signal analysis Fourier transform.

Laplace transforms and their application to system analysis, impulse response, step response and convolution integral, Transfer Function, Poles and Zeroes, Concept of Stability, Routh's criteria.

State-space representation, state-transition matrix.

References:

[1] Signals and Systems - A. V. Oppenheim, A. S. Willsky & Nawab.

[2] Signals and Systems: Continuous and Discrete - R. F. Zeimer, W. H. Tranter and D. R. Fannin.

[3] Discrete Time Signal Processing-A. V. Oppenheim and R. W. Schafer.

[4] Modem Control Engineering - K. Ogata.

[5] Signals and Systems - K. M. Soni.

CSR13101
(3 0 0)

DATA STRUCTURES

Data structure overview, Data types, Creation and analysis of programs, Algorithm analysis; Different data structures: Arrays, Stacks, Queues, Circular queues, Priority queues, Linked lists together with algorithms for their implementation and uses; Sorting algorithms: Insertion: Selection, Bubble, Quick, Merge, Heap etc; Searching algorithms:
Linear searching, Binary searching, Hashing strategy, Hashing functions and hash search~ Trees: Binary tree representation, Traversal, binary search tree, AVL trees, balancing, rotations, Applications Graphs: Representation, traversals, Shortest-path problems, Applications; Recursive: Divide: and-conquer, tower of Hanoi, etc.

AMR13101
(4 1 0)

METHODS OF APPLIED MATHEMATICS - I

Section-A: Analysis of Complex Variables: Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Riemann's and Cauchy's integral theorem, Morera's theorem, Cauchy's integral formula, Expansion of function of complex variables in Taylor's and Laurent's series, singularities and poles. Residue theorem, contour integration, conformal mappings and its application, Bilinear Transformation.

Section-B: Special Functions: Solution in series of ordinary differential equations, Solution of Bessel and Legendre equations, recurrence relations and generating function for $J_n(x)$, orthogonal property and Integral representation of $J_n(x)$. Legendre polynomial, Rodrigue's formula, orthogonality properties and generating function for $P_n(x)$. Elliptic integrals and Error function and their properties.

Section-C: Laplace Transform and PDE: Laplace Transform of simple functions, first and second shifting theorems, t-multiplication and t-division theorems; Laplace transforms of derivatives, integrals and periodic functions. Inverse Laplace transform and convolution property. Use of Laplace transform in evaluating complicated and improper integrals and solution of ordinary differential equations related to engineering problems.

Partial Differential Equations: Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation in cartesian and polar coordinates by variable separable method with reference to Fourier trigonometric series and by Laplace transform technique.

EEC13311 FIELD THEORY (S)
(4 0 0)

Introduction : Physical interpretation of gradient, divergence and curl. The Laplacian operator, vector relationship in rectangular, cylindrical and spherical polar co-ordinate systems.

Electric field : Potential and potential gradient, Gauss' law, Stokes' theorem, Green's theorem, divergence and curl of electric field. Laplace's equation and Poisson's equation, Helmholtz theorem, field equations in different co-ordinate systems, boundary conditions, dipoles.

Magnetic field: Boit-Savart law, Ampere's law, scalar and vector potentials, divergence and curl of magnetic field, force and torque equations. Field equations in different co-ordinate systems, boundary conditions.

Electromagnetic field : Time varying field and Faraday's law, displacement current. Maxwell's wave equation, wave equations in conducting medium, skin effect, wave equations in imperfect dielectrics. Reflection, refraction and polarization of electromagnetic waves. Maxwell's field equations vs circuit equations.

Power flow and the Poynting vector, Poynting theorem. Transmission line.

References:

[1] Electromagnetics, - J. A. Edminister.
[2] Introduction to Electromagnetic Fields Clayton R. Paul, Keith W. Whites, Syed A. Nasar
[3] Electromagnetics with application J. D Kraus and D.A. Fleish.
[4] Engineering Electromagnetics - W. H. Hayt & J. A. Buck
[5] Field Theory - K. A. Gangadhar.

EEC13211 CIRCUIT THEORY PRACTICAL
(0 0 3/2)
Experiments on network theorems, two-port networks, transient study of RLC circuit, filters. Use of standard software's like PSPICE for circuit analysis.

EEC13212 ANALOG ELECTRONICS PRACTICAL
(0 0 3/2)
Experiments on Bipolar junction transistor amplifier, Field-effect transistor amplifier, OPAMP inverting and non-inverting amplifiers, Filters, OPAMP integrator and differentiator, Multivibrator, Oscillator, Analog comparator, Regulated power supply etc.

FOURTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC14111	Electrical Measurements	4	0	0	8
2.	EEC14112	Electrical Machines I	3	1	0	7
3.	EEC14113	Digital Electronics	3	1	0	7
4.	AMR14101	Numerical and Statistical Methods	4	0	0	8
5.	MMR14101	Mechanical Engineering - II	3	1	0	7
6.	EEC14211	Electrical Measurements Practical	0	0	3/2	1.5
7.	EEC14212	Electrical Machines I Practical	0	0	3/2	1.5
8.	AMR14201	Numerical and Statistical Methods Practical	0	0	3	3
9.	EEC14213	Digital Electronics Practical	0	0	3/2	1.5
10.	EEC14511	Composite Viva-Voce	0	0	0	4
11.	SWC	Co-Curricular Activity	0	0	0	0
		Total	**17**	**3**	**7. 5**	**48.5**

FOURTH SEMESTER

EEC14111 (4 - 0 - 0) **ELECTRICAL MEASUREMENTS**

Classification of Electrical Measuring Instruments, General features of Indicating Instruments; Systematic and Random Errors, Error analysis.
Principle of Permanent Magnet Moving Coil (PMMC), D'Arsonval, Vibration and Ballistic type Galvanometers; Principles of Electrothermal, Rectifier, Moving Iron, Electrodynamic, Electrostatic and Induction type Instruments for the measurement of Voltage, Current, Power, Energy, Frequency, Phase Angle, Power Factor; Maximum Demand Indicator and Trivector Meter; Shunt and Multiplier; Instrument Transformers.
Measurement of Low, Medium and High Resistances, Cable Fault Localization; Measurement of Inductance and Capacitance by AC Bridges; Potentiometers (DC and AC), Magnetic measurements (DC and AC); Hall effect.
CRO and oscilloscopic measurements, Signals Generators, EVM, DVM, Harmonic distortion, Wave and spectrum Analyzers, Electronic frequency meter. A/D and D/A conversions (ladder and weighted resistor type DACs, Successive Approximation and Dual-Slope Integrating type ADCs), Sample and Hold circuit, Data Acquisition Systems. Noise in electronic systems.

References:

[1] Electrical Measurements and Measuring Instruments- E. W. Golding, F. C. Widdis.
[2] Modern Electrionic Instrumentation and Measurement Techniques - A. D. Helfrick, W. D. Cooper.
[3] Elements of Electronic Instrumentation and Measurements J. J. Carr.
[4] A Course in Electrical and Electronic Measurements and Instrumentation - A. K. Sawhney.
[5] A Course in Electronics and Electrical Measurements and Instrumentation J. B. Gupta

EEC14112 ELECTRICAL MACHINES I

(3 -1 - 0) Magnetic Circuit

Transformer: Performance of single-phase transformer, Construction, Connections and operation of 3-phase transformer, Vector groups, Phase conversion, Tap changers, Parallel operation, Tertiary windings, Auto-transformer, Harmonics, Magnetising in rush current. Testing of transformer.

DC Machines: Armature winding, Armature reaction, Commutation, Interpoles, Compensating winding.

DC Generators: Voltage regulation, Characteristics, Parallel operation.

DC Motors: Starters, Speed control, Speed-torque and Load-torque characteristics.

References:

[1] The performance and design of alternating machines by M. G. Say.
[2] The performance and design of direct current machines by Clayton and Hancock.
[3] Theory of alternating current machinery by Alexander S. Langsdorf.
[4] Electric Machinery by Fitzgerald, Kingsley, Umans.
[5] Electrical Machines by P. K. Mukherjee and S. Chakravorti.

EEC14113 DIGITAL ELECTRONICS

(3 -1 - 0) Boolean algebra, logic gates and circuits, Minimization of logic expressions.

Different Logic families RTL, DTL, TTL, ECL, NMOS and CMOS, their operation and specifications.

Combinational circuits adder, subtractor, encoder, decoder, comparator, multiplexer, demultiplexer, parity generator, etc. Design of combinational circuits-programming logic devices and gate arrays.

Sequential Circuits Flip Flops, various types of registers and counters, sequential circuits.

Different types of A/D and D/a conversion techniques.
Interfacing TTL-CMOS Interfacing, CMOS-TTL Interfacing. Interfacing with Buzzers, Relays, Motors and Solenoids. Interfacing with opto-isolators.
Memory Systems: RAM, ROM, EPROM, EEROM
Waveform generation using gates, Timing circuits.

Reference:

[1] Digital Principles & Application - Leach & Malvino
[2] Digital Logic Design Morries Mano.
[3] Digital Integrated Electronics H. Taub & D. Shilling.
[4] Digital Principles & Design - Givone
[5] Introduction to Digital Computer Design V. Rajaraman and T. Radhakrishnan.

AMR14101
(4 -0 - 0)

NUMERICAL AND STATISCAL METHODS

A. Numerical Methods

Solution of algebraic and transcendental equations by bisection, iteration, false position, secant and Newton Raphson methods, Generalised Newton's method for multiple roots.

Solution of a system of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Crout's triangularisation, Jacobi and Gauss Seidel methods. Finite differences, Symbolic relations, differences and factorial notation of a polynomial, data smoothing, Interpolation and. extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel, Everett, Lagrange and Newton's divided difference formulae, Inverse interpolation by Lagrange and iterative methods, Cubic splines, Numerical differentiation and integration, Trapezoidal, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$, Weddle and Gaussian quadrature formulae.

Numerical solution of first order ordinary differential equation by Taylor's series, Picard's, Euler's, Modified Euler's, Runge-Kutta, Adams-Moulton and Milne's methods. Solution of simultaneous first order, and second order ordinary differential equations with initial conditions by Taylor's series, Runge-Kutta and Milne's methods. Numerical solution of boundary value problems' by finite difference and shooting methods.

B. Statistical Methods

Concept of a frequency distribution: Moments, skewness and kurtosis.

Probability: Various approaches of probability-classical, frequency (statistical), subjective and axiomatic. Theorems on probability, conditional probability, Independence, Bayes Theorem.

Random variable-discrete and continuous. Distribution function and their properties, probability mass and density functions, Mathematical expectation, Moment generating function and its properties.
Probability distributions: Bernoulli, binomial, negative binomial, Poisson and normal distributions.

Theory of least squares and curve fitting.

Correlation-Simple, multiple and partial, Regression lines and regression coefficients, Multiple and partial regression.

Tests of Significance: Normal test, t-test, Chi-square and F-test.

MMR14101 (3 - 1 - 0) **MECHANICAL ENGINEERING - II**

Analysis of various thermodynamic processes, P-V and T-S diagrams.
Analysis of Air Standard Cycles.
Classifications, applications and performance estimation of Internal combustion engines, Gas turbines and Compressors, Basic maintenance steps.
Performance study and power estimation based on laboratory experimental data.
Properties of fluid; Classifications; Ideal fluid, Newtonian and Non-Newtonian fluids; Newton's law of viscosity.
Fluid Statics: fluid pressure and its measurement.
Fluid Kinetics: Continuity equation; types of flow.
Fluid dynamics: One dimensional equations of motion; Bernoulli's equation; applications of Bernoulli's equation; venturimeter.
Flow through pipes Darcy Weisbach's equations.
Classifications, basic construction and applications of different types of pumps and water turbines.
Performance study and power estimation based on laboratory experimental data.

EEC14211 **ELECTRICAL MEASUREMENTS PRACTICAL**
(0 - 0 3/2)

Experiments on study of various instruments such as galvanometer, PMMC, moving iron, electro dynamometer, induction type, digital meters, CRO and measurement of voltage, current, power, power-factor, frequency, resistance, inductance, capacitance, magnetic flux.

EEC14212 **ELECTRICAL MACHINES I PRACTICAL**
(0 - 0 3/2)

Experiments on testing of transformer, connection of three-phase transformer, separation of losses of transformer, characteristics of DC generators and motors, Speed control of DC motors, testing of DC machines.

AMR14201 **NUMERICAL AND STATISTICAL METHODS PRACTICAL**
(0 - 0 3)

A. Numerical Methods

Numerical solution of non-linear algebraic and transcendental equation by bisection, iteration, false position, secant and Newton Raphson methods.

Numerical solution of a system of linear simultaneous equation by Gauss elimination and Gauss Seidel methods.

Interpolation by Lagrange's interpolation formula.

Numerical evaluation of definite integral by Trapezoidal, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$, Weddle and Gaussian quadrature formulae.

Numerical solution of first order ordinary differential equation by Euler's, Modified Euler's, second and fourth order Runge-Kutta, Adams-Moulton and Milne's methods.

B. Scope of practice sessions:

Computation of raw moments, central moments, coefficient of variation, coefficients of skewness and kurtosis; Fitting of straight line, second degree polynomial (parabola), power curve and exponential curve; Computation of product moment correlation, multiple and partial correlation coefficients; Regression coefficients and regression lines, plane of regression. Application of tests of significance based on numerical data.

EEC14213
(0 - 0 3/2)

DIGITAL ELECTRONICS PRACTICAL

Verification of function of IC7400 and implementation of standard Gates, Realization of Boolean expressions using only NAND gates, Binary adder, Binary subtractor, BCD adder, Binary comparator, Cascading of MUX, Latches and flip-flops using Gates and ICs, Counters, Multivibrators using IC555.

FIFTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC15111	Electrical Machines II	3	1	0	7
2.	EEC15112	Control Systems I	3	1	0	7
3.	EEC15113	Power Systems I	3	1	0	7
4.	EEC15114	Microprocessor & Microcontroller	3	1	0	7
5.	EEC15115	Digital Signal Processing	3	1	0	7
6.	EEC15311	Electrical Machines & Power System Design (S)	3	0	0	6
7.	EEC15211	Electrical Machines II Practical	0	0	3/2	1.5
8.	EEC15212	Control Systems I Practical	0	0	3/2	1.5
9.	EEC15213	Power Systems I Practical	0	0	3/2	1.5
10.	EEC15214	Microprocessor & Microcontroller Practical	0	0	3/2	1.5
		Total	**18**	**5**	**6**	**47**

FIFTH SEMESTER

EEC15111 **ELECTRICAL MACHINES II**
(3 1 0)

Three-phase Induction motor: Construction and types, Rotating Magnetic Field, Equivalent circuit, Phasor diagram, Speed-torque characteristics, Circle diagram, Deep bar rotor and Double cage rotor. Cogging and Crawling, Starting and Speed control of 3-phase induction motor, induction generator.

Single phase Induction motors: Construction, Theories of operation, Revolving Field Theory, Equivalent Circuit, Starting methods, Speed-torque characteristics, Phasor diagram, Cross-field theory.

Synchronous Generator: Constructions and types, Emf equation, Phasor diagram, Armature reaction, Characteristics, Voltage regulations, Synchronization, Parallel operation, Alternator connected to infinite bus, Power angle characteristics, Synchronizing power, Excitation characteristics. Salient pole synchronous machine: Two-reaction theory, Phasor diagram and Voltage regulation.

Synchronous Motor: Expression for torque, Phasor diagram, Operating characteristics, Electrical and mechanical power, Circle diagrams, V-curves and O-curves, Starting, Hunting and Damper winding.

References:
[1] The performance and design of alternating machines M. G. Say
[2] Theory of alternating current machinery Alexander S. Langsdorf
[3] Electric Machines Kothari & Nagrath
[4] Electric Machinery and Transformers Kosow
[5] Electrical Machines by P. K. Mukherjee and S. Chakravorti

EEC15112 CONTROL SYSTEMS I
(3 - 1 0)

Introduction: Types of control systems and control strategies.
Mathematical model of physical systems: Differential equations, Transfer Function, Block diagram, Signal flow graphs, Modelling of different types of systems (e.g., electrical, mechanical, thermal, etc.)
Control System Components: Potentiometer, Differential amplifier, Synchro, Tachogenerator, Servomotor, Stepper motor, Hydraulic valves.
Time response of first and second order systems, Steady-state errors and Error constants, Performance specifications in time domain.
Frequency response analysis: Bode plot, Nyquist plot, Performance specifications in frequency domain.
Concept of stability, Routh stability criterion, Gain margin, Phase margin. Root-locus technique, Nyquist criterion,
Compensation Technique: Performance goals, Lag-lead compensators, PID controllers.

References:
[I] Modern Control Engineering - K. Ogata.
[2] Automatic Control Systems - B. C. Kuo.
[3] Feedback Control Theory - I. C. Doyle, B. A. Francis and A. R. Tannenbaum.
[4] Feedback Control of Dynamic Systems - G. Franklin, J. D. Powell and A. EmamiNaeini.
[5] Control Systems Engineering - I. J. Nagrath and M. Gopal.

EEC15113 POWER SYSTEMS I
(3 - 1 - 0)

Transmission line parameters, Performance of transmission lines, Overhead line insulators, Cables, Corona loss, Neutral grounding practices, Electrical design of transmission lines, Principles of rate making of electricity tariff, High voltage DC transmission system, Basic concept of power generation.

Distribution systems: - Feeders and distributors, radial & ring-main distribution system, Substation: Types of substation, bus bar layout.

References:

[1] Power System Analysis- J.J. Grainger and William D. Stevenson. Jr.
[2] Generation, Transmission and utilization by A. T. Starr.
[3] Power System Analysis Hadi Saadat
[4] Electrical Power Systems- C.L. Wadhwa.
[5] Power System Engineering : Nagrath & Kothari

EEC15114 MICROPROCESSOR & MICROCONTROLLER
(3 - 1 - 0)

Architecture and organization of 8085A Microprocessor:
Hardware Interrupts, Interrupt driven I/O Operation.
Memories and I/O: Various types, interfacing with microprocessor, memory mapped and I/O mapped I/O, memory mapped memory.
Functional descriptions of the Intel chips: 8255, 8253, 8259 and 8257.
Analog Interfacing: Interfacing of A/D & D/A converters, 8086 Architecture, organization and pin out details, memory segmentation minimum mode and maximum mode of operation. Instruction sets of 8086.
Pin out descriptions of 8051, Memory organization, Register Banks, special function registers, External Memory: External code memory access, External data memory access, Address decoding, Addressing modes of 8051, Instructions types.

References

[1] Microprocessors and Interfacing D. V. Hall.
[2] The Intel Microprocessors 8086/8088, 80186/80188, 80286,80386, 80486, Pentium, Pentium processors, Pentium II, Pentium III, Pentium-4, Architecture, Programming and interfacing- B. B. Bery.
[3] Advance Microprocessors and Peripherals A. K. Ray and K. M. Bhurchandi
[4] The 8051 Microcontroller and Embedded systems: Using Assembly and C Mazidi, Mazidi & McKinlay.
[5]Micro controllers: Architecture, Programming, Interfacing and System Design Raj Kamal.

EEC15115
(3 - 1 - 0)

DIGITAL SIGNAL PROCESSING

Sampling, aliasing, z-transform and its properties, discrete LTI systems, z-transfer function, discrete convolution, inverse z-transform.

Digital filters - FIR and IIR filters, Filter structure, Design of FIR and IIR filters, Effect of finite word length.

Random signals: Probability, correlation, power spectral density, Fourier transform.

Discrete Fourier Transform: DFT and FFT algorithms, Applications of FFT - spectrum analysis, FFT based digital filtering.

Digital processing of continuous time signals - sampling, anti-aliasing filter, sample and hold process, reconstruction filter.

References:

[1] Discrete Time Signal Processing - A. V. Oppenheim and R. W. Schafer.

[2] Theory and Application of Digital Signal Processing - L. R. Rabiner and B. Gold.

[3] Digital Signal Processing - M. H. Hayes and S. Bhattacharya.

[4] Digital Signal Processing: Principles, Algorithms and Applications - J. G. Proakis, D. G. Manolakis and D. Sharma.

[5] Digital Signal Processing: A Computer Based Approach - S. K. Mitra.

EEC15311
(3 0 0)

ELECTRICAL MACHINES AND POWER SYSTEMS DESIGN (S)

General considerations for design: Temperature rise, Output coefficients, Main dimensions, Winding design, Analysis of magnetic circuits, Design of transformer and induction motor, Computer aided design.

Design of transmission and distribution system, design of substation. Use of softwares: Application of software for design of electrical machines & power system.

References:

[1] The performance and design of alternating machines M. G. Say

[2] The performance and design of direct current machines Clayton and Hancock

[3] Design of Transformer Indrajit Dasgupta.

[4] A Course in Electrical Machine Design A. K. Sawhney.

[5] J & P Transformer Book Martin. J. Heathcote.

EEC15211 **ELECTRICAL MACHINES II PRACTICAL**
(0 0 3/2)

Experiments on characteristics of three-phase induction motor, circle diagram, starter and speed control of three-phase induction motor, no-load, blocked rotor and load test on a single-phase induction motor, Voltage regulation of alternator, Synchronization of alternators and V-curves of synchronous motor.

EEC15212 **CONTROL SYSTEMS I PRACTICAL**
(0 0 3/2)

Experiments on control system components, time response and frequency response of first and second order systems, PID controller. Simulation study of control systems using standard software's like MATLAB.

EEC15213 **POWER SYSTEMS I PRACTICAL**
(0 0 3/2)

Study of cables, overhead line insulators, Determination of phase sequence by R-C method, Study of dc distributor, Determination of A,B,C,D parameters of transmission line, Study of active and reactive power flow through short transmission line, VAR compensation, measurement of earth resistance,

EEC15214 **MICROPROCESSOR & MICRO CONTROLLER PRACTICAL**
(0 0 3/2)

Assembly language programs to get familiarization of arithmetic, logical, branch operation.
Assembly language program illustrating the stack operation, subroutines, interrupts, code conversion, BCD arithmetic and 16-bit data operation.
Interfacing of different I/O modules like keyboard, IC tester, A/D, D/A and display.
Application of micro controllers.

SIXTH SEMESTER

Sl. No.	Course No.	Name of the course	L	T	P	Cr. Hrs.
1.	EEC16111	Power Electronics	3	1	0	7
2.	EEC16112	Power Systems II	3	1	0	7
3.	EEC16113	Instrumentation & Process Control	4	0	0	8
4.	EEC16114	Control Systems II	3	1	0	7
5.	CSR16101	Computer Networks	3	0	0	6
6.	EEC16211	Power Electronics Practical	0	0	3/2	1.5
7.	EEC16212	Power Systems II Practical	0	0	3/2	1.5
8.	EEC16213	Instrumentation & Process Control Practical	0	0	3/2	1.5
9.	EEC16214	Control Systems II Practical	0	0	3/2	1.5
10.	EEC16511	Composite Viva-Voce	0	0	0	4
11.	SWC	Co-curricular Activity	0	0	0	0
		Total	**16**	**3**	**6**	**45**

SIXTH SEMESTER

EEC16111 (3 1 0) **POWER ELECTRONICS**

Brief Introduction of Power Electronics Components Thyristors, DIACs, TRIACs, GTO's, Power Transistors (BJT, MOSFET and IGBT), Losses and Cooling, Triggering circuits for Thyristors and Power Transistors, Snubber design and protection, Commutation Circuit for Thyristors.

AC to Dc conversion: Single phase controlled rectifiers Phase angle control, Single-phase half-wave controlled rectifier, Single-phase full-wave controlled rectifier, Single-phase half controlled and fully controlled bridge converters, The effect of input source impedance, Dual converter (for DC drives).

Three phase controlled rectifiers M - 3, B - 6, Dual converter.

DC to DC Converter: Buck and Boost converters using BJT and IGBT: problems, design, operation and application, Class A, B, AB, C, D, CD,

ABCD Chopper operation for DC drives.
DC to AC Converter: Classification of inverter, Single phase and three phase inverters operation using BJTs and MOS devices for VSI and CSI, Basic concept of PWM controlled inverter (for AC drives).

AC to AC Converter: AC voltage controllers. Single and three-phase Cycloconverter circuits, blocked group operation, circulating current mode operation (for AC drives).

Application: ON-Line & OFF-line UPS, SMPS, Electronic Ballast, HVDC transmission, A.C. Line Filters for EMI & RFI suppression, HF inverters for induction heating.

References:

[1] Power Electronics - Rashid M H
[2] Power Electronics - Mohan N, Underland T M & Robbins W P
[3] Power Electronics - Sen P C
[4] Modern Power Electronics & AC Drives - Bimal K. Bose
[5] Thyristorised Power Controllers - Dubey G. K

EEC16112 **POWER SYSTEMS II**
(3 1 0)

Power system Control: - Voltage, Active & Reactive power control, VAR Compensators.
Transients in power system: Transients in simple circuits, Travelling waves in transmission line, over voltage due to arcing ground.
Transient Stability: Equal area criterion, methods of improving transient stability, Representation of excitation system and its inclusion in stability studies. Introduction of Multi-machine transient stability.
Economic operation: Characteristics of generating units, generation scheduling neglecting transmission loss, hydro-thermal scheduling.
Load Flow studies: Bus Classification, Nodal Admittance Matrix, Development of load flow equations, Gauss Seidal method and Newton-Raphson method.

References:

[1] Power System Analysis- J.J. Grainger and William D. Stevenson. Jr.
[2] Power System Analysis- A.R. Bergen and V. Mittal
[3] Electrical Power Systems - C.L. Wadhwa.
[4] Power System Engineering - I. J. Nagrath and D. P. kothari
[5] Electric energy systems theory Olle J. Elgard

EEC16113
(4 - 0 - 0)

INSTRUMENTATION & PROCESS CONTROL

Variable Resistance, Inductance and Capacitance type Transducers, Piezoelectric, Optical, Magnetic and Thermal Transducers, Digital Displacement Transducers (incremental and absolute types). Application of Transducers to measurement of Displacement, Force, Strain, Pressure, Flow, Temperature and other non-electrical quantities.

Instrumentation Amplifiers, Isolation Amplifiers, Programmable Gain Amplifiers, Signal conditioning, V/F, F/V Conversion, Filtering (passive and active), Linearisation, Telemetry systems: Voltage, Current, Position, Frequency and Pulse Telemetering, Components of Telemetry.

Microprocessor Based Instrumentation, Programmable instruments and digital interface: serial, parallel and GPIB (IEEE488).

Characteristics of chemical process blending, heat exchangers, distillation column, etc. Process Controllers: On-off, Cascade, Feed Forward, Ratio, PID. PID controller settings. Electronics simulation of PID controllers.

References:

[1] Measurement Systems : Application and Design - E. O. Doebelin and D. N. Manik.
[2] Transducers and Instrumentation - D. V. S. Murty.
[3] Process Control Instrumentation Technology - C. Johnson.
[4] Process Control Hauriott
[5] Process Control Conghnour and Kopel

EEC16114
(3 - 1 - 0)

CONTROL SYSTEMS II

Sampled-Data System:

Sampling-and-hold operation, Sampling theorem, Signal reconstruction, Difference equation, z-transform, Pulse transfer function, Inverse z-transform and response of linear discrete-time systems, z-transform analysis of sampled-data control system, Standard transformation techniques, Modified z-transform, Stability analysis, Root Locus technique, Compensation technique by digital computer.

State Space Analysis:

State variables, State model for linear continuous-time systems, Types of

state models, Diagonalization, Eigenvalues and eigenvectors, Solution of state equation, State transition matrix, Computation of state transition matrix by Laplace transformation, Controllability and Observability, Transfer matrix. Control system design by pole-placement using state feedback.
Introduction to Optimal Control, Adaptive Control and Fuzzy Control.

References:
[1] Discrete Time Control Systems - K. Ogata.
[2] Digital Control Systems - B. C. Kuo.
[3] Digital Control, Vol I and II - R. Isermann.
[4] Modern Control Systems - R. C. Dorf and R. H. Bishop.
[5] Analog and Digital Control System Design: Transfer-function, State-space and Algebraic Methods - C. T. Chen.

CSR16101 **COMPUTER NETWORKS**

(3 - 0 - 0)

Overview of data communication and networking, Network Architecture; Physical layer communication: Signals, Media, Bits, Digital transmission; Circuit/Packet switching; Error detection/correction techniques; Data link control and protocols, Medium access control Pure/Slotted ALOHA, CSMA/CD: CSMA/CA; Ethernet addressing and wiring; Internetworking: Architecture; IP addressing; Address binding with ARP; Datagram encapsulation and fragmentation; Link-state and Distance-vector routing; Dijkstra's algorithm; IPv6 Internet Protocols; UDP and TCP; TCP segment format; Protocol ports; ICMP and Error handling; Network applications: Client/Server concept; Socket API; DNS, Electronic mail, HTTP and WWW including HTML.

EEC16211 **POWER ELECTRONICS PRACTICAL**

(0 0 3/2)

Experiments on characteristics of power semi-conductor devices, single-phase and three-phase controlled rectifiers, dual converter, DC chopper, inverter, cycloconverter.

EEC16212 **POWER SYSTEMS II PRACTICAL**

(0 0 3/2)

Study of symmetrical and unsymmetrical fault, Experiments on characteristics of induction pattern overcurrent relay and thermal

overload relay, induction pattern directional overcurrent relay earth fault relay, Merz-price protection, digital relay, circuit breaker.

EEC16213 INSTUMENTATION & PROCESS CONTROL PRACTICAL
(0 0 3/2)

Experiments on characteristics of various types of transducers, measurement of displacement, angular speed, vibration, temperature, pressure, luminous flux; Simulation study with standard softwares like LABVIEW data acquisition system.

EEC16214 CONTROL SYSTEMS II PRACTICAL
(0 0 3/2)

Experiments on microcomputer based analysis and control of simulated systems. Use of standard softwares like MATLAB for time response, frequency response, stability analysis of discrete-time systems, state space analysis.

SEVENTH SEMESTER

Sl. No	Course No.	Name of the course	L	T	P	Cr. Hr.
1.	EEC17111	Electrical Drives	3	1	0	7
2.	EEC17112	Switchgear and Protection	3	1	0	7
3.	MSC17152	Industrial Engineering and Management	3	0	0	6
4,5.		**Electives (Any Two)**	2 · (4 - 0 - 0)			16
(i)	EEE17111	Advanced Power Electronics				
(ii)	EEE17112	Material Science				
(iii)	EEE17113	Mine Electrical Technology				
(iv)	EEE17114	Communication Engineering				
(v)	EEE17115	Computer Application in Power System				
(vi)	EEE17116	Illumination & Utility Services				
(vii)	EEE17117	Power Plant Instrumentation and Control				
(viii)	EEE17118	Systems Modelling & Simulation				
(ix)	EEE17119	Soft Computing Techniques				
(x)	EEE17120	Filter Design & Synthesis				
(xi)	EEE17121	Bio-medical Instrumentation				
(xii)	EEE17122	Robotics				
(xiii)	CSE17113	Information & Coding Theory				
6.	EEC17211	Electrical Drives Practical	0	0	3/2	1.5
7.	EEC17212	Switchgear and Protection Practical	0	0	3/2	1.5
8.	EEC17411	Project and Seminar	0	0	6	6
9.	EEC17011	Vocational Training	0	0	0	5
		Total	**17**	**2**	**9**	**50**

Note: Vocational Training taken at the end of VI-th Semester is credited in VII-th Semester.

SEVENTH SEMESTER

EEC17111 ELECTRICAL DRIVES
(3 1 0)

Dynamics of Electrical Drives: Types of loads, Quadrantal diagram of speed-Torque characteristics, Dynamics of Motor-Load combination.

Starting: Starting characteristics of electric motor, starting time, Energy relation during starting.

Electric Braking: Types of electric braking, Braking of DC motor, Induction motor and Synchronous motor, Energy relation during braking, Dynamics of braking.

Motor power rating selection: Loading conditions and classes of duty, motor heating & cooling characteristics: determination of motor power rating for different application, Load equalization.

Solid State Speed Control of DC Motor: Controlled Rectifier fed DC drives, chopper-controlled DC drives, Microprocessor based controllers for DC drives.

Solid State Speed Control of Induction Motor: AC voltage controllers, Voltage Source Inverter control, Current Source Inverter control Cycloconverter control, Static Rotor Resistance Control, Slip power recovery: Static Scherbius drive, Static Kramer drive.

Solid State Speed Control of Synchronous Motor: Constant V/f control, Cycloconverter control, Self-controlled Synchronous Motor drive. Introduction to mine electrical drives.

References:

[1] Electric Drive M. Chilikin.
[2] Fundamentals of Electrical Drives by G. K. Dubey
[3] A first Course an electrical drives by S. Pillai.
[4] Modern Power Electronics and AC Drives by B. K. Bose.
[5] Power Electronics Circuits, Devices and Applications by M. H. Rashid.

EEC17112 SWITCHGEAR AND PROTECTION
(3 1 0)

Nature of faults in electrical systems, symmetric and asymmetric faults,

symmetrical components and sequence networks.
Construction, Operating principle of various types of protective relays, Concept of static relays, Protection of Generators, Transformers, Bus bars & Transmission lines, Distance and Carrier Current protection, Protection of Induction motors, Concept of digital protection, Condition monitoring of electrical equipment.
Switching over voltage, Theory of arc interruption, types of circuit breakers, (air, air blast, oil, vacuum & SF_6) Circuit Breaker rating & testing of circuit breaker, Fuses, Insulation Co-ordination, Protection against over voltages.

References:

[1] Protective Relays vol. I & vol. II by A. R. Van C. Warrington.
[2] The art and Science of Protective Relaying by C. R. Mason.
[3] The J & P Switchgear Book by R. T. Lythall
[4] Switchgear Protection and Power System Sunil S. Rao
[5] Power System Protection and Switchgear : B. Ravindranath and M. Chandar

MSC17152 (3 0 0) **INDUSTRIAL ENGINEERING AND MANAGEMENT**

Basic function of Management Planning, organization, starting, directing and controlling.

Introduction to Industrial Engineering techniques.
Productivity: definition, measurements.
Work study and its role in improving productivity of an organization.
Types of production systems.
Introduction to production planning and control.
Concepts of Human Resource Managements Selection, Tranning & Development.
Finance Management Capital Budgeting Techniques. Pay back period ARR, APV, IRR, PI; Sources of capital; Cost concepts and Break-even analysis.
Project Management Introduction, Network construction & identification of critical activities in CPM & PERT.]

EEE17111 (4 0 0) **ADVANCED POWER ELECTRONICS**

Brief Introduction of Advanced Power Electronics Components: Static Induction Transistors (SITs) MOS-Controlled Thyristor (MCTs).

Synchronous Rectifier: Synchronous Rectifier in Switch Mode Regulator, Design and performance of MOSFET Synchronous Rectifiers, Gate drive circuits for Synchronous Rectifiers.

Introduction to Reconant Converters: Review of Series and Parallel Resonnance, Soft Switching Techniques. Soft Switching in DC-DC Converter, ZCS Transsistor Action, ZVS Transsistor Action.

Application: Application of PWM principle to converters and inverters, Static VAR Control (SVC) in transmission lines, High Frequency Coreless Induction Heating, Microprocessors controlled Stepper and Switched Reluctance Motor Drive.

EEE17112 **MATERIAL SCIENCE**
(4- 0- 0)

Introduction: Atomic structure of materials and energy levels. Gross electrical and thermal properties of materials in terms of cohesive energies. Crystal geometry Crystal systems, Space lattices, Unit cells. Structure of solids Bonded structures (covalent, metallic, ionic), complex structures (plastic, fibres, elastomers). Crystal imperfections in insulators.

Insulators: Dielectric property, Frequency and temperature dependency, Dielectrics in alternating fields, dielectric losses, classification of insulating materials. High polymers, Active dielectrics and their applications.

Conductors: Electrical conductivity of metals Lorents theory, free electron theory etc. Electron scattering and resistivity of metals. Atomic interpretation of ohm's law. Temperature coefficient of resistance. Alloys and other conductors for engineering application

Semiconductor: Junction diode and transistor, Zener breakdown. Field effect, Photoelectric phenomena. Hall effect, Gamm effect, Tunnelling effect.

Magnetic materials: Atomic interpretation of magnetic properties, Weiss field and magnetic domains; Sponteneous magnetization and Curie Weiss law. Ferro and ferrimagnetism. magnetic anisotropy, magnetostriction, magnetic materials for engineering applications.

Super conductivity: Critical field and critical current density Trasition temperature, normal and superconducting states.

Super conducting materials, Superconducting magnets, dryconductors (superconductors) Josephson-junction effects, Quantum Hall effect.

EEE17113
(4 0 0)

MINE ELECTRICAL TECHNOLOGY

Concept of earth fault current limitation in underground (UG) mine power systems, Type of electrical power supply systems for UG coal mines solidly-earthed, restricted-neutral and insulated-neutral systems of power supply their comparison.

Earth fault protection techniques for various types of mine power supply systems, sensitive and fail-safe earth fault relays.

On-line insulation monitoring for UG insulated neutral electrical distribution systems.

Mining type circuit breaker air circuit breaker, vacuum and SF_6 breaker, Transwitch unit, Gate-end box, drill panel, Remote control and inter-lock circuits for mining type circuit breakers, Solid-state protective devices for modern mining type circuit breakers.

Electrical power planning for mechanized longwall faces general electrical distribution scheme, voltage drop problems and remedial measures, Inbye substation capacity selection

General Schem of electrical power distribution in open-cast project, quarry sub-station capacity selection.

Haulage signaling and longwall face signaling systems, Illumination planning for UG coal mines roadway lighting systems, Intrinsically safe lighting systems for longwall faces.

Earthing practice in mines: earth pits, earthing of mobile electrical equipment in mines, mining cable types and contraction details, Principle of flame-proof enclosure.

Introduction to Mining methods & regulations, Intrinsically safe circuit methods of attaining intrinsic safety, zener safety, barriers and their applications, Indian electricity rules as applied to mines.

EEE17114
(4 0 - 0)

COMMUNICATION ENGINEERING

Elements of an Electrical Communication System; Analog Modulation Techniques (Block diagrams only) - AM, DSB, SSB, FM, PM; Random Processes; Effect of noise on analog modulation techniques; Pulse modulation - Sampling, PCM, DM,. DPCM; Base band Pulse transmission - Matched filter, Intersymbol interference; Pass band Digital Transmission - ASK, FSK, PSK, QPSK; Introduction to Information theory and Coding; Selected topics - Spread Spectrum Systems; Multiuser Radio Communication.

EEE17115
(4 0 0)

COMPUTER APPLICATION IN POWER SYSTEM

Load flow analysis: Formulation of the load flow problem. Solution of load flow problem by Gausse-Seidel & Newton-Raphson methods. Comparison of the two methods, area interchange control, sensitivity analysis sensitivity matrix and its application.
Short circuit study: Formulation of bus impedance matrix, digital computer solution of symmetrical and unsymmetrical faults.
Economic operation: Characteristics of generating units, generation scheduling neglecting transmission loss, scheduling problems considering transmission loss and its solution by B-coefficient method, derivation of B-coefficients, unit commitment problem and its solution by dynamic programming, hydro-thermal scheduling and its solution for short range problem.
Load frequency control: Concept of control area, analysis of single area load frequency control, Two area (multi area) load frequency control problem and tie line control.
Optimal power flow and voltage stability.

EEE17116
(4 0 0)

ILLUMINATION AND UTILITY SERVICES

Radiation, colour, eye and vision; different entities of illuminating systems; Light sources: daylight, incandescent, electric discharge, fluorescent, are lamps and lasers; Luminaries, wiring, switching & control circuits
Laws of illumination: illumination from point, line and surface sources. Photometry and spectrophotometry; photocells, Enviroment and glare. General illumination design.
Interior lighting: Industrial, Residential, Office departmental stroes, Indoor stadium, Theater and Hospitals.

Exterior lighting: Food, Street, Aviation and Transport lighting, Lighting for displays and signaling-neon signs, LED-LCD displays beacons and lighting for surveillance.
Utility services for large building/office complex and layout of different meters and protection units.
Different type of loads and their indidual protection, Selection of cable/wire sizes, potential sources of fire hazards and precautions.
Emergency supply: Stand-by and UPS. A specific design problem on this aspect.

EEE17117 POWER PLANT INSTRUMENTATION AND CONTROL
(4 0 0)

Block Diagram of different parts of a Power Plant and scope of Instrumentation. Measurements on Boiler Plant, turbo-generator Plant and Nuclear Reactors.
Measurement: Fuel Measurement and various types of weighing systems, Pressure Measurement - capsules; bellows; diaphragm gauges; bourdon tube pressure gauges; pressure transducers - capacitive type, piezo resistive type; Smart pressure transmitters. Temperature Measurement - Resistance temperature detectors, thermocouples; radiation pyrometers. Flow Measurement: Head type-orifice, venturi; area type-rotameter; mass flow meter. Level Measurement: Capacitive sensors; sensors; ultrasonic; DP transmitters.
Analytical: Gas Analysis - Oxygen - zirconium sensor, paramagnetic;. SO_x; NO_x; CO; CO_2 Liquid Analysis - pH; conductivity; dissolved oxygen. Coal Analysis - moisture, carbon, ash.
Control: Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feed water control. Data logger and computer control, supervisory control and monitoring system.

EEE17118 SYSTEMS MODELLING & SIMULATION
(4 0 0)

Concept and role of modelling in engineering, various methods of modelling. Signal flow graph and block diagram representation. State variable formulation. Modelling of electrical, mechanical, chemical and network systems. Modelling of time-delay systems. Analog simulation, Digital simulation, Simulation of non-linear, hybrid and distributed parameter dynamical systems, Simulation languages: Matlab/Simulink,

Mathematica, Symbolic Computations.
Overview of methods for model simplifications, approximation and order reduction of dynamic systems. Different techniques of model order reduction: Balanced realizations, Singular perturbation, Aggregation technique, Continued Fraction Approximation, Moment matching methods, Pade approximation.

EEE17119 **SOFT COMPUTING TECHNIQUES**
(4 0 0)

Introduction to Soft Computing: Rationale and Basics of Learning: Neural Networks, Self-organising Networks; Fuzzy Logic: Basics, inferencing scheme, Neuro-Fuzzy systems; Evolutionary Algorithms: GA and Optimisation, Evolutionary Systems, Genetic Programming; Introduction to Rough Sets, Rough-Fuzzy representations, Belief Networks; Principles of SVM; Applications.

EEE17120 **FILTER DESIGN & SYNTHESIS**
(4 0 0)

Fundamental concepts and tools for the design of linear analog filters, Design of filters using lumped elements. Study of sensitivity of filters, Operational-amplifier based fundamental building blocks of active filters, Bi-quadratic active filters based on Op-amps, Low-pass, high-pass, band-pass, notch, all-pass and universal filters, Switched capacitor filter, Non-ideality analysis of filters.

EEE17121 **BIO-MEDICAL INSTRUMENTATION**
(4 0 0)

Introduction to the physiology of cardiac, nervous and muscular systems, transducers and electrodes: different types of transducers and their selection for biomedical applications, Electrode theory, Selection criteria of electrodes and different types of electrodes such as Hydrogen Calomel, Ag-AgCl, pH, etc.
Cardiovascular measurement: Heart and other cardiovascular systems, Measurement of blood pressure, blood flow, cardiac output and cardiac rate, Electro-cardiography, Phono-cardiography, Ballisto-cardiography, Plethysmography, Magneto-cardiography, Cardiac Pace-maker and computer application.
Measurement of electrical activities in muscles and brain: Electro-encephalograph, Electro-myograph and their interpretation
Medical Imaging: Ultra sound imaging, Radiography and application.

EEE17122 **ROBOTICS**
(4 0 0)

Robotics instrumentation, Basic concepts, classification and structure of robotic systems. Kinematics of manipulators, Selection of co-ordinate frames, Transformations, Configuration kinematics forward and inverse kinematics. Solution of kinematics and manipulator dynamics, Newton-Euler dynamic formulations, Trajectory planning, position, velocity, force control, feedback systems, digital control, sensors, actuators and effectors. Introduction to robot vision. Basic robot programming. Applications in manufacturing and others.

CSE17113 **INFORMATION & CODING THEORY**
(4 0 0)

Measure of information, source encoding, data compaction, Huffman coding, binary symmetric channel, channel capacity, channel coding, information capacity and limit, compression of information;
Principle of error control coding; Linear block codes, syndrome decoding and Hamming codes. Cyclic codes, generation and decoding, syndrome calculation; Bose-Chaudhuri-Hocquenghem (BCH) codes and Reed-Solomon codes; Burst error detecting and correcting codes, Interlaced codes for burst and random error detection; Convolution codes, code tree and state diagram; Introduction to turbo coding. Selection of coding scheme.

EEC17211 **ELECTRICAL DRIVES PRACTICAL**
(0 0 3/2)

Experiments on braking of motors, solid state speed control of DC motors and induction motors, microprocessor/microcomputer based DC motor speed control.

EEC17212 **SWITCHGEAR AND PROTECTION PRACTICAL**
(0 0 3/2)

Experiments on study of switchgears, various protective relays such as electromagnetic relays, static relays, directional relay, differential relay, distance relay, testing of relays, protection of motor, transformer, feeder, study of switchgears.

EIGHTH SEMESTER

Sl.No	Course No	Name of the course	L	T	P	Cr.Hr
1.	EEC18111	Utilization of Electrical Power	3	1	0	7
2.	EEC18112	Industrial Automation and Control	4	0	0	8
3.	EEC18113	Electrical Energy Systems	4	0	0	8
4, 5.		**Electives (Any Two)**	2 · (4 - 0 - 0)			16
(i)	EEE18121	Special Purpose Electrical Machines				
(ii)	EEE18122	Static Relays				
(iii)	EEE18123	Opto - Electronics				
(iv)	EEE18124	Digital Instrumentation				
(v)	EEE18125	HVAC & HVDC Transmission Techniques				
(vi)	EEE18126	Flexible AC Transmission System				
(vii)	EEE18127	Power System Dynamics and Control				
(viii)	EEE18128	High Voltage Engineering				
(ix)	EEE181289	Optimal Control				
(x)	EEE18130	Pattern Recognition				
(xi)	EEE18131	Mine Instrumentation				
6.	EEC18411	Project and Seminar	0	0	6	6
7.	EEC18411	Composite Viva-Voce	0	0	0	4
8.	SWC	Co-curricular Activity	0	0	0	0
		Total	**19**	**1**	**6**	**49**

EIGHTH SEMESTER

EEC18111 **UTILIZATION OF ELECTRICAL POWER**
(3 1 0)

Traction: System of track electrification, supply system, power factor & harmonics, train movement, Speed time curves and Energy consumption, tractive effort, factors affecting energy consumption, Electric and diesel traction systems, traction motors, starting and braking of traction motors, protective devices, Over Head Equipment.
Drives used in electric vehicle: DC drives, vector controlled ac motor drives, Permanent magnet brushless motor drives, switched reluctance motor drives, Linear Induction motor. Battery powered Vehicles

Illumination: Laws of illumination, polar curves, photometry, integrating spheres, types of lamps, lamp fittings, Light control, design aspects of indoor and outdoor lighting. Energy efficiency Lighting.
Welding: Its classification, resistance, arc and ultrasonic welding, characteristics of welding transformers modern welding techniques and control.
Heating: Resistance heating, Induction heating and Dielectric heating.

References:
[1] Utilization of Electrical Eneergy by Openshaw Taylor.
[2] Generation Distribution and Utilization of Electrical Power by C. L. Wadhwa
[3] Modern Power Electronics and AC Drives B. K. Bose.

EEC18112 **INDUSTRIAL AUTOMATION AND CONTROL**
(4 0 - 0)

Brief introduction about industrial processes and their automation, Elements of pneumatic, hydraulic and electrical control systems, valves and actuators, Stepper motors.
PID controllers and their tuning, Implementation of digital controller, control strategies for industrial processes, Programmable Logic Controller.

Real-time issues on signal transmission and control, Communication systems for industrial automation. Data acquisition, Introduction to SCADA.

References:
[1] Process Control Instrumentation Technology - C. Johnson.
[2] Industrial Electronics: Applications for Programmable Controllers,

Instrumentation and Process Control, and Electrical Machines and Motor Control - Kissel.
[3] Modern Control Systems - R. C. Dorf and R. H. Bishop.
[4] Modern Control Engineering - K. Ogata.
[5] Microprocessors and Interfacing - Programming and Hardware - D. V. Hall.

EEC18113 ELECTRICAL ENERGY SYSTEMS
(4 0 0)

Conventional energy sources:
Energy Audit
Choice of power station and unit: Type of generator, size of generator and number of units.

Thermal power station: Main parts and working, main flow circuits of thermal power station, power station auxiliaries, cooling system of alternators, starting up procedure of thermal units.

Nuclear power station: Principle of nuclear reactor, layout of nuclear power station, types of power reactors, main parts and control reactors, nuclear waste disposal, radioactivity and hazards.

Hydroelectric power station: Steam flow, hydrographs, flow duration curve, arrangement and location of hydroelectric station, principle of working, power station control, pump and storage system.

Advanced direct energy conversion systems: Basic principles of design and operations of photovoltaic energy systems, fuel cells, magneto-hydrodynamic power generators.

Non-Conventional energy sources (NCES):

Energy sources Classification, need and potential of NCES, electricity generation from NCES: Photovoltaics, mono, poly crystalline and amorphous silicon solar cells, efficiency and cost of PV systems; Wind electricity wind as an energy source, wind electricity generating system Basic components, wind electric generators, sitting of wind farms; Energy from biomass gasifiers and bio-gas reactors; Tidal energy; wave and geothermal energy; environmental effects and economics of NCES.

References:
[1] Renewable Energy Sources & Conversion Technology - Bansal,

Kleeman and Melisa
[2] Solar Energy - S P Sukhatme
[3] Renewable Energy Sources - Abbasi & Abbasi
[4] Renewable Energy Resources - Twidell & Weir
[5] Surves of Energy Conservation in India 2006 Labour & Industria Chronicle.

EEE18121 SPECIAL PURPOSE ELECTRICAL MACHINES
(4 0 0)

AC Commutator Motors: Transformer and rotational emf's in phase windings and commutator windings, Action of commutator as frequency converter, Commutation emf's, calculation of torque and mechanical power in single phase motors.
Single Phase AC Series Motor: General construction, vector diagram, circle diagram, characteristics, commutation, operation on ac and dc supplies, power factor, design features, performance and application.
Compensated Series Motor: General principle, brush shift, starting and speed control, commutation, power factor, design features, applications.
Stepper Motor: Construction, various types, operating principle, application.
Reluctance Motor: Construction operating principle, application.
Hysteresis Motor: Construction, operating principle, application
Synchronous Induction Motor: Induction Voltage Regulator, Brushless DC motor, Switched Reluctance Motor, Linear Induction Motor.
Introduction to generalized theory of Electrical Machines: Synchronous and Induction Machines.

EEE18122 STATIC RELAYS
(4 0 0)

General introduction to static relays, comparators amplitude comparators, phase comparator, semiconductor comparator and circuits for static relays.
Solid state power supply circuits directional relays, phase comparator directional unit, amplitude comparator directional unit, polyphase directional relays, applications.
Overcurrent relays instantaneous overcurrent relay, application of different type of time-current characteristics, basic principles of time overcurrent relays, practical circuits.
Differential relays basic principle, multi-input differential comparator circuit, analysis of static differential relays, static differential relay schemes.

Distance relay principle of distance measurement, fault area on impedance diagram, multi-input comparator, conic section characteristics, synthesis of quadrilateral characteristics, practical static distance relay circuits.
Computer application to protective relaying block diagram of digital relaying, sampling theorem, Fourier analysis of analog signal, digital filtering basics, digital overcurrent protection, digital differential and distance protection fundamentals

EEE18123 **OPTO ELECTRONICS**
(4 0 0)

Characteristics of optical radiation, LED, Photodiodes, Phototransistor, CCD, Opto-couplers and their applications in analog and digital devices.
Optical fiber fundamentals, Modes in fiber, Step index and Graded index fibers, fiber coupling.
Fiber optic sensors: Modulation techniques, displacement, pressure, acceleration, flow, current, voltage etc. Interferometers, Optical signal processing.
Characteristics of Laser Radiation, structure of Gas and Solid state Lasers, Pulse mode Lasers, Semiconductor Lasers, Holographic data systems, Memories and read-out, Optical data processing fundamentals.

EEE18124 **DIGITAL INSTRUMENTATION**
(4 0 0)

Sampling, signal digitization, Special digitization techniques: Non-linear ADCs, Flash and hybrid ADCs, ADC codes and Quantisation errors.
Discrete modeling of LTI systems, System identification techniques, Discrete signal conditioning techniques: Linear and exponential averaging, median filtering, Random signal statistics, Probabilistic measurement techniques, Correlation method of measurement, Frequency domain analysis.
Microprocessor based instruments: Design of intelligent and smart instruments, PC based instruments and instrumentation systems: PC architecture, analog/digital interface, Ohmic isolation techniques, I/O systems, RS 232C serial link, GPIB (IEEE)

EEE18125 **HVAC & HVDC TRANSMISSION TECHNIQUES**
(4 0 0)

Basic design aspects of EHV AC and DC lines, transmission line models for steady state and transient studies AC transmission systems: series

compensation, shunt compensation. Concepts of high phase order transmission Flexible AC transmission and compact lines.

HVDC transmission systems: Comparison of AC and DC Transmission systems; HVDC converters and their control, harmonics and filters, Multi-terminal DC systems.

EEE18126 FLEXIBLE AC TRANSMISSION SYSTEM
(4 0 0)

Concepts of reactive power support and voltage stability. Compensation at a bus and over a line. The synchronous condenser, static var compensation, static phase shifter, thyristor controlled switched capacitor, STATCON's and DVR's unified power flow controller, interphase power controller. Reactive power balance over a network and optimization.

EEE18127 POWER SYSTEM DYNAMICS AND CONTROL
(4 0 0)

Introduction of problems related to power system stability, synchronous machine models, excitation systems, prime mover and governor models, load models. Transient stability analysis of a multi-machine system, effect of excitation control. Dynamic equivalents, approaches based on modal analysis techniques and coherency identification. Dynamic stability analysis: Effect of AVR gain, application of power system stabilizers. Techniques for the improvement of stability. Different levels of power system control, generating unit controls, excitation and prime-mover controls, p-f and q-v loops. Automatic generations control, SCADA and computer control of power systems.

EEE18128 HIGH VOLTAGE ENGINEERING
(4 0 0)

Cables, insulators and bushings, Voltage distribution and string efficiency in suspension insulators, Stress in cables, oil filled and gas filled cables, Cross linked cables, Capacitance grading, Inter-sheath grading, Breakdown and mechanism of break-down in dialectics [gaseous, liquid & solids] Partial breakdown corona & EMI (electromagnetic interference)
Utility of bushings, oil filled, condenser bushings, optimum characteristics, Lightning, switching and Power frequency over

voltages, The physical phenomenon of lightning, interaction between lightning and power system, causes of switching surges, and power frequency over voltages.
The protection of systems and equipment against over voltages, Some basic ideas about protection, lightning arresters and surge suppressors, Ground wires, grounding practices, insulation, Coordination scheme of an open air sub-station, Basic Impulse level.
Generation of High/Test Voltages for laboratory works, Alternating Voltages Transformers in cascade, the series resonant circuit, Transient voltages Impulse Generator, Tripping and synchronization with oscilloscope, Direct Voltages Voltage Doublers and Cascade Circuits, Electrostatic Generators.
Measurement of High Voltages Electrostatic Voltmeters, Sphere gaps, Uniform field gap, Ammeter in series with High Impedance, Potential Dividers.
Non-destructive High Voltage Testing: Testing of insulators, transformers, isolators, circuit breakers and cables as per relevant Indian standard specifications. High Voltage Schering Bridge, Mega ohmmeter.

EEE18129 **OPTIMAL CONTROL**
(4 0 0)

Calculus of variations. Application to optimal control of dynamical systems. Pontryagin's minimum principle and its application to optimal control problems with constraints. Dynamic programming. Bellman-Jacobi equation and its application. Introduction to optimal control of distributed parameter systems.

EEE18130 **PATTERN RECOGNITION**
(4 0 0)

2-D/3-D image representation, Time domain/Frequency domain representation, Correlation characteristics, Sampled data structure in 2-D/3-D representation.
PCM coding for image digitization, Redundancy in images and psycho-visual characteristic, IP and ER techniques for image coding, Image coding without memory and with memory, DPCM, ADPCM, block/transform coding, Entropy coding, Enhancement/ Restoration techniques.
Image analysis/synthesis and image understanding techniques.

EEE18131
(4 0 0)

MINE INSTRUMENTATION

Mine environment monitoring:
Methane, carbon monoxide, pressure, temperature, air velocity, humidity and convergence monitoring.
Microprocessor and micro controller applications in mine instrumentation.
Advanced mine signaling: Winder signaling & instrumentations, Mine Communication and data transmission.
Digital techniques of mine instrumentation. Fiber optic based mines instrumentation system.