New Course Structure and Syllabus of Dibrugarh University | Electrical Engineering (2016-17) & (2017-2018) Batch Dibrugarh University

Jorhat Engineering College, Jorhat
Assam – 785 007

COURSE STRCUTURE FOR UG ENGINEERING UNDER

DIBRUGARH UNIVERSITY

ELECTRICAL ENGINEERING

SEMESTER I

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS101	Sociology	2	0	0	2	2
02	HS102	Business Communications	2	0	0	2	2
03	MA101	Mathematics I	3	1	0	4	4
04	PH101	Applied Physics I	3	0	0	3	3
05	PH102	Applied Physics Laboratory I	0	0	2	2	1
06	CH101	Engineering Chemistry I	3	0	0	3	3
07	CH102	Engineering Chemistry Laboratory I	0	0	2	2	1
08	CE101	Engineering Graphics	2	0	2	4	3
09	EE101	Basic Electrical Engineering	3	1	0	4	4
10	EE102	Basic Electrical Engineering Laboratory	0	0	2	2	1
11	ME101	Engineering Workshop I	0	0	2	2	1
TOTAL						**30**	**25**

SEMESTER II

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS203	Economics for Engineers	2	0	0	2	2
02	HS204	Presentation Skills	1	0	2	3	2
03	MA202	Mathematics II	3	1	0	4	4
04	PH203	Applied Physics II	3	0	0	3	3
05	PH204	Applied Physics Laboratory II	0	0	2	2	1
06	CH203	Engineering Chemistry II	3	0	0	3	3
07	CH204	Engineering Chemistry Laboratory II	0	0	2	2	1
08	CS201	Computer Programming	3	0	0	3	3
09	CS202	Computer Programming Laboratory	0	0	2	2	1
10	ME202	Engineering Mechanics	3	1	0	4	4
11	ME203	Engineering Mechanics Laboratory	0	0	2	2	1
12	ME204	Engineering Workshop II	0	0	2	2	1
TOTAL						**30**	**25**
13	AC201	Environmental studies	3	0	0	3	0

SEMESTER III

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA301	Mathematics III	3	1	0	4	4
02	PH301	Electrical Engineering Materials	3	0	0	3	3
03	EE301	Basic Electronics Engineering	3	1	0	4	4
04	EE302	Electrical Circuit Analysis	3	0	0	3	3
05	EE303	Electrical Machines I	3	0	0	3	3
06	EE304	Digital Electronics and Microprocessor Programming	3	1	0	4	4
07	EE305	Digital Electronics and Microprocessor Programming Lab	0	0	2	2	1
08	EE306	Electrical Machines - I Laboratory	0	0	2	2	1
09	EE307	Basic Electronics Laboratory	0	0	2	2	1
		Total				**27**	**24**
10	AC301	Language laboratory	0	0	4	4	0

SEMESTER IV

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA401	Mathematics IV	3	1	0	4	4
02	EE401	Automatic Control System I	3	0	0	3	3
03	EE402	Electro Magnetic Field Theory	3	0	0	3	3
04	EE403	Advanced Electronics & Microprocessor Interfacing	3	2	0	5	5
05	EE404	Electrical Machines – II	3	0	0	3	3
06	EE405	Power System I	3	1	0	4	4
07	EE406	Advance Electronics & Microprocessor Interfacing Lab	0	0	2	2	1
08	EE407	Electrical Machines – II Laboratory	0	0	2	2	1
						26	**24**
09	AC401	Language laboratory	0	0	4	4	0

SEMESTER V

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA501	Mathematics V	3	1	0	4	4
02	EE501	Automatic Control System II	3	0	0	3	3
03	EE502	Power System II	3	1	0	4	4
04	EE503	Power Electronics	3	0	0	3	3
05	EE504	Discrete Time Signal Processing	3	0	0	3	3
06	EE505	Electrical Measurement I	3	0	0	3	3
07	EE506	Power Electronics Laboratory	0	0	2	2	1
08	EE507	Automatic Control System & DSP Lab	0	0	2	2	1
09	EE508	C++ & Object Oriented Programming Lab	0	0	2	2	1
						26	**23**

SEMESTER VI

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS6-1	Introduction to Accountancy & Management	3	0	0	3	3
02	EE601	High Voltage Engineering	3	1	0	4	4
04	EE602	Power System III	3	1	0	4	4
05	EE603	Electrical Measurement II	3	0	0	3	3
06	EE604	Electrical System Design & Drawing (Electrical Workshop)	0	0	6	6	3
07	EE605	Power System Laboratory	0	0	2	2	1
08	EE606	Mini Project	0	0	4	4	2
03		Elective – I (Open)	3	0	0	3	3
	Total					**29**	**23**

List of Elective – I (Open)

1. EE607 Microprocessor and Microcontroller
2. EE608 Computer Organisation
3. EE609 Advance Digital Signal Processing
4. EE610 Basic Thermal Science
5. EE611 Principles of Tele-communication Engineering
6. EE612 Solid Mechanics

SEMESTER VII

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	EE701	Power System Interconnection and Control	3	0	0	3	3
02	EE702	Computer Methods of Power System Analysis	3	0	0	3	3
03	EE703	Seminar Presentations	0	0	2	2	1
04	EE704	Project I	0	0	12	12	6
05		Elective – II	3	0	0	3	3
06		Elective – III	3	0	0	3	3
07		Elective - IV (Open)	3	0	0	3	3
	Total					**29**	**22**
08	AC701	Industrial Training	0	0	0	0	0

List of Elective – II, III

1. EE705 Utilization of Electric Power and Machine Drives
2. EE706 Flexible AC Transmission Systems
3. EE707 Advance Control System
4. EE708 VLSI Circuits Design
5. EE709 Speech Processing
6. EE710 Advances in Tele-communication Engineering

7. EE711 Embedded Systems
8. EE712 Computer Architecture
9. EE713 Biomedical Instrumentation

Elective—IV (Open)

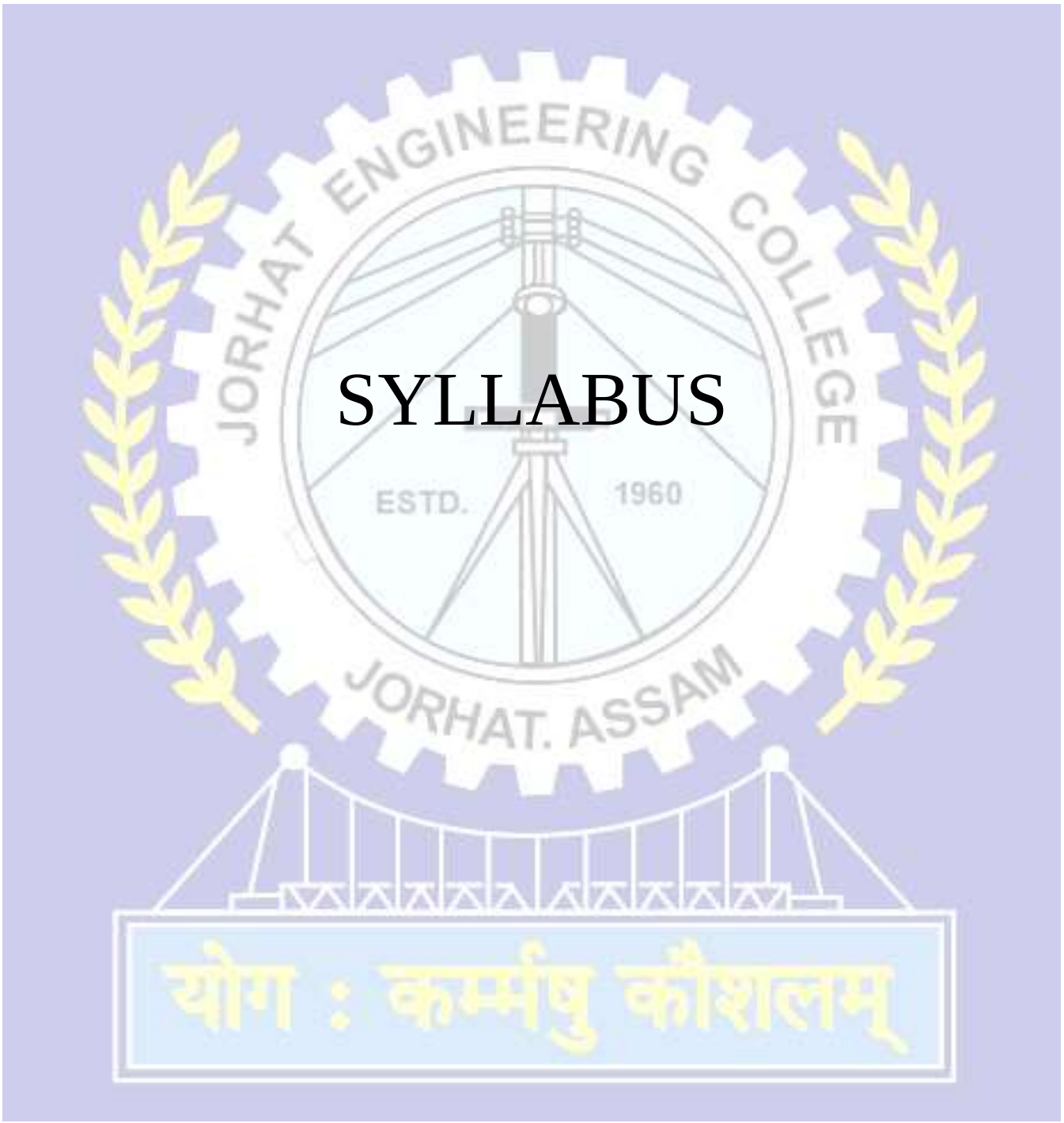
1. EE713 Digital Image Processing
2. EE714 Prime Movers
3. EE716 Illumination Engineering
4. EE717 Optimisation Techniques
5. EE718 Operating System Design
6. EE719 Ultrasonic & High Frequency Instrumentation
7. EE720 MEMS & NEMS Data Communication & Networks
8. EE721 Optoelectronics

SEMESTER VIII

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	EE801	Electrical System Installation & Professional Practice	3	0	0	3	3
03	EE802	Project II	0	0	20	20	10
05		Elective-V	3	0	0	3	3
06		Elective-VI	3	0	0	3	3
07		Elective-VII	3	0	0	3	3
	Total					**32**	**22**

List of Elective – V , VI & VII

1. EE803 Generating Station & Sub-Station Practice
2. EE804 High Voltage Direct Current Transmission
3. EE805 Electric Drives Modelling , Analysis and Control
4. EE806 Dynamic Modelling & Analysis of Electrical Machines
5. EE807 Discrete Time Control System
6. EE808 Process Dynamics & Control
7. EE809 Computer Vision
8. EE810 Computer Graphics
9. EE811 Multiple View Projection Geometry
10. EE812 VLSI Signal Processing
11. EE813 Adaptive Signal Processing
12. EE814 Power Plant Instrumentation
13. EE815 Intelligent Control System
14. EE816 Expert Systems Artificial Intelligence
15. EE817 Optical Communication Engineering


JORHAT ENGINEERING COLLEGE
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1960
JORHAT. ASSAM
योग : कर्मसु कौशलम्

SYLLABUS

SEMESTER I

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS101	Sociology	2	0	0	2	2
02	HS102	Business Communications	2	0	0	2	2
03	MA101	Mathematics I	3	1	0	4	4
04	PH101	Applied Physics I	3	0	0	3	3
05	PH102	Applied Physics Laboratory I	0	0	2	2	1
06	CH101	Engineering Chemistry I	3	0	0	3	3
07	CH102	Engineering Chemistry Laboratory I	0	0	2	2	1
08	CE101	Engineering Graphics	2	0	2	4	3
09	EE101	Basic Electrical Engineering	3	1	0	4	4
10	EE102	Basic Electrical Engineering Laboratory	0	0	2	2	1
11	ME101	Engineering Workshop I	0	0	2	2	1
TOTAL						**30**	**25**

1st Semester BE (EE)

Syllabus for Sociology (HS 101)

L-2 T-0 P-0

Md.No.	**Contents**	**No. Of Lectures**
1.	Introduction to Sociology concepts – structures, system, organisation, social institutions, culture, civilization, social stratification (cast, class, gender, power), state and civil society.	7
2.	Political economy of Indian Society, industrial, urban, agrarian and tribal society, cast, class, ethnicity and gender, ecology and environment.	6
3.	Social change in contemporary India – Modernisation, Westernisation, Globalisation, Secularism and Communalism, name of development, changing nature of work and organization	7
4.	Science, technology and society – meaning and differences, social process of innovations, influence of social factors on scientific innovation, technology and rate of social change.	4

Text Books:

1. Introduction to sociology – Dr. Sachdeva and Vidyabhushan
2. Principles of Sociology with an Introduction to Social Thought – C.N. Shankar Rao

1st Semester BE (EE)

Syllabus for Business Communication (HS 102)

L-2 T-0 P-0

Module	Contents	No. of Lectures
1	Business Communication covering, Role of communication in information age; communication in a technical organization; concept and meaning of communication; process of communication; forms of communication; mass communication; Barriers to the process of communication; effective communication	5
2	Style and organization in technical communication covering, Listening, speaking, reading and writing as skills; Objectivity, clarity, precision as defining features of technical communication; Principles of effective writings; Various types of business writing: Language and formats of various types of letters, developing outlines, key expressions, **article** reviews.	5
3	Professional speaking and Advanced Techniques in Technical Communication covering Elements of effective presentation; Connecting with audience during presentation; Planning and preparation a model presentation. Power-point presentation; Seminar Preparation; Professional interaction.	5

Text/Reference Books:

1. Fred Luthans, Organizational Behaviour, McGraw Hill
2. Lesikar and petit, Report writing for Business
3. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill
4. Wallace and masters, Personal Development for Life and Work, Thomson Learning
5. Hartman Lemay, Presentation Success, Thomson Learning
6. Malcolm Goodale, Professional Presentations
7. Farhathullah, T. M. Communication skills for Technical Students
8. Michael Muckian, John Woods, The Business letters Handbook
9. Herta A. Murphy, Effective Business Communication

1st Semester BE (EE)

Syllabus for Mathematics-1**(**Elementary Mathematics For Engineers)(MA101)

L-3 T-1 P-0

Module	Contents	No. of Lectures
1	Differential and Integral Calculus - Successive differentiation; Standard forms, Leibnitz Theorem, Mean value Theorems of Lagrange's and Cauchy's; Expansion of functions by Taylor's Series, Indeterminate forms; L'Hospital's rule, Tangents and Normal, Sub-tangents and subnormal. Curvature and radius of Curvature in Cartesian and Polar co-ordinates. Asymptotes and tracing of simple curves. Reduction formulas, Areas and lengths of plane curves, Volumes and surface areas of solids of revolution.	24
2	Differential Equations - Ordinary differential equations of first order and first degree, Exact equations, Equations of first order but not first degree; Equations solvable for "p". Equations solvable for "y" and for "x".Clairauit's form. Linear equations with constant coefficients. Homogeneous linear equations. Simultaneous differential equations, Some Engineering applications (mechanical and electrical circuits).	12
3	Linear Algebra - Some special types of matrices such as orthogonal matrices, complex matrices, Hermitian and skew-Hermitian matrices, unitary, nilpotent and involuntary matrices. rank of a matrix, elementary transformation and equivalent matrices, triangular form, normal form, inverse by elementary transformation, Vector spaces and subspaces, linear dependence ,basis and dimensions, consistency and solutions of linear equations (non-homogeneous and homogeneous). Characteristic equations, Eigen values, Eigen vectors and their properties, Cayley- Hamilton's theorem, Eigen values of Hermitian, skew-Hermitian and orthogonal matrices.	12

Text Books/References

1. Differential Calculus - Shanti Narayan (S.Chand & Co.)
2. Integral Calculus - Shanti Narayan (S.Chand & Co.)
3. Differential Calculus - Das & Mukherjee (U. N. Dhar & Co.)
4. Integral Calculus - Das & Mukherjee (U. N. Dhar & Co.)
5. A Text Book of Engineering Mathematics - N.P Bali & Dr. Manish Goyal (Lakshmi Publication)
6. A Text Book of Matrices - Shanti Narayan (S. Chand & Co.)

1st Semester BE (EE)
Syllabus for Applied Physics-1(PH101)

L-3 T-0 P-0

Module	Contents	No. of Lectures
1	Optics and Imaging covering Ray Optics- Lens aberration (chromatic, achromatic, spherical, distortion, astigmatism, coma), Aberration removal; (Chromatic & Spherical); Interference – coherence (spatial, temporal) in thin films of uniform thickness (derivation); Diffraction Grating–use as a monochromatic; Imaging: including importance, types of imaging (microscopes, telescopes ,cameras etc.); Classification (visible ,IR, electron, magnetic, UV/X-rays, gamma rays, microwaves);Comparative study of different types of imaging(with respect to magnification, resolution, image quality, applications); Fiber Optics including Introduction, Optical fiber as a dielectric wave guide-total internal reflection, Numerical aperture and various fiber parameters, losses associated with optical fibers, step index and graded index fibers, application of optical fibers.	12
2	Elastic Properties of materials and Waves and Vibrations covering, Relation between elastic constants, internal bending moment, bending of beams-cantilever, torsion of a cylinder, torsional rigidity; Simple harmonic motion–its expression and differential equation, superposition of two linear SHMs(with same frequency), Lissajous figures; Damped vibration–differential equation and its solution, critical damping, Logarithmic decrement, Analogy with electric circuits; Forced vibration – differential equation, Amplitude and velocity resonance, Sharpness of resonance and Quality factor.	12
3	Sound covering, Definitions: Velocity, frequency, wavelength, intensity, loudness (expression), timber, of sound, reflection of sound, echo; Reverberation, reverberation time, Sabine's formula, remedies over reverberation; Absorption of sound, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies; Ultrasonic– Production of ultrasonic by Piezo-electric and magnetostriction; Detection of ultrasonic; Engineering applications of Ultrasonic (Non-destructive testing, cavitation, measurement of gauge);Infrasound Seismography (concept only).	12
4	Measurements and Errors: covering Measurement and, precision, accuracy, certainty, resolution; Errors-types and sources of errors(definitions and examples), Systematic error, Random error, Ambiguity error, Dynamic error, Drift, Noise; Elements of statistics including precision and variance; Propagation of error with example of Wheatstone bridge; Design of instrument/ experiment, Specifications including Measurand, Utility of Measurand, Environment of instrument; Accomplishment of design including commercial availability of components, detectors, displays, energy sources etc; Estimation and minimization of errors in the design followed by Implementation and testing.	12

Text and Reference Books:

1. Text book of Sound Subramanian & BrijLal,
2. Eugene Hecht & A. R. Ganesan(2009),Optics, Pearson
3. Fundamentals of Optics – Francis A. Jenkins, Harvey E. White,
4. Optics - Ajoy Ghatak

5. A text book of Optics - Subrahmanyam & Brij Lal
6. General properties of matter - DS Mathur
7. Books with titles-Engineering Physics

1st Semester BE (EE)

Syllabus for Chemistry-1(CH101)

L-3 T-0 P-0

Module	Contents	No. of Lectures
1	Water covering Types of hardness, units. Determination of hardness by EDTA method. Softening methods and numerical problems based on these methods, membrane based processes. Problems with boiler feed water and its treatments. Specifications of drinking water (BIS and who standards). Chlorination of water , sources and quality of drinking water .concepts of water harvesting , storage and recycling .toxicity of water , sources of water pollutants . Water pollution from analytical laboratories in schools, colleges and universities. Measures for minimization and recycling of laboratory waste water.	10
2	Polymers and composites covering basics of polymer chemistry , molecular weight molecular shape , crystallinity, glass transition temperature and melting point, visco-elasticity , structure property relationship . Methods of polymerization, thermoplastics and thermo – sets, copolymerization, elastomers - structure, applications, curing techniques. Advanced polymeric materials; conducting polymers, liquid crystal properties. Synthesis , properties and uses of pe, pvc, pmma, formaldehyde resin , melamine – formaldehyde resin , adhesives and their adhesive mechanism. Composites – basics of composites, composition and characteristic properties of composites. Types of composites – particle, fiber, reinforced – structural and their applications.	10
3	Surfactants and lubricants covering Surface active agents, methods of preparation of soaps. Cleaning mechanism, limitations of soap as cleaning agents. Types and advantages of detergents; critical miceller concentration, hydrophilic and hydrophobic interaction. Fricoohesty of surfactant solutions, hlb values . Lubricants types of lubricants and mechanism of lubrications. Physical and chemical properties of lubricants,	06
4	Biotechnology covering Significance and application of biotechnology, bioreactors. Biotechnology processes; fermentation, production of ethanol. Brief idea of vitamins, bio fuels, biosensors, bio-fertilizers, bio-surfactants. Application of bio-chips, intermolecular multiple force theory (immft) of bio surfactants.	06
5	Green chemistry covering Introduction, significance, principles of green chemistry.R4m4(reduce, reuse , recycle, redesign, multipurpose , multidimensional , multitasking , multi -tracking) models with special reference of survismeter , econoburette Concept of molecular and atomic economy and its use in green chemistry. Brief idea of alternative solvents-- water, ionic --liquids, supercritical fluid system (carbon di- oxide). Advances and applications of green chemistry. (Few examples.)	06

6	Instrumental techniques covering Fundamentals of spectroscopy, principles and applications of uv – visible spectroscopy. Application of ir ,aas , mass , nmr , spectroscopy. Principle and applications of chromatographic techniques , including tlc, column , gas , hplc ,	07

Text Book/ Reference Books:

1. Engineering Chemistry-Jain & Jain (Dhanpat Rai & Company)
2. Engineering Chemistry-Shashi Chawla (Dhanpat Rai & Company)
3. Industrial Chemistry-B. K. Sharma
4. A text book of Engineering Chemistry-Dr S. Rattan
5. Wiley Engineering Chemistry
6. Atomic Structure and Chemical bond-Manas Chandra (TMH edition)
7. Quantum Chemistry-B.K. Sen
8. Quantum Mechanics-L. Pauling & E. Wilson (McGraw Hill Book Company)
9. Physical Chemistry-P. W. Atkins (Oxford University Press)
10. Advance Inorganic Chemistry- Cotton et. Al. (John Willey)
11. Inorganic Chemistry-Shriver, Atkins, Langford (ELBS)
12. Green Chemistry-Paul T Anastas, John C. Warner
13. Introduction to Polymers-R. J. Young
14. Polymer Science-V.R.Gowarikar (New Age International)
15. Fundamentals of Molecular Spectroscopy-C. N. Banwell & E. N. McCash
16. Atomic & Molecular Spectroscopy-Chatwal & Anand (Himalayan Publishing House)

Syllabus for Engineering Graphics (CE101)

L-2 T-0 P-2

Module	Contents	No. of Lectures
1	**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their significance, usage of drawing instruments.Lines and Lettering : Different types of line, Single stroke letter – Vertical and inclined capital and small letter Scales: Introduction, Reducing and enlarging scales, representative fraction, types of scale – plain scale, diagonal scale, comparative scale, venier scale, chord scale.Curves: Conic sections – Ellipse, parabola, hyperbola, different methods of construction of conic sections, tangents and normal to conics. cycloid curves – cycloid, trochoid, epicycloids, hypocycloid. Normal and tangents to cycloid curves. Involutes and Archimedean spiral, normal and tangents to involutes and Archimedean spiral	13
2	**Orthographic Projections:** Principles of Orthographic Projections-Conventions Projection of points: Introduction of projection, quadrants, 1st , 2nd , 3rd and 4th angle projection of points. Projection of lines (First angle only) : Line parallel to one or both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both plane. traces of lines Projections of planes (First angle only): Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other, oblique plane. Projection of solids (First angle only) : Axis perpendicular to one plane and parallel to other, axis parallel to both plane, axis inclined to one plane and parallel to other, axis inclined to both plane.	15
3	**Sections and Sectional Views of Right Angular Solids:** Section of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.	4
4	**Isometric Projections:** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.	4

Text/Reference Books:

1. Engineering Drawing - N.D. Bhat,& M. Panchal (2008).
2. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana (2008)
3. A Text Book of Engineering Drawing- R.K. Dhawan (2007)
4. Engineering Drawing- K.L Narayana & P Kannaiah (2008), Scitech Publishers.

Syllabus for Basic Electrical Engineering(EE101)

L-3 T-1 P-0

Module	Contents	No. of Lectures
1	D.C Networks: Definition of active, passive, linear, non-linear circuit elements and network; Kirchoff's laws; Node and mesh analysis; Voltage and current sources; Network Theorems: Superposition, Thevennin's, Norton's and Maximum power transfer.	10
2	Single Phase A.C Circuits: Waveforms of alternating voltage & current; Instantaneous, average and R.M.S. values; Form factor and peak factor; Forms of representation of alternating quantities; Concept of phasor and phasor diagrams; Concept of lead & lag; Reactance and impedances; A.C. circuits: resistive, inductive, R-L, R-C and R-L-C series, parallel and series-parallel combinations; Impedance and admittance triangle; Active and reactive power and power factor.	10
3	Magnetic Circuits: Definitions of mmf, flux density and reluctance; Comparison between electric and magnetic circuits; Series, parallel and series parallel circuits and their solutions; Energy stored in a magnetic field; Hysteresis and eddy current losses; Magnetically coupled circuits; Self-inductance, mutual inductance and coupling coefficient; Analysis of coupled circuits; Dot-rule and equivalent conductively coupled forms of Magnetically coupled circuits.	6
4	Three-Phase Circuits: Concept or three-phase A.C; Phase and line values in star and delta connections; Solutions or simple 3-phase balanced circuits with resistive and reactive loads; 3-phase power; Phase sequence.	6
5	Instruments: Classification of instruments; Essentials of indicating type of instruments: deflecting torque, controlling torque and damping torque; Types of indicating instruments; MC and MI type ammeters and voltmeters; Extension of range using shunt and multipliers; Errors and Compensations.	6
6	Basics of Electrical Installations: Domestic wiring, Types of cables (names only); Types of wiring; Circuit layouts: single-phase A.C. mains to DB; 3-phase connections; Accessories: main switch, ceiling rose, fuse, MCB etc; Testing of wiring installation; The megger; Earthing: purpose and methods; Lamps: fluorescent tube and its connection and operation; Indian Electricity Rules regarding electrical installation.	7

Text Books:

1. A Text Book of Electrical Technology Vol I – B. L. Theraja, A. K. Theraja (S. Chand & Co.)
2. Engineering Circuit Analysis 6th Ed - William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin (McGraw-Hill, 2002).
3. Basic Electrical Technology - N. K. De, G. D. Ray and T. K. Bhattacharya (IIT Kharagpur)

Syllabus for Applied Physics Laboratory-1(PH102)

L-0 T-0 P-2

List of experiments

Exp. No.	List of experiments
1	Determination of the resistance of a galvanometer by Thompson's method.
2	Determination of the value of H (Earth's horizontal intensity) in the laboratory by using deflection and vibration magnetometers.
3	Determination of the value of J (Mechanical equivalent of heat) with a Joule's calorimeter.
4	Determination of the value of a given low resistance by potential difference method using a potentiometer.
5	Determination of the Young's modulus of the material of a wire by Searle's apparatus.
6	Finding the wavelength of a source of light by Newton's ring method.
7	Study of charging and discharging of a capacitor and determination of time constant
8	Determination of the magnifying power of a telescope.
9	Study of rotational motion of a flywheel.
10	Study of ultrasound properties.
11	Inverse square law studies for light using photo diode as detector.
12	Optical experiments with diffraction grating.
13	Study of transverse nature of light based on polarization phenomenon.
14	Thermal conductivity studies.

1st Semester BE (EE)

Syllabus for Engineering Chemistry Laboratory-1(CH102)

L-0 T-0 P-2

List of experiments

Exp. No.	List of experiments	Contact Hrs.
1	Determination of total hardness of water by edta method	12
2	Determination of acidity / alkalinity of water sample.	
3	Determination of available chlorine in bleaching powder.	
4	Determination of percentage of copper in brass.	
5	Estimation of fe_2 volumetrically.	
6	Qualitative detection of constituents of any two alloys: --- brass, bronze, nichrome, German silver and gun metal, type metal , monel metal.	

Syllabus for Basic Electrical Engineering Laboratory (EE102)

L-0 T-0 P-2

List of experiments

Exp. No.	List of experiments
1	To measure the armature and field resistance of a DC machine.
2	To calibrate a test (moving iron) ammeter and a (dynamometer) Wattmeter with respect to standard (DC PMMC) ammeter and voltmeters.
3	Verification of circuit theorems – Thevenin's and superposition theorems (with DC sources only).
4	Measurement of current, voltage and power in R-L-C series circuit exited by single phase) AC supply.
5	Open circuit and short circuit tests on a single phase transformer.
6	Connection and starting of a three phase induction motor using direct on line (DOL) or star – delta starter.
7	Connection and measurement of power consumption of a fluorescent lamp and voltage – current characteristics of incandescent lamps.
8	Determination of open circuit characteristics (OCC) or a DC generator.
9	Two wattmeter method of measuring power in three phase circuit (resistive load only)

1st Semester BE (EE)

Syllabus for Engineering Workshop (ME101)

L-0 T-0 P-2

List of Experiments

Exp. No.	List of experiments

1	To remove piston, crankshaft and connecting rod from the given 4-stroke petrol engine.
2	To inspect the transmission system i.e., gear box, differential and live axle by assembling the parts.
3	To make the following patterns to be used in casting. a) Stepped cone pulley b) 'V' block
4	To make a taper mandrel shaped job.
5	To make a T-Half lap joint as per drawing and dimensions.
6	To perform pipe fitting (plumbing).
7	To perform sheet metal operations such as, a) Notching b) Edge folding c) Seam making

SEMESTER II

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS203	Economics for Engineers	2	0	0	2	2
02	HS204	Presentation Skills	1	0	2	3	2
03	MA202	Mathematics II	3	1	0	4	4
04	PH203	Applied Physics II	3	0	0	3	3
05	PH204	Applied Physics Laboratory II	0	0	2	2	1
06	CH203	Engineering Chemistry II	3	0	0	3	3
07	CH204	Engineering Chemistry Laboratory II	0	0	2	2	1
08	CS201	Computer Programming	3	0	0	3	3
09	CS202	Computer Programming Laboratory	0	0	2	2	1
10	ME202	Engineering Mechanics	3	1	0	4	4
11	ME203	Engineering Mechanics Laboratory	0	0	2	2	1
12	ME204	Engineering Workshop II	0	0	2	2	1
TOTAL						**30**	**25**
13	AC201	Environmental studies	3	0	0	3	0

2nd Semester BE (EE)

Syllabus for Economics for Engineers (HS203)

L-2 T-0 P-0

Module	Contents	No. of Lectures
1	Basic Principle and Methodologies of Economics (Basic concepts), Demand/supply – elasticity, Government policies and application, Theory of the firm and market structure, Basic macroeconomic concepts (including GDP/GNP/NI/disposable income), Aggregate demand and supply (IS/LM), Price indices (WIP/CPI), Interest rates, Direct and indirect taxes	5
2	Public sector economics –Welfare, Externalities, Labour market, Components of monitory and financial system, Central bank, Commercial banks and their functions, Capital and debt market, Monetary and fiscal policy – Tools and their impact on the economy, Inflation and Phillips curve	5
3	Elements of business/managerial economics and forms of organizations, Cost and cost control – techniques, types of costs, budgets, break even analysis, capital budgeting, application of linear programming, investment analysis – NPV, ROI, IRR, payback period (5 lectures)	5

Text and Reference Books:

1. Elementary Economic Theory- Dewett, K.K. and Varma, J.D, Chand and Company Ltd.
2. Micro Economics Theory and Applications - Maddala, G.S. and Ellen Miller, Tata McGraw Hill.
3. Mathematical Analysis for Economics, Allen, R.G.D., Macmillan.

4. Fundamental Methods of Mathematical Economics, Chiang, A.C., McGraw Hill.
5. Statistical Methods, Gupta, S.P., S.Chand and Sons Publishers.
6. Paul, R.R., Monetary Economics, Kalyani Publishers.
7. Indian Economy, Dutt, Ruddar and Sundharam, K.P.M.,, S.Chand and Company Ltd.
8. Public Finance and Fiscal Policy, Choudhury, R.K., Kalyani Publishers.
9. Micro Economics Theory, Jhingan, M.L., Vrinda Publisher (P) Ltd.
10. Engineering Economics, Afazuddin Ahmed and Gulzar Begum,, Chandra Prakash.
11. Modern Economic Theory, Dewett, K.K.,

2nd Semester BE (EE)

Syllabus for Presentation Skills (HS204)

L-1 T-0 P-2

Module	Contents	No. of Lectures
1	Communication and personality development covering Psychological aspects of communication, audience analysis, types of audience, importance of audience analysis, analyzing individual and members of groups, adapting message to audience.	4
2	Carrier Oriental Communication covering Resume and bio-data: Design and style; Applying for a job: Language and format of job application. Job Interviews: purpose and process; Group discussion: structure and process; Techniques of effective participation in group discussion; Model group discussion through the choice of appropriate programmes.	4
3	Professional speaking and Advanced Techniques in Technical Communication covering Elements of effective presentation; Connecting with audience during presentation; Planning and preparation a model presentation. Power-point presentation; Seminar Preparation; Professional interaction.	5

Text/Reference Books:

1. Organizational Behaviour-Fred Luthans,, McGraw Hill
2. Report writing for Business-Lesikar and petit,
3. Effective Technical Communication-M. Ashraf Rizvi, McGraw Hill
4. Personal Development for Life and Work -Wallace and masters, Thomson Learning
5. Presentation Success -Hartman Lemay,, Thomson Learning
6. Professional Presentations- Malcolm Goodale,
7. Communication skills for Technical Students- Farhathullah, T. M.
8. The Business letters Handbook -Michael Muckian, John Woods,
9. Effective Business Communication -Herta A. Murphy,
10. MLA Handbook for Writers of Research Papers

2nd Semester BE (EE)

Syllabus for Mathematics- II (MA202)

L-3 T-1 P-0

Module	Contents	No. of Lectures
1	Multivariate Analysis - Euler's theorem on homogeneous function .Differentiation of implicit and composite function, Errors and approximation, Jacobian, Taylor's series for function of two variables .Maxima and minima of function of two variables. Lagrange method of undetermined multipliers. Double, triple integral, change of variable, change of order of integration, Greens theorem connecting line and surface integral. Application to areas, volumes Improper integrals, Beta and Gamma functions. Differentiation under integral sign.	24
2	Fourier series and Transforms - Sine, cosine series in any interval, Half range series. Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier sine and cosine transforms, properties of Fourier transforms: linear property, change of scale property and shifting property.	12
3	Laplace Transforms - Laplace transforms of elementary functions. Properties of Laplace transform. Laplace transforms of derivatives and integrals. Laplace transforms of periodic function, unit step function, error function and Bessel's function. Inverse Laplace transform and it's properties, Inverse Laplace transform of derivatives and integrals, Convolution theorem. Application to ordinary differential equations.	12

Text Books/References:

1. Advanced Engineering Mathematics by Erwin Kreysig (Willy)
2. Higher Engineering Mathematics by B.S. Grewal
3. A Text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal
4. Theory and problems of Laplace transforms By Murray R.Spiegel.
5. Differential Calculus By B. C. Das & B.N. Mukherjee
6. Mathematical Analysis By S. C. Malik & Savita Arora

2nd Semester BE (EE)

Syllabus for Applied Physics- II (PH203)

L-3 T-0 P-0

Module	Contents	No. of Lectures
1	Solid State Physics covering Free electron theory (qualitative), Fermi energy, Fermi- Dirac distribution function(with derivation), Kronig-Penny model(qualitative)–formation of allowed and forbidden energy bands, Concept of effective mass–electrons and holes, Density of states (qualitative), Electron scattering and resistance, magneto-resistance, Hall effect (with derivation);Semiconductors and insulators–direct & indirect band gaps, Fermi level for intrinsic (derivation) and extrinsic semi - conductors(dependence on temperature and doping concentration). Diffusion and drift current (qualitative), Conductivity and photo-conductivity, Optical response; Classification of different types of diode on the basis of doping concentration (rectifier diode, Zener diode, tunnel diode); Concept of optoelectronics, Light Emitting Diode (as direct band gap material), solar cell, avalanche and photodiode;	12
2	Laser covering Fundamentals of LASER-Energy levels in atoms, radiation-matter interaction, absorption of light, spontaneous emission of light, Stimulated emission of light– population of energy levels, Einstein A and B coefficients, Metastable state, population inversion, resonant cavity, excitation mechanisms, Lasing action; Properties of laser, characteristics of different types of laser; Types of laser-Solid State Laser: Nd–YAG, Gas Laser – He-Ne, Semiconductor Laser; Applications of Laser in Engineering – drilling, welding, micro machining, measurement of long distances, in CD write devices & printers, in Medicine as a surgical tool, in Nuclear fusion, Holography, Optical signal processing and Remote sensing of the atmosphere; Laser safety	12
3	Introductory Quantum Mechanics covering Concept of de Broglie's Matter waves, derivation of wavelength of matter waves in different forms, Heisenberg's Uncertainty principle, illustration-why an electron cannot exist in the nucleus; Concept of Phase velocity and Group velocity(qualitative);Concept of wave function Ψ and interpretation of $\|\Psi\|2$; Schrödinger's Time independent equation, Applications of Schrödinger's equation (qualitative treatment)–a)Particle in one dimensional rigid box, b) Potential Barrier (emphasis on tunneling effect) tunnel diode, scanning-tunneling microscope c)Hydrogen atom model(qualitative); Selection rules Elements of linear vector spaces- The idea of n–dimensional vector space, use of 'bra-ket' notation, linear independence, basis, inner product, norm of a vector; Hilbert space, Ortho normality; Matrix representation of kets and linear operators;Pauli matrices; Definitions of Hermitian, Inverse and Unitary Operators; Commutators; Tensor products.	12

4	Thermal Physics covering Concept of Heat: Lattice vibrations Einstein (individual) and Debye (collective), Boltzmann's distribution; Definition of temperature in terms of Boltzmann's distribution; Concept of entropy, specific heat; Attaining low temperature by variation of parameter X (like pressure, magnetic field etc.) in two steps-isothermal increase of X followed by adiabatic decrease of X. Example: a) Liquefaction of gas with X= Pressure; b) Adiabatic demagnetization; Transfer of heat by conduction, convection and radiation-Conduction in a) solids b) liquids c)gases; Convection- heat and mass transfer; Radiation- Stefan's law (statement and equation); Thermal diffusivity; Applications like, Insulation-Glass Dewar/Thermos flask ,Super insulation Dewar, High temperature furnaces; Heat pipes; Heat sinks and Forced cooling/Radiators; Heat exchangers; Solar water heater.	12

Text/Reference Books:

1. Introduction to Solid State Physics, Kittel C.,WileyEastern
2. Solid State Physics -AJ Dekker
3. Elementary Solid State Physics - Omar, Pearson Publication
4. Lasers and Non-Linear Optics, Laud B. B., New Age Publications
5. Essentials of Laser Physics - G. D. Baruah, Pragati Prakashan
6. Quantum Mechanics by Leonard I Schiff
7. Quantum Mechanics - G Aruldhas
8. A treatise on Heat - Saha & Srivastava
9. Experimental Techniques in Low Temperature Physics, Oxford Science Publications Guy K. White,
10. Books with titles-Engineering Physics

2nd Semester BE (EE)

Syllabus for Engineering Chemistry- II (CH203)

L-3 T-0 P-0

Module	Contents	No. of Lectures
1	Electrochemistry covering Conductance, cell constant and its determination. Single electrode potentials, electrolytic and galvanic cells. Emf series , nernst equation , cell emf measurement , reversible and irreversible cells	06
2	Corrosion covering Definition and scope of corrosion , direct chemical corrosion , and electrochemical corrosion and its mechanisms. Types of electrochemical corrosion (differential aeration, galvanic, concentration cell). Typical electrochemical corrosion like pitting, inter – granular, soil, waterline. Factors affecting corrosion, protection of corrosion. Applications with few practical problems of corrosion.	08
3	Energy sciences covering fuels (conventional) – types of fuels.	10

	Calorific value, determination of calorific value. Refining of petroleum , liquid fuel s , fuels for ic engines , knocking and antiknock agents , octane and cetane values , cracking of oils , alternative sources of energy , limitations of fossil fuels. Non - conventional sources of energy advantages and disadvantages. Nuclear energy production from nuclear reactions, brief idea of nuclear reactor. Battery technology fundamental of primary cells, rechargeable batteries , ni-cd , ni - metal hydride . Fuel cells principles, applications, advantages and disadvantages.	
4	Nanomaterials covering introduction , fullerenes , carbon nano tubes , nanowires : electronic and mechanical properties . Application of nanomaterials, catalysis , electronics and telecommunications , medicines , composites , energy sciences . Fundamentals of Nano-material.	06
5	Environmental chemistry covering air pollution, noise pollution, optimum decibel levels, water pollution. Determination and significance of cod, bod, toc . Numerical problems. Solid waste treatment and collection of nkp. Green house effect and global warming. E – Waste and radioactive pollution. Role of electromagnetic radiation in global warming.	10
6	Metals and alloys covering Gibb's phase rule , phase rule application to water , two component system s – pb – ag / fe – c phase equilibrium diagram. Types of alloys – ferrous and non-ferrous alloys. Carbon steel, alloy steel. Alloys of cu, al ,pb .	05

Text/ Reference Books:

1. Engineering Chemistry-Jain & Jain (Dhanpat Rai & Company)
2. Engineering Chemistry-Shashi Chawla (Dhanpat Rai & Company)
3. Industrial Chemistry-B. K. Sharma
4. A text book of Engineering Chemistry-Dr S. Rattan
5. Wiley Engineering Chemistry
6. Atomic Structure and Chemical bond-Manas Chandra (TMH edition)

2nd Semester BE (EE)

Syllabus for Engineering Mechanics (ME201)

L-3 T-1 P-0

Module	Contents	No. of Lectures
1	Introduction to Engineering Mechanics covering, Basic concepts, System of Forces, Coplanar Concurrent Forces, Components in Space –	5

	Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Virtual work	
2	Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack; ladder friction, lifting machine	8
3	Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.	8
4	Analysis of framed structure (Trusses), perfect and important frame, determinations of reactions, determination of stress- tensile and compression, graphical method, analytical method.	8
5	Introduction to Dynamics covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D ‟Alembert‟s principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;	8
6	Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;	8

Text/Reference Books:

1. Engineering Mechanics- Shanes and Rao (2006), Pearson Education,
2. Engineering Mechanics (Statics, Dynamics)-Hibler and Gupta (2010), by Pearson Education
3. Singers Engineering Mechanics- Reddy Vijaykumar K. and K. Suresh Kumar (2010),
4. A Text Book of Engineering Mechanics- Bansal R.K.(2010), Laxmi Publications
5. Engineering Mechanics- Khurmi R.S. (2010), S. Chand & Co.
6. Engineering Mechanics -Tayal A.K. (2010),, Umesh Publications

2nd Semester BE (EE)

Syllabus for Computer Programming (CS201)

L-3 T-0 P-0

Module	Contents	No. of Lectures
1	Introduction to computer organization; Software and hardware, Definition and examples of Operating System, Machine language, Assembly Language, High Level Language, Procedural & Object Oriented Programming Methodologies, Structured Programming	4
2	Introduction to C language with the help of a simple 'hello world' program, Data types in C, operators in C language, Control Structures – If else, While, for, do-while, Switch, break and continue statements, Formatted input-output for printing Integers, floating point numbers, characters and strings.	6
3	Designing Structured Programs in C- Top Down Design and Stepwise refinement, C function as a module, Function Definition, Prototypes, Header files, Parameter passing in C, Call by Value and Call by reference; Standard Library functions, Recursive functions, Preprocessor commands, Scope, Storage classes.	6
4	Introduction to arrays, declaring arrays in C, Passing arrays to functions, two – dimensional arrays, Multidimensional arrays.	2
5	Introduction to Pointers in C, Pointer variable declaration and Initialization. Pointer operators, Pointer expressions and arithmetic, Relationship between pointers and arrays; Concept of strings in C, Standard String Functions.	5
6	Introduction to Derived types, Declaration, definition and initialization of structures, accessing structures, passing structures to functions, unions, arrays of structures, structures and pointers, self-referential structures.	4
7	Introduction to Data Structures, Stacks, Queues, Trees, representation-using arrays.	2

Text/Reference Books:

1. Let us C- Y.P. Kanetkar - Infinity Science Press
2. Understanding pointers in, BPB Publication -Y.P. Kanetkar -
3. C – How to Program, Pearson Education -Dietel & Dietel (2000),
4. Fundamentals of Data Structures in C- Ellis Horowitz, Sartaj Sahni, Susan Anderson (1993), Prentice Hall of India.
5. The C Programming Language- B.W. Kernighan and Dennis M.Ritchie- Pearson Education, 1988.
6. Problem Solving and Program Design in C- J.R. Hanly and E.B. Koffman - Pearson Education, 2007.

2nd Semester BE (EE)

Syllabus for Applied Physics Laboratory- II (PH202)

L-0 T-0 P-2

List of Experiments

Exp. No.	List of experiments
1	Study of series and parallel resonance circuits with identification of the resonant frequency.
2	Determination of the Young's modulus of the material of a beam by bending.
3	Determination of the co-efficient of viscosity of a liquid by its flow through a capillary tube.
4	Determination of specific heat of a liquid by the method of Newton's law of cooling.
5	Drawing of I-D curve for a ray of light passing through a prism with the help of a spectrometer and determination of the refractive index of the material of the prism.
6	Determination of the acceleration due to gravity by Kater's pendulum.
7	Determination of frequency of a source of sound (a tuning fork) by means of a sonometer.
8	Study of the variation of thermo e.m.f with temperature for a given thermocouple and determination of (a) the neutral temperature (b) melting point of a substance.
9	Study of the variation of magnetic field with distance along the axis of a circular current carrying coil.
10	Determination of the band gap of a material.
11	Study of the characteristics of a PN junction diode.
12	Study of transistor characteristics.
13	Determination of Planck's constant using photocell.
14	Hall Effect and determination of Hall coefficient.
15	Determination of dielectric constant
16	Moment of inertia studies.

2nd Semester BE (EE)

Syllabus for Engineering Chemistry Laboratory -II (CH202)

L-0 T-0 P-2

List of Experiments

Exp. No.	List of experiments	Contact Hrs.
1	Determination of surface tension of a given liquid at room temperature by stalagmometer.	12
2	Determination of co-efficient of viscosity of a given liquid by Ostwald's viscometer.	
3	Determination of max. Of simple organic compound with the help of spectrophotometer.	
4	Determination of strength of strong and weak acid & bases by p^h metric method.	
5	Separation of components of a mixture by paper – chromatography.	
6	Measurement of conductivity of an electrolyte.	

2nd Semester BE (EE)

Syllabus for Computer Programming Laboratory (CS202)

L-0 T-0 P-2

List of Experiments

Exp. No.	List of experiments
1	Algorithm, flowchart, Pseudo code
2	Simple C Programming examples showing structure of a C program, data types and operators.
3	C programs on control structures and formatted I/O
4	C programs on functions
5	C programs on pre-processor directives, C programs on scope

6	C program examples showing Array applications
7	C programs on pointers, pointers and arrays
8	C programs on strings, strings and pointers.
9	C programs on structures, unions, arrays of structures, pointers and structures
10	Writing programs for implementation of Insertion, deletion and traversal operations on stack, queues and trees
11	Self-referential structures, implementation of Insertion, Deletion and Searching operations on linked linear list
12	C programs on searching and sorting

2nd Semester BE (EE)

Syllabus for Engineering Mechanics Laboratory (ME203)

L-0 T-0 P-2

List of Experiments

Exp. No	List of experiments
1	Determination of coefficient of friction
2	Parallelogram law of forces
3	Screw jack
4	Rope and pulley system
5	Parallel force systems
6	Law of conservation of mass

2nd Semester BE (EE)

Syllabus for Engineering Workshop (ME202)

L-0 T-0 P-2

List of Experiments

Exp. No.	List of experiments

1	To remove piston, crankshaft and connecting rod from the given 4-stroke petrol engine.
2	To inspect the transmission system i.e., gear box, differential and live axle by assembling the parts.
3	To make the following patterns to be used in casting. c) Stepped cone pulley d) 'V' block
4	To make a taper mandrel shaped job.
5	To make a T-Half lap joint as per drawing and dimensions.
6	To perform pipe fitting (plumbing).
7	To perform sheet metal operations such as, d) Notching e) Edge folding f) Seam making

2nd Semester BE (EE)

Syllabus for Environmental Studies (MC201)

L-0 T-0 P-0

Module	Contents	No. of Lectures
1	The Multidisciplinary nature of environmental studies Definition, scope and importance, Need for public awareness.	4
2	**Natural Resources:** Renewable and non-renewable resources: Natural resources and associated problems. Forest Resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral Resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, and salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Lance sources: Land as a resources, land degradation, man-induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for Sustainable lifestyles.	10
3	**Ecosystems-** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem: a. Forest ecosystem, b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	10
4	**Biodiversity and its conservation**- Introduction – Definition: genetic, species and ecosystem diversity. Biogeographically classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Hot spots of biodiversity – India. Threats to biodiversity: habits loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species. Conservation of biodiversity: in-situ Ex-situ conservation of biodiversity.	10

5	**Environmental Pollution-** Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes biodegradable and non-biodegradable wastes. Role of an individual in prevention of pollution. Disaster Management: Floods, earthquake, cyclone and landslides.	10
6	**Social Issues and the Environment**- From Unsustainable to sustainable development. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people, its problems and concerns. Environmental ethics. Climate change, global warming, acid rain, ozone layer depletion, unclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environmental legislation. Public awareness.	10
7	**Human Population and the Environment**- Population growth, variation among nations. Population explosion – Family Welfare programme. Environment and human health and hygiene (including Sanitation and HIV/AIDS) etc. Role of Information Technology in Environment and Human Health.	10

Text/ Reference Books

1. Agarwal, K.C. 2001 Environmental Biology, Nidi publ. Ltd. Bikaner.
2. Bharucha Earch, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmadabad – 380 013, India Email: Mapin@icenet.net ®
3. Bharucha Erach, Text book on Environmental Studies, UGC, New Delhi
4. Borua P.K., J.N.Sarma and others, A Text book on Environmental Studies, Banlata, Dibrugarh
5. Brunner R.C., 1989 Hazardous Waste Incineration, McGraw Hill Inc. 480p.
6. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
7. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jacio Publ. House, Mumbai, 1196p.
8. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
9. Down to Earth, Centre for Science and Environment ®.
10. Dutta Prasanna, Rofique Ahmed & Sumbit Chaliha, Environmental Studies., Eunika Publication, Jorhat

SEMESTER III

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA301	Mathematics III	3	1	0	4	4
02	PH301	Electrical Engineering Materials	3	0	0	3	3
03	EE301	Basic Electronics Engineering	3	1	0	4	4
04	EE302	Electrical Circuit Analysis	3	0	0	3	3
05	EE303	Electrical Machines I	3	0	0	3	3
06	EE304	Digital Electronics and Microprocessor	3	1	0	4	4
07	EE305	Digital Electronics and Microprocessor Lab	0	0	2	2	1
08	EE306	Electrical Machines - I Laboratory	0	0	2	2	1
09	EE307	Basic Electronics Laboratory	0	0	2	2	1
		Total				**27**	**24**
10	AC301	Language laboratory	0	0	4	4	0

3rd Semester BE (EE)

Syllabus for Electrical Engineering Materials (PH301)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1.	**Crystal Structure:** Unit cell and Bravais lattice; Bravais lattice in tow-dimensional and three-dimensional crystal structures; Direction and planes in a crystal lattice: Miller indices; Crystal structures of solids - LCC, FCC, BCC, simple cubic and diamond structures; X-ray diffraction and Bragg's law.	4
2.	**Conductor Materials:** Free electron theory of metals-conductivity, drift velocity, relaxation time, collision time and mean free path; Fermi-Dirac distribution; Temperature and impurity effect; Frequency effect; Effect of magnetic fields-Hall effect and megnetoresistance; Heat developed in current carrying conductors; Thermal conductivity; Conductor materials-choice of conductor materials, high conductive materials, materials of high resistivity, materials for fuse and soldiers, materials for lamp filaments, thermionic materials.	6
3.	**Magnetic Materials:** Magnetic parameters-permeability and magnetic susceptibility; Magnetic dipole moment and angular momentum; Classification of magnetic materials; Diamagnetism; Paramagnetism; Ferromagnetism and Curie-Weiss law; Ferrimagnetism; Magnetic domain; Magnetic anisotropy and	6

magnetostriction; Ferromagnetic materials; Powder Magnet; Magnetic memories – Magnetic Bubbles, Hard Disks.

4.	**Dielectric Materials:** Dielectric parameters-Dielectric constant, dipole moment, polarization and polarizability, Clausius-Mosotti equation; Mechanism of polarization-electronic polarization, ionic polarization and dipolar polarization; Frequency dependence of polarizability; Dielectric losses; Ferroelectric materials their properties and classification; Piezoelectricity; Mechanism of dielectric breakdown of gases; Liquids and solids; Factors influencing dielectric strength; Insulating materials; Properties of common insulating materials used in electrical apparatus like mica, asbestos, glass, bakelite, porcelain, rubber, paper, cotton, silk fibre, wood, plastics, PVC resins, varnishes, insulating oil and liquids, gaseous insulator etc.	8
5.	**Introduction to Nanoelectronic materials**: Principle of operation and Construction of Single Electron devices and applications; Photonoic Crystals and Quantum dot devices; Concept of Spintronics - Giant Magneto-Resistance (GMR), Tunnelling Magneto-Resistance (TMR), Magnetic Random Access Memory (MRAM); Concept of Quantum Computers.	4
6.	**Introduction to Polymer Electronic materials**: Conductive polymers; Principle of operation and fabrication of Organic Light Emitting Diode (OLED) – Small Molecule OLED and Polymer OLED; Organic Field Effect Transistors (OFET) - Small Molecule OFET and Polymer OFET; Organic Solar Cells. ,	4
7.	**Superconductivity**: Transition temperature Tc – Critical field Hc- Isotope, pressure, magnetic field effects on Tc – Meissner effect – type I and type II super conductors – London equation – thermodynamics of superconductors – free energy – entropy – specific heat – BCS theory – Superconducting energy gap – DC and AC Josephson effects – Quantization of flux – Quantum interference.High temperature superconductors – copper free oxide superconductors – preparation of Cuprates – Modern theories of HTSc – Qualitative ideas of RVB theory – application of superconductors – High field magnets, motors, generators – Magnetic Levitation and transportation – Nuclear magnetic resonance imaging – energy storage – superconducting power transmission - devises based on Josephson's effect – SQUID – memory elements – Signal Processing.	8

Text Books:

1. Electrical and Electronics Engineering Materials 2013 – J. B. Gupta, S. K. Kataria & Sons
2. Electrical Engineering Materials 1970 - A. J. Dekker, Prentice Hall of India
3. Solid State Physics 2000 - A J Dekkar, Macmillan Publishers India
4. Science of Engineering Materials and Carbon Nanotubes 3rd Ed 2010 - C. M. Srivastava and C. Srinivasan, New Age International

5. An Introduction to Electrical Engineering Materials 4th Ed 2006 - C. S. Indulkar and S. Thiruvengadam, S. Chand & Company, India.
6. Electrical Engineering Materials 2001 - N Alagappan and N Kumar, McGraw Hill
7. Electrical Engineering Materials - G. P. Chalotra and B. K. Bhatt, Khanna Publishers
8. Electrical Engineering Materials 2nd Ed 2015 - R. K. Rajput, Laxmi Publications, India
9. Material Science for Electrical & Electronics Engineers 2000 - Ian P. Hones, Oxford University Press
10. A Course in Electrical Engineering Materials 3rd Ed 2011 – S. P. Seth, Dhanpat Rai Publications
11. Nanotechnology for Electronic Materials and Devices 2007 – Edited by A. Korkin, E. Gusev, J.K. Labanowski, S. Luryi, Springer
12. Nanotechnology and Nanoelectronics Materials, Devices, Measurement Techniques 2005 - Edited by W. Fahrner, Springer
13. Quantum Electronics 3rd Ed 2012 - Amnon Yariv, Wiley India
14. Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory 1996 - Attila Szabo and Neil S. Ostlund, Dover Publications
15. Quantum Computing Explained 2016 - David McMahon, Wiley
16. Organic Electronics Materials and Devices 2015 - Edited by Shuichiro Ogawa, Springer
17. Superconductivity 2nd Ed 2013 - S. L. Kakani and Shubhra Kakani, New Age International
18. Super conductivity 1992 - Mical. Cesnot, World University.
19. Electronic Engineering Materials and Devices, J. Allison, Tata Mc Graw Hill, 1985, 5th Edition.

3rd Semester BE (E)

Syllabus for Basic Electronics Engineering(EE301)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1.	**Diode Circuits**: Piece-wise linear static model and dynamic incremental model; Practical circuits employing diode; Voltage multiplier, Clipper and Clamper; Power rectifying circuits; Power (C, L, LC and π) filters.	4
2.	**Bipolar Junction Transistor (BJT)**: Basic construction and the physical behaviour of the device; Low level injection condition; Forward active region (FAR) and the study of the flow of carriers through the BJT; Control valve action; Volt-amp curves; Base width modulation and early effect; Static circuit models; Ebers – Moll equations for the current of BJT forward bias conditions; A simple amplifier circuit; Bias stability, compensation and biasing methods; The common base (CB), common emitter (CE) and common collector (CC) configurations.	6

3.	**Small signal operation of BJT amplifier**: Incremental models for the BJT; Hybrid-Π model; Analysis of amplifiers with the help of incremental models; Simplified low frequency operation; Gains, input and output impedances of the amplifiers; Some ideas about high frequency analysis such as Miller effect and Dominant pole approximation; Determination of the Hybrid-Π parameters; Details about Two port Π- and h-parameter analysis; Multiple stage BJT amplifiers: PNP and NPN combinations; Voltage and current biasing methods; Gains; Frequency response of the amplifiers.	12
	Feedback Amplifiers: Negative feedback amplifier; Current-Series and Shunt Feedback Amplifiers; Voltage-Series and Shunt Feedback Amplifiers. **Transistor Oscillators:** Positive feedback and Barkhausen criterion for sustained oscillations; Classification of oscillators, Tuned collector oscillator; Hartley oscillator; Colpitt's oscillator, RC oscillators, Crystal oscillator.	
4.	**Field Effect Transistor (FET)**: Construction and characteristics of Junction FET (JFET); Principle of operation; Characteristic parameters of JFET; Effect of temperature on JFET parameters; Biasing of JFETs; Common drain (CD), Common source (CS) and Common gate (CG) configurations; Frequency response of JFET amplifiers; Metal oxide semiconductor FET (MOSFET); Enhancement MOSFET (EMOSFET) and Depletion MOSFET (DMOSFET); Differences between JFETs and MOSFETs; Biasing of EMOSFET and DMOSFET; Applications of MOSFETs; Complementary MOSFET (CMOS); Multistage FET Amplifiers.	10
5.	**High Input Impedance and Power Amplifier:** Need for High input impedance amplifier, Emitter follower; Darlington amplifier; Tuned amplifier; Class-A, Class-B, Class-AB and Class-C amplifiers; Distortions in power amplifiers.	4
6.	**Realization of Logic Gates**: Switching circuits & devices; Characteristics of ICs and logical level; Positive & negative logic levels; Tri-state devices; AND, OR, NOT, NAND, NOR, XOR & XNOR gates and their truth tables; Elementary idea of TTL & MOS technology for logic gates; Important Characteristics of logic gate families.	4

Text Books:

1. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C. C. Halkias, TMH
2. Microelectronics 2nd Ed 2001- Jacob Millman and Arvin Grabel, TMH
3. Electronic Devices and Circuits 5th Ed 2008 – David A. Bell. Oxford University Press
4. Electronic Principles 8th Ed 2015– Alvert Paul Malvino and David J. Bates, McGraw Hill
5. Electronic Devices and Circuit Theory 11th Ed 2013 – Robert L. Boylestad and Louis Nashelsky, Pearson Education
6. Electronic Principles: Physics, Models and Circuits 1970 – Paul E. Gray and Campbell L. Searls, John Wiley & Sons
7. Electronic Devices and Circuits: An Introduction 1979 – Allen Mottershead, PHI

3rd Semester BE (E)

Syllabus for Electrical Circuit Analysis (EE302)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Sinusoidal Steady State Analysis**: Phasor representation of sinusoidal functions; Frequency domain diagram; Phasor diagram; Node and Loop analysis methods; Steady state response using network theorems – Thevenin's, Norton's, Superposition, Reciprocity and Maximum power transfer theorems; Magnetically coupled circuits; Duality of networks.	20
2	**Resonance circuits**: Resonance in series and parallel R-L-C circuits; Resonant frequency; Selectivity; Bandwidth; Q-factor and their relationship for series & parallel resonance circuits.	10
3	**Circuit Transients**: Concept of circuit transient; Transient response & steady state response; Laplace Transform method and solution of network problems due sudden application of step, sinusoidal and exponential forcing functions.	10
4	**Network Functions**: Driving point impedance and admittance; Transfer functions; Poles & zeroes of network functions.	15
5	**Two port networks**: Impedance; Admittance; Transmission (T) and hybrid (h) parameters of two port network; Condition for reciprocity & symmetry; Relation between the parameter sets; Equivalent T & π section representation.	15
6	**Non-sinusoidal periodic waves**: Periodic waves; Fourier analysis of non-sinusoidal periodic waves; Waveform symmetry; Frequency spectrum; Average value; Root mean square (RMS) value; Average power of non-sinusoidal periodic functions.	20
7	**Graph Theory**: Graph of a network and its parts; Oriented graph; Tree; Co-tree; Loops; Tie-set; Cut-set matrix; Incidence matrices; Network equilibrium equations.	10

Text Books:

1. Electric Circuits - Schaum's Outlines on Theory and Problems 6th Ed/ 2012 - Joseph A. Edminister, McGraw Hill
2. Engineering Circuit Analysis 6th Ed - William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin (McGraw-Hill, 2002).

3. Circuits and Networks: Circuits & Networks: Analysis, Design and Synthesis 2010 - M. S. Sukhija, T. K. Nagsarkar, Oxford University Press
4. Fundamentals of Electric Circuit Theory 2011 - B. Chattopadhyay, P. C. Rakshit, S. Chand & Co. Publication.
5. A Text Book of Electrical Technology Vol I – B. L. Theraja, A. K. Theraja (S. Chand & Co.)
6. Network and Systems 2nd Ed 2009 - D. Roy Choudhury, New Age Science
7. Network Analysis and Synthesis 3rd Ed 2007 - C. L. Wadhwa, New Age International
8. Fundamentals of Electric Circuits 5th Ed 2013 - Charles K. Alexander and Matthew N.O. Sadiku, McGraw Hill
9. Circuits & Networks: Analysis & Synthesis 5th Ed 2015 – A. Sudhakar and Shyammohan S. Palli, McGraw Hill
10. Circuit Theory : Analysis and Synthesis 6th Ed 2004 - Abhijit Chakrabarti, Dhanpat Rai Publication

3rd Semester BE (E)

Syllabus for Electrical Machines - I (EE303)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Principles of Electromechanical Energy Conversion**: Forces and Torques in Magnetic Field Systems; Energy Balance; Energy in Singly-Excited Magnetic Field Systems; Determination of Magnetic Force and Torque from Energy; Determination of Magnetic Force and Torque from Coenergy; Multiply-Excited Magnetic Field Systems; Forces and Torques in Systems with Permanent Magnets; Dynamic Equations; Analytical Techniques.	10
2	**D.C. Generators**: Construction and working principle of D.C. generator; Armature winding-different types of windings; Dummy coil; Equalizer rings; e.m.f. equation; Armature reaction and commutation; Solution of commutation problems; Compensation winding; Types of D.C. generators; Voltage build up in self excited generators; Characteristics of separately excited and self exited generators; Parallel operations of D.C. generators; Losses and efficiencies; Applications.	20
3	**D.C. Motors:** Principle of D.C. motor; back e.m.f; Torque equation; Condition for maximum torque; Armature reaction and commutation; Types of D.C. motors; Characteristics and applications of series, shunt and compound motors; Method of speed control; Starters for different D.C. motors; Electric braking; Losses and efficiency; Testing of D.C. machines-brake test; Swinburn test; Hopkinson test; retardation test.	20
4	**Transformers:** Types and construction; Transformer cooling and transformer oil; Working principle; e.m.f equation; Transformation ratio; Ideal transformer; Winding resistance and magnetic leakage; Phasor diagrams; Equivalent circuit; Losses and efficiency; Condition for maximum efficiency; All-day efficiency; Voltage regulation; Testing of transformers- polarity test, O.C. and S.C. tests; Sumpner's test; Principle of autotransformer; Saving in copper; Phasor diagram; Equivalent circuit; Advantages and disadvantages; 3 phase transformer- Y-Y, Δ-Δ,Y-Δ, Δ-Y and V-V connections; Scott connections; 3-ph to 6-ph conversion- double star, double delta and diametrical connections; Parallel operation-conditions for parallel operations and load sharing; Pulse transformer.	30

5	**3-Phase Induction Machines:** Construction of squirrel-cage and phase-wound motor; Principle of operation; Slip and frequency of rotor current; Torque equation; Starting torque; Condition for maximum torque; Full-load torque; Power flow diagram; Torque-slip curve; Starting methods; No-load and block rotor tests; Circle diagram; Speed control; Double cage induction motor; Induction generator; Induction regulator; Cogging and crawling; Applications; Advantages and disadvantages.	20

Text Books:

1) Electric Machinery 6thEd 2003 - A. E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, McGraw-Hill
2) A Text Book of Electrical Technology Vol II A.C. & D.C. Machines – B. L. Theraja and A. K. Theraja, S. Chand & Co.
3) Theory and Performance of Electric Machines 2013 – J. B. Gupta, S. K. Kataria & Sons Publication
4) Theory of Alternating Current Machinery 2nd Ed 1984 - A. S. Langsdrof, McGraw Hill
5) Electrical Machines 4th Ed 2010 – D.P. Kothari and I J Nagrath, McGraw Hill
6) Performance & Design of A.C. Machines 3rd Ed 1968 - M. G. Say, Pitman Publishing
7) Advanced Electrical Technology 2011 - H. Cotton, Reem Publications Pvt. Ltd.
8) Fundamentals of Electrical Machines 2005 – B.R Gupta, New Age International
9) Problems in Electrical Engineering 9th Ed 2003 - N. N. Parker Smith, CBS Publication

3rd Semester BE (E)

Syllabus for Digital Electronics and Microprocessor (EE304)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
	Digital Systems	
1	**Representation of Information** : General number Systems – decimal, binary, octal & hexadecimal numbers; Conversion from one system to another; Codes & code conversion; BCD, Gray, Natural BCD & Extended code; Negative, positive & floating point numbers; Sign magnitude; 1's compliment and 2's compliment representation; Arithmetic operations; Representation of textual information in ASCII & EBCDIC codes; Error Detecting/Correcting codes – Hamming code.	10
2	**Logic Gates, Boolean Algebra & Logic Functions**: AND, OR, NOT, NAND, NOR, XOR & XNOR gates and their truth tables; Concept of Boolean algebra; Theorems & laws; Boolean expressions; Canonical & standard forms of logic functions & their properties; Truth table representation; Minimization of logic functions – Karnaugh map.	6
3	**Combinational Logic Circuits**: Implementation of Boolean functions using logic gates; Decoder; Multiplexer/Demultiplexer; Encoder; Code converters; Half- and Full-adder; Parity generator & parity checker.	10
	Sequantial Logic Circuits : Concept of sequential circuits; Flip-flop and its different types – clocked R-S, D, T, J-K & J-K-Master-slave; Registers – Buffers, Serial and Parallel; Hazards of sequential circuits; Sequence generator; State diagram; Design of Synchronous Counters.	
	Semiconductor Memories: Static and Dynamic; Read-only Memory (ROM), Random-access Memory (RAM), Read/Write Memory; Address and Word Expansion.	
	8085 Microprocessor	
4	**INTEL 8085 Microprocessor**: Introduction; Register structure; Memory addressing; Addressing modes; Instruction sets; Timing methods; CPU pins and associated signals; Instruction timing and execution; T-state and Machine cycle; Timing diagrams; Programmed I/O; Interrupt systems; DMA operations; SID & SOD lines.	10
	INTEL 8085 Programming: Assembly Language Program (ALP); Machine Codes; Debugging of Program; Programming techniques – looping, counting and indexing, counters and time delays, stack and subroutines; Code conversion – BCD arithmetic and 16-bit data operations.	

5	**Introduction to Peripheral Interfacing ICs:** 8-bit Input/Output port 8212; 8255 programmable peripheral interface. **Microprocessor Based Applications:** Digital clock; Traffic light controller; Hex key-board interface; Seven segment display interface.	4

Text Books:

1. Digital Electronics: Principles, Devices and Applications 1st Ed 2007 – Anil K Maini, Wiley
2. Fundamentals of Digital Circuits 4th Ed 2016 – A. Anand Kumar, PHI
3. Solid State Pulse Circuits 4th Ed 1991 – David A. Bell, PHI
4. Digital Circuits and Logic Design 1976 – Samuel C. Lee, Prentice Hall
5. Digital Fundamentals 10th Ed 2011 – Thomas L. Floyd, Pearson
6. Digital Principles and Applications 5th Ed 1994 – Don Leach and Albert Malvino, McGraw Hill
7. Digital Electronics – An Introduction to Theory and Practice 1982 – William H. Gothmann, PHI
8. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C. C. Halkias, TMH
9. Microelectronics 2nd Ed 2001- Jacob Millman and Arvin Grabel, TMH
10. Logical Design of Switching Circuits – Douglas Lewin, Elsevier Science & Technology
11. Microprocessor Architecture, Programming and Applications with the 8085 6th Ed 2013 - Ramesh S. Gaonkar, Penram International Publishing
12. Fundamentals of Microprocessors and Microcomputers 2012 – B. Ram, Dhanpat Rai Publications

LABORATORIES

3rd Semester BE (E)

Syllabus for Digital Electronics & Microprocessor Laboratory (EE305)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.
1	**Basic Digital IC's**: Verification of truth table for AND, OR, EXOR, NOT, NOR and NAND gates	10
2	Design and Implementation of an Universal (NAND) Combinatorial Logic Circuit	
3	Design and Implementation of an Universal (NOR) Combinatorial Logic Circuit	
4	Design and Implementation of an Half Adder/Full Adder; Subtractor; Code converter; Encoder and Decoder.	
5	**Sequential Logic Circuit**: Study of RS, D, T, JK and JK Master-Slave Flip-Flops (FF).	
6	Design and Implementation of 4-bit SISO/SIPO/PISO/PIPO Shift registers	
7	Design and Implementation of a Modulo-N Synchronous/Asynchronous Counter and Ring counter.	

3rd Semester BE (E)

Syllabus for Electrical Machines-I Laboratory (EE306)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.
1	To obtain the speed characteristics of a D.C shunt motor as a function of armature voltage, field current, and external resistance in the armature circuit.	12

2	To obtain the performance characteristics of a DC shunt motor by load test.	
3	To obtain the performance characteristics of a DC compound motor by brake test.	
4	To plot O.C.C. and find the critical resistance (Rc) and critical speed (Nc) of a dc shunt generator	
5	To conduct a load test on a dc shunt generator and obtain its internal and external characteristics.	
6	To conduct a load test on a dc compound generator,(a) As Cumulatively Compounded, (b) As a differentially compounded and draw its internal and external characteristics.	
7	To perform Hopkinson's test on two similar DC shunt machines and hence obtain their efficiencies at various loads.	
8	To determine the efficiency of the two given dc series machines which are mechanically coupled.	
9	To separate the mechanical and iron losses of the given dc shunt machine by retardation test.	
10	To pre-determine the efficiency of a D.C shunt machine considering it as a motor by performing Swinburne's test on it.	
11	To obtain separately the hysteresis, eddy current, function and Windage losses of the given motor.	

3rd Semester BE (E)

Syllabus for Basic Electronics Laboratory (EE307)

L-0 T-0 P-2 C-1

Md No.	**Contents**	**No. of Lecture Hrs.**
	Experiments on Analog Electronic Devices and Circuits	8
1	Characteristic of a PN diode	
2	Voltage regulation of Half wave and Full wave rectifier at No-load and Full-load	
3	Input Characteristic of a NPN/PNP Transistor	
4	Output Characteristic of a NPN/PNP Transistor	
5	Current, Voltage and Power Amplifications of an CE NPN/PNP Transistor Amplifier	

********************************END********************************

SEMESTER IV

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA401	Mathematics IV	3	1	0	4	4
02	EE401	Automatic Control System I	3	0	0	3	3
03	EE402	Electro Magnetic Field Theory	3	0	0	3	3
04	EE403	Advanced Electronics & Microprocessor Interfacing	3	2	0	5	5
05	EE404	Electrical Machines – II	3	0	0	3	3
06	EE405	Power System I	3	1	0	4	4
07	EE406	Advance Electronics & Microprocessor Lab	0	0	2	2	1
08	EE407	Electrical Machines – II Laboratory	0	0	2	2	1
						26	**24**
09	AC401	Language laboratory	0	0	4	4	0

4th Semester BE (E)

Syllabus for Automatic Control System - I (EE401)

L-3 T-01 P-0 C-3

Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Introduction**: Concept of automatic control systems; Classifications- open loop and closed loop systems, Linear and Non-linear systems, Continuous and Discrete time systems, SISO and MIMO systems, Time-invariant and Time varying systems, Servo systems and Automatic regulating systems, Adaptive control systems.	8
2	**Block diagram and signal flow graphs**: Block diagram (BD) representation of physical systems, BD reduction techniques; **Signal Flow Graph (SFG)**: Definition, terminology, SFG representation of physical systems, Mason's Gain formula, BD reduction using SFG techniques.	8
3	**Mathematical modelling of physical systems**: Differential equations and transfer function form of models, Mathematical model of electrical, Mechanical and Electro-mechanical systems, Analogous systems.	6

	Control system components: Potentiometer, Synchros, DC and AC Servomotors, Rotating Amplifier, Stepper Motor, Tachogenerators.	
4	**Transient response analysis**: Type and order of systems, standard test signal, Steady state error and error constants, Generalized error series, Sensitivity, Characteristic equation, Transient response of 1st, 2nd and higher order systems, Transient response specifications, Definition of absolute and relative stability, Routh-Hurwitz stability criterion.	8
5	**Root locus method**: Introduction, Angle and Magnitude conditions, Construction of complete root locus, Stability analysis, Effect of addition of poles and zeroes.	6
6	**Control System Design based on Root Locus method**: Preliminary design considerations, Lead, Lag and Lag-Lead Compensation techniques based on Root locus.	4

Text Books:

1) Control System Engineering 5th Ed 2009 – I J Nagrath and M Gopal, New Age International Publishers
2) Modern Control Engineering 2015 – K Ogata, Pearson
3) Control System Engineering 6th Ed 2010 - Norman S. Nise, John Wiley & Sons
4) Control Systems: Theory and Applications 2nd Ed 2012 - Smarajit Ghosh, Pearson
5) Schaum's Outline of Feedback and Control Systems 2nd Ed 2014 – Joseph J. DiStefano, Allen J. Stubberud and Ivan J. Williams, McGraw-Hill
6) Modern Control System 12th Ed 2013 - Richardo C. Dorf, Robert H. Bishop, Pearson
7) Control Systems –Principles & Design 4th Ed 2012 - M Gopal, Tata McGraw Hill

4th Semester BE (E)

Syllabus for Electromagnetic Field Theory (EE402)

L-3 T-0 P-0 C-3

Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Vector Analysis:** Scalar & Vector Field; Vector algebra; Vector calculus – gradient, divergence and curl of a vector; Cartesian, cylindrical and spherical systems of vectors; Transformation between vectors; Line & surface integral; Divergence theorem; Stokes theorem and Green's theorem.	4
2	**Electrostatics in Vacuum & Dielectrics:** Coulomb's law; Principles of superposition of forces; Electric field intensity; Field due to point charges, line charges and sheet of charges; Electric flux & flux density; Gauss's law	8

	(Integral & differential form); Applications of Gauss's law; Laplace's & Poisson's equations; Maxwell's first equation (Electrostatics); Electric potential & potential difference; Relation between field & potential; Equipotential surface; Potential gradient; Electric dipole; Electrostatic energy; Energy & field in presence of dielectrics; Boundary equations.	
3	**Boundary Value Problems:** Poisson's & Laplace's equations; Uniqueness theorem and boundary conditions; Solution of Laplace's equation in different co-ordinate systems; Solution of Poisson's equation; Method of images.	4
4	**Magnetostatic Field**: Magnetic field; Biot-Savart law; Ampere's circuital law; Laws of magnetostatic in vector form; Magnetic scalar & vector potential; Magnetic dipole moment of current loop.	4
5	**Electromagnetic Field**: Faraday's laws in integral & differential form; Energy in magnetic field; Force & Torque on current loop; Magnetic boundary conditions.	4
6	**Time Varying Fields:** Maxwell's equations in differential & integral form; Retarded potential; Poynting vector; Power & energy consideration; Poynting theorems.	8
7	**Plane Electromagnetic Waves**: Wave equation in free space; Wave equation in perfect dielectrics; Plane wave in lossy dielectrics; Propagation in good conductors; Polarization of plane electromagnetic waves; Retarded potential; Standing wave ratio; Reflections of uniform plane waves.	8

Text Books:

1. Engineering Electromagnetics 8th Ed 2014 – William Hayt, John Buck, Akhtar, TMH
2. Schaum's Outline of Electromagnetics 4th Ed 2013 – Joseph A Edminister, McGraw Hill
3. Introduction to Electromagnetic Field and Waves 2nd Ed 1970 – Paul Lorrain, Dale R. Corson, W.H.Freeman & Co Ltd
4. Electromagnetic Fields 2008 - R. Meena Kumari and R. Subasri, New Age International
5. Engineering Electromagnetics 2012 - C. L. Wadhwa, New Age International Publishers
6. Principles of Electromagnetics 6th Ed 2015 - Matthew N.O. Sadiku and S.V. Kulkarni, Oxford University Press
7. Elements of Electromagnetics 6th Ed 2014 - Matthew N.O. Sadiku, Oxford University Press
8. Elements of Electromagnetic Fields 2nd Ed 2001 – S. P. Seth, Dhanpat Rai & Sons
9. Basic Electromagnetics with Applications – N. N. Rao, Oxford University Press
10. Elements of Engineering Electromagnetics 6th Ed 2004 – N N Rao, Prentice Hall
11. Fundamentals of Electromagnetics for Electrical and Computer Engineering 2008 – N N Rao, Pearson

12. Introductory Course in Electromagnetic Fields 2013 – P. V. Gupta, Dhanpat Rai Publication

4th Semester BE (E)

Syllabus for Advanced Electronics & Microprocessor Interfacing (EE403)

L-3 T-2 P-0 C-5

Md No.	Contents	No. of Lecture Hrs.
1	**Integrated Circuits:** Advantages of Monolithic ICs, Classification of ICs, IC package types, Pin identification and Temperature ranges; Fabrication of monolithic ICs by Epitaxial-diffused method: Crystal growth of the substrate, Epitaxial growth, Isolation diffusion, Base diffusion, Emitter diffusion, Aluminium metalization by vacuum evaporation of aluminium; Masking and Etching; Lateral diffusion of impurities; Monolithic Integrated Diodes, BJTs, FETs, Resistors, Metal-semiconductor contacts and Capacitors; Characteristics of Integrated components, Design rules for Monolithic IC layout: Pin connections, Crossovers, Isolation Islands, Fabrication sequence, Dielectric isolation method.	10
	Large Scale Integration (LSI) and Very Large Scale Integration (VLSI) Systems: Dynamic MOS shift registers: Dynamic MOS Inverter, Ratioed and ratioless memory cell, Dynamic CMOS shift register stage; Static MOS shift register; MOS ROM, EPROM, EAROM, PLA, FPLA, FPGA, RAM, R/W memory cell: static and dynamic, Memory expansion, Charge-Coupled Device (CCD); CCD structures: 1-, 2- and 4-Phase CCDs; CCD memory organizations, Line-addressable RAM (LARAM); Microprocessors and Microcomputers: Block diagram and fabrication; Integrated-Injection Logic (I^2L) and Injection Logic circuits.	
2	**Operational Amplifiers:** Ideal Op-Amp, Practical Inverting and Non-inverting Op-Amp; Difference amplifiers; Common-mode Rejection Ratio (CMRR); Emitter-coupled Diff-Amp; Op-Amp Design Techniques: Constant Current Sources, Biasing techniques: current repeaters/mirrors, Active loads, Level shifting, Output stages, Offset error voltages and currents, Op-Amp performance parameters, Universal balancing techniques, Measurement of Op-amp parameters; FET Op-Amps; Frequency response of Op-Amps; Compensation	10

methods: Dominant-pole and pole-zero compensation, Modification of open-loop input impedance, Miller-effect compensation, Lead compensation.

	Linear Applications of Op-Amps: Open loop operation of Op-Amps; Voltage-series and current-series feedback; Non-inverting and inverting configurations of Op-Amp circuits; Instrumentation amplifiers; V-to-I and I-to-V converters; Summing, Scaling and Averaging amplifiers; Log and Antilog amplifiers; Integrators and Differentiators; Electronic analog computation.	
	Non Linear Applications of Op-Amps: Comparators; Zero-Crossing Detector; Schmitt Trigger; Voltage limiters; f-to-V and V-to-f converters; Op-Amp Oscillators: Principles and types, Phase-shift, Wien Bridge, Quadrature, and Voltage-controlled oscillators; Op-Amp Multivibrators; Wave generators: Square, Triangular, Sawtooth; Clipper, Clamper, Peak Detector; Sample-and-Hold circuit.	
3	**Active Filters:** Classification of filters; Butterworth RC filters of various types and orders using Op-Amp; High-Q Band Pass and Band Stop filter; All pass filter; Universal active filter; Switched capacitor filter.	4
	Specialized IC Applications: The 555 Timer IC; Phase Locked Loops, Voltage Regulator ICs; Power Amplifiers, DAC and ADC ICs.	
	Microprocessor Interfacing	
4	**Peripheral Interfacing:** Review of 8085 Microprocessor Instruction set and 8255 General purpose programmable peripheral device; 8155 programmable peripheral interfaces; 8253 programmable interval timer; 8259 programmable interrupt controller; 8257 DMA controller; 8279 programmable key-board/ display controller; Key debounce; Parallel versus Serial transmission; Universal Synchronous/Asynchronous Receivers/ Transmitters (USART) & Universal Asynchronous Receivers/Transmitters (UART); 8251 Programmable communication interface; ADC & DAC interfacing; Interfacing standard; IEEE 488 parallel interface bus; RS 232C Serial interface.	10
	Microprocessor Based Applications: Stepper motor control; Washing machine controller; Microprocessor based protective relays; Measurement of electrical quantities; Measurement & control of non-electrical quantities.	
5	**MDS and Other Development Aids:** Introduction to MDS; Hardware & software support to MDS; PROM programmer; EPROM eraser; Simulators and Emulators; Monitor; Operating systems; File manager; Linker; Loader; Locator; Debugger; Assembler; Text editor; Compiler; System software; Application software; Utility program; BIOS.	6

Text Books:

1. Linear Integrated Circuit 3rd Ed 2010 – D. Roy Chowdhury and S. Jain, New Academic Science Ltd
2. Linear Integrated Circuit 5th Ed 2013 – J. B. Gupta, S. K. Kataria & Sons Publication
3. Op-Amps and Linear Integrated Circuits 4th Ed 2017 – Dr Sanjay Sharma, S. K. Kataria & Sons Publication
4. Operational Amplifiers and Linear Integrated Circuits 4th Ed 2007 – William D. Stanley, Pearson
5. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C. C. Halkias, TMH
6. Microelectronics 2nd Ed 2001- Jacob Millman and Arvin Grabel, TMH
7. Op-Amps and Linear Integrated Circuits 4th Ed 2015 - Ramakant A. Gayakwad, Pearson
8. Electronic Devices and Circuit Theory 11th Ed 2013 – Robert L. Boylestad and Louis Nashelsky, Pearson Education
9. Microprocessor Architecture, Programming and Applications with the 8085 6th Ed 2013 - Ramesh S. Gaonkar, Penram International Publishing
10. Fundamentals of Microprocessors and Microcomputers 2012 – B. Ram, Dhanpat Rai Publications

4th Semester BE (E) Syllabus for Electrical Machines - II (EE404) **L-3 T-0 P-0 C-3**		
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Synchronous Generators:** General principle; Construction of cylindrical and salient pole machines; Armature winding and winding factors; e.m.f. equation; Armature reaction; Leakage reactance; Synchronous reactance and impedance; Phasor diagrams; Power angle characteristics of cylindrical machine; Voltage regulation by synchronous impedance method; Ampere-turn method and zero-power factor / Potier methods; Synchronizing and parallel operation.	8
2	**Synchronous Motor:** Principle of operation; Equivalent circuit and phasor diagram; Power output and torque; Effect of variation of excitation and load; V-curve and O-curve; Hunting; Damper winding; Synchronous condenser; Starting methods; Synchronous induction motor.	8
3	**Tow-reaction Analysis of Salient Pole Machines:** Blondel two-reaction theory and phasor diagram of salient pole machines; Modified phasor diagram; Power angle characteristics; Voltage regulation; Slip test.	4
4	**Sudden Short circuit of Synchronous Generators:** Transient and subtransient reactances; Equivalent circuits at transient conditions; Current variation during symmetrical short circuit; Measurement of direct-axis subtransient reactance; Unsymmetrical short circuit of 3-phase Alternator; Measurement of negative and zero sequence impedances.	8
5	**Single phase Induction Motor:** Construction; Principle of operation- double revolving field theory and cross-field theory; Torque slip characteristics; Equivalent circuits; Determination of parameters by no-load and blocked rotor tests; Starting methods - split phase motors and shaded pole motor; Speed control.	6
6	**A.C. commutator motors:** AC series motor-construction, Phasor diagram and characteristics; Universal motor; Repulsion motor; Repulsion-start induction motor and repulsion-induction motor; Schrage motor-construction and working principle; Speed control and power factor improvement; Applications.	6

Text Books:

1. Electric Machinery 6thEd 2003 - A. E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, McGraw-Hill
2. A Text Book of Electrical Technology Vol II A.C. & D.C. Machines – B. L. Theraja and A. K. Theraja, S. Chand & Co.
3. Theory and Performance of Electric Machines 2013 – J. B. Gupta, S. K. Kataria & Sons Publication
4. Theory of Alternating Current Machinery 2nd Ed 1984 - A. S. Langsdrof, McGraw Hill
5. Electrical Machines 4th Ed 2010 – D.P. Kothari and I J Nagrath, McGraw Hill
6. Performance & Design of A.C. Machines 3rd Ed 1968 - M. G. Say, Pitman Publishing
7. Advanced Electrical Technology 2011 - H. Cotton, Reem Publications Pvt. Ltd.
8. Fundamentals of Electrical Machines 2005 – B.R Gupta, New Age International
9. Problems in Electrical Engineering 9th Ed 2003 - N. N. Parker Smith, CBS Publication

4th Semester BE (E) Syllabus for Power System - I (EE405) **L-3 T-1 P-0 C-4**		
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**General Background**: Layout diagrams of electric power generating stations (Hydel and Thermal); Function and growth of electric power systems; Transmission of electrical energy; Comparison of D.C & A.C systems; Comparison of overhead & underground systems.	4
2	**Overhead Line Transmission Part A**: Choice of transmission voltage & its effect on transmission efficiency; Type of conductors and selection criterion of different sizes for 400, 220, 110, 66 and 33 kV lines. Line Parameters: Calculation of inductors and capacitors of 1-ph & 3-ph single and double circuit transmission lines; Stranded & bundled conductors; Transposition; Effect of earth in 1-ph and 3-ph lines; Internal impedance and current density in a hollow conductors; Skin & proximity effects; Use of tables for conductors; Typical parameters of 400, 220, 110, 66 and 33 kV lines. Performance of Short, Medium & Long Transmission Lines: Nominal T & Π Representation of Transmission-line system; Rigorous solutions for long transmission line; Ferranti effect; Regulation & Efficiency; ABCD/Transmission-line parameters.	10
3	**Overhead Line Transmission Part B**: Voltage Control: Sending end & receiving end voltage; Methods of voltage control – Synchronous machines, shunt capacitor & reactors, series capacitors, tape-changing transformers, booster transformers. Circle Diagrams: Receiving end power circle diagram; Calculation of synchronous phase modifier capacity; Percentage regulation & efficiency; Sending end power circle diagram; Lossy line & loss circle diagram.	6
4	**Overhead Line Transmission Part C**: Overhead Line Insulators: Types of insulators; Voltage distribution on an insulator string; Stringing efficiency; Methods of grading of insulators and static shielding; Testing of insulators. Mechanical Design: Calculation of sag & tension – effect of wind and ice loading; Support at different levels; Sag templates; Stringing chart; Spacing	6

between conductors; Type of supporting structures; Conductor vibration and vibration damper.

5	**Overhead Line Transmission Part D**: Corona: Electric stress at surface of overhead line conductors; Disruptive critical voltage; Visual critical voltage; Corona loss; Factors effecting corona loss; Method of reducing loss; Radio interference – electrostatic and electromagnetic interference with communication lines.	4
6	**Underground Cables:** Different types; Insulating materials; Insulation resistance; Breakdown of cable insulation; High voltage cables – Internal & external gas pressure cables, Gas filled cables; Capacitance of single and multi core cables; Grading of cables; Insulation; Sheath losses; Dielectric losses; Thermal ratings; Testing of cables; Method of cable laying and cable jointing.	6
7	**A.C & D.C Distribution**: Copper efficiency of d.c. 2-wire, d.c. 3-wire, a.c. 1-ph 2-wire, a.c. 3-ph 3-wire & a.c. 3-ph 4-wire systems; Radial system-distributed & concentrated loads on feeders; Feeders feed at one end and both ends with equal & unequal voltages; Ring mains, sub-mains and tapperd mains; Choice of feeding points; Sectionalisation of networks; Electricity regulations.	4

Text Books:

1. Elements of Power System Analysis 4th Ed 1955 – William D Stevenson Jr., TMH
2. Power System Analysis 1994 - John Grainger, William Stevenson Jr., TMH
3. Electrical Power Systems 6th Ed 2012 – C. L. Wadhwa, New Age International
4. Modern Power System Analysis 4th Ed 2011 – I. J. Nagrath & D. P. Kothari, TMH
5. Power System Analysis and Design 2005 – B. R. Gupta, S. Chand & Co.
6. Electrical Power System 15th Ed – S. L. Uppal and S. Rao, Khanna Publishers
7. A Text Book on Power System Engineering 2008 - A.Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and, Dhanpat Rai & Co. Pvt. Ltd.

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LABORATORIES

4th Semester BE (E)

Syllabus for Advance Electronics & Microprocessor Laboratory (EE406)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.
1	Op-Amp Linear Application: Comparator, Differentiator, Integrator, Adder, Subtractor.	8
2	Op-amp Non Linear Application: Clipper, Clamper, Peak detector, The 555 Timer IC application, VCO and PLL.	
3	Simple arithmetic operations: Multi precision addition/subtraction/multiplication /division (8-bit & 16-bit).	
4	Programming with control instructions: Increment/Decrement, Maximum/Minimum of numbers, Ascending/Descending order Sorting, Rotate instructions, Hex/ASCII/BCD code conversions.	
5	Interface Experiments: • Simple experiments using 8212, 8251, 8255, 8259, 8279, 8253.	
6	Interface Experiments: • Interfacing of Linear and Matrix Keyboard, Digital Clock, Traffic light controller, Stepper motor control, ADC & DAC Interfacing, Temperature Monitoring & Control, Voltage & Current Monitoring, Line Power Factor Control.	

4th Semester BE (E)

Syllabus for Electrical Machines-II Laboratory (EE407)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.
1	To determine the iron losses, copper losses and efficiency of a transformer at any load by doing OC, SC and Load tests on single phase transformer.	12

2	To predetermine the efficiency, regulation and equivalent circuit of a given pair of identical single -phase transformers by conducting Sumpner's test.	
3	To draw the V and Λ curves of a 3-phase synchronous motor at no-load and load conditions.	
4	To perform the brake test on a 3-ϕ slip ring induction motor and obtain its performance characteristics.	
5	To draw the circle diagram of a 3-phase squirrel cage Induction motor by No-load and block rotor tests on squirrel cage induction motor.	
6	Draw the equivalent circuit of the single phase Induction motor by conducting (a) No-load test (b) Blocked rotor test.	
7	To determine the Xd & Xq of the salient pole type Synchronous Machine by Slip test.	
8	To pre determine the regulation of an alternator at full load at different power factors using synchronous impedance and MMF methods.	
9	To record the hysteresis loop of the core of an iron cored transformer and to find the hysteresis losses (the power converted to heat due to hysteresis) in the iron core of the transformer.	
10	To study the Scott Connection of transformers and to verify different types of connections of Three-Phase Transformers.	
11	To start a 3-Phase slip ring induction motor by rotor resistance starter.	
12	Run the induction machine as an induction generator and measure the real and reactive powers.	
13	To measure the rise in temperature inside the winding of a 3- phase transformer using Heat-Run test.	
14	Start a squirrel cage induction motor by using star- delta starting method.	
15	To determine the sub-transient reactance of salient pole synchronous machine from Standstill Single-frequency a.c. test.	
16	To determine positive, negative and zero sequence impedance of salient pole synchronous machine. **********END**********	

SEMESTER V

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	MA501	Mathematics V	3	1	0	4	4
02	EE501	Automatic Control System II	3	0	0	3	3
03	EE502	Power System II	3	1	0	4	4
04	EE503	Power Electronics	3	0	0	3	3
05	EE504	Discrete Time Signal Processing	3	0	0	3	3
06	EE505	Electrical Measurement I	3	0	0	3	3
07	EE506	Power Electronics Laboratory	0	0	2	2	1
08	EE507	Automatic Control System & DSP Lab	0	0	2	2	1
09	EE508	C++ & Object Oriented Programming Lab	0	0	2	2	1
						26	**23**

5th Semester BE (E)

Syllabus for Automatic Control System - II (EE501)

L-3 T-0 P-0 C-3

Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Frequency response analysis**: Frequency response of systems, frequency domain specifications, correlation between time-domain and frequency-domain specification, Polar plot, Nyquist plot and Nyquist stability criterion, Bode plot, Gain margin & Phase margin, Minimum and Non-minimum phase transfer function, Determination of transfer function from Bode plot, Magnitude and Phase angle plot, Constant-M & Constant-N circles, Nichol's chart.	8
2	**State Space Method of System Analysis**: Concept of State and State variables, State model, State-Space representation of physical systems, Block diagram representation, State transition matrix and its properties, Relation between State equation and Transfer function, Solution of State equation, Characteristic equation, Eigen values and Eigen vectors, Controllability and Observability of linear systems.	8

3	**Control System Design using Bode Plot and State Space methods**: Review of Preliminary design considerations; Lead, Lag and Lag-Lead Compensation techniques based on Bode plot and State Space method.	6
4	**Introduction to Digital Control System**: Introduction, Spectrum Analysis of Sampling Process, Signal Reconstruction, Difference Equation, The z-Transform, z-Transfer Function (Pulse Transfer Function), Inverse z-Transform and Response of Linear Discrete Systems, z-Transform Analysis of Sampled-data Control Systems, Block Diagram Reduction, Stability, Steady-State Errors, Transient Response on the z-Plane, Gain Design on the z-Plane, Cascade Compensation via s-Plane, Implementation of Digital Compensator.	6
5.	**Nonlinear Systems:** Common Physical Nonlinearities, Phase-plane method, Singular points, Stability of Nonlinear System, Construction of Phase-trajectories, Describing function method of Stability analysis, Jump resonance.	6
6.	**Liapunov's Stability Analysis:** Liapunov's Stability Criterion, Direct method of Liapunov and Linear Systems, Methods of constructing Liapunov Functions for Nonlinear Systems.	6

Text Books:

1. Control System Engineering 5th Ed 2009 – I J Nagrath and M Gopal, New Age International Publishers
2. Modern Control Engineering 2015 – K Ogata, Pearson
3. Control System Engineering 6th Ed 2010 - Norman S. Nise, John Wiley & Sons
4. Control Systems: Theory and Applications 2nd Ed 2012 - Smarajit Ghosh, Pearson
5. Schaum's Outline of Feedback and Control Systems 2nd Ed 2014 – Joseph J. DiStefano, Allen J. Stubberud and Ivan J. Williams, McGraw-Hill
6. Modern Control System 12th Ed 2013 - Richardo C. Dorf, Robert H. Bishop, Pearson
7. Control Systems –Principles & Design 4th Ed 2012 - M Gopal, Tata McGraw Hill

5th Semester BE (E)

Syllabus for Power System - II (EE502)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**General inroduction:** Typical power system network, Signal time diagram, Per unit system, Calculation based on per unit values for steady state condition.	4
2	**Symmetrical components and fault conclusion:** Fortesque theorem, Symmetrical components of an unbalanced three phase system, Average power in terms of symmetrical components, Sequence impedance, Methods of determining sequence components, Fault calculation, Sequence network equation, Short circuit faults: Line to Ground (LG), Line to Line (LL), Double Line to Ground (LLG), Three-phase LLL and LLLG; Effect of fault impedances and grounding impedance on fault current, sequence network.	10
3	**Stability studies:** Power limits of transmission line, Steady state stability, Transient stability, Swing equation, Equal area criteria, Calculation of critical clearing angle, Calculation of power angle curves for fault and post fault conditions, Effect of reclosing, Step-by-step method of the solution of the swing equation, Dynamic stability, Factors effecting stability, Phase shifting transformers.	8
4	**Transients in power system:** Lightening phenomena, switching surges, travelling wave shapes and specifications, attenuation and distortion of travelling waves, attenuation due to corona, behaviour of travelling waves of a transmission lines, construction of Bewlly-Lattice diagram.	8
5	**Economics of power system:** Economics of power plants, load curves, load factors, diversity factors; Utilization factor, Tariffs and Tariff structure, Economics of power factor improvement, Definitions and Characteristics of Base load and Peak load plant.	6
6	**Electrical Power System Ethics:**	
7	**Electrical Energy Audit**:	4

Text Books:

1. Elements of Power System Analysis 4th Ed 1955 – William D Stevenson Jr., TMH
2. Power System Analysis 1994 - John Grainger, William Stevenson Jr., TMH
3. Electrical Power Systems 6th Ed 2012 – C. L. Wadhwa, New Age International
4. Modern Power System Analysis 4th Ed 2011 – I. J. Nagrath & D. P. Kothari, TMH
5. Power System Analysis and Design 2005 – B. R. Gupta, S. Chand & Co.
6. Electrical Power System 15th Ed – S. L. Uppal and S. Rao, Khanna Publishers
7. A Text Book on Power System Engineering 2008 - A.Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and, Dhanpat Rai & Co. Pvt. Ltd.
8. Power Generation Operation and Control, 2ndEd 1996 - Allen J Wood and Bruce F Wollenberg, John Wiley & Sons
9. Economic Operation of Power Systems 1st Ed 1958 – Leon K. Kirchmeyer, John Wiley & Sons

5th Semester BE (E)

Syllabus for Power Electronics (EE503)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Semiconductor Power Devices:** Characteristics of power devices – Diode, Power transistor, Thyristor and Triac; Firing circuits for Thyristor & Triac; Rating, Cooling & mounting of Thyristor; Series & parallel connection of Thyristor; Protection of Thyristor; Gate trigger & commutation circuits; Gate Turn-Off Thyristor (GTO); Power MOSFET; UJT; Diac & IGBT.	8
2	**Rectifier Circuits:** Circuit nomenclature; Commutating diode; Single-phase half wave, 2-phase half wave, Single-phase bridge uncontrolled, fully control & half controlled rectifiers; 3-ph half wave, 6-ph half wave, 3-ph bridge & 12-ph rectifier circuits; Transformer rating; Rectification with R-L & R-C loads; Power factor improvement; Excitation angle control; Symmetrical angle control; Pulse Width Modulation (PWM) & Sinusoidal PWM.	8
3	**Inverter:** Principle of operation of inverter; voltage driven inverter; Current driven inverter; Forced-commutated inverter; Classification of circuits for forced commutation; Parallel inverter; Poly-phase inverter; Self commutated inverter; Bridge inverter; McMurray–Bedford commutation; Bridge circuit using McMurray–Bedford commutation; 3-ph bridge inverter; Current source inverter; PWM inverter; Voltage control of 3-ph inverter; Harmonics reduction; Inverter applications.	8
4	**Chopper:** Principle of operation of chopper; Constant frequency operation; Variable frequency operation; Classification - Class A, Class B, Class C, Class D & Class E operation; Series turn-off chopper; Parallel capacitor turn-off chopper; Morgan chopper; Jones chopper.	4
5	**Cycloconverter:** Mathematical analysis; Bridge configuration; Control circuits; Improved cycloconverter circuits; Harmonic analysis; Input characteristics; Circulating current mode; Control; Envelope cycloconverter.	4
6	**A.C. Voltage Controller:** Introduction; ON-OFF control; Phase angle control; Single phase bi-directional controller with resistive load.	8
	Power Supplies: D.C. power supply; Switching Mode Power Supply (SMPS) d.c. power supply; Resonant d.c. power supply; Bi-directional power supplies; A.C.	

power supplies; Uninterrupted Power Supply (UPS) configuration; SMPS a.c. power supplies; Power factor conditioning.

Text Books:

1. Power Electronics: Circuits, Devices and Applications 4th Ed 2013 - Muhammad H. Rashid, Pearson Education India
2. Power Electronics: Converters Applications and Design 3rd Ed 2007 - Ned Mohan, Tore M. Undeland and William P. Robbins , John Wiley & Sons
3. Power Electronics 3rd Ed 1993 - Cyril W. Lander, McGraw Hill
4. Modern Power Electronics 2nd Ed 2005 - P. C. Sen, S. Chand & Co.
5. Power Electronics – Sugandhi and Sugandhi
6. Thyristors - Theory and Applications 2nd Ed 2003 - R. K. Sugandhi and K. K. Sugandhi, John Wiley and Sons
7. Power Electronics 2012 – P. S. Bimbhra, Khanna Publishers
8. Power Electronics 2011 – Daniel W. Hart, McGraw Hill
9. Power Electronics 6th Ed 2010 – B. R. Guta and V. Singhal, S. K. Kataria & Sons
10. Thyristorized Power Controllers 2nd Ed 2012 - G. K. Dubey, S. R. Doradla, A. W. Joshi and R. M. K. Sinha , New Age International
11. An Introduction to Thyristors and Their Applications 2nd Ed 1991 - M. Ramamoorthy, Affiliated East-West Press

5th Semester BE (E)

Syllabus for Discrete Time Signal Processing (EE504)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction:** Introduction to Signals, Systems & Signal processing; Classification of Signals; Concept of frequency in continuous-time and discrete-time Signals; Analog to Digital and Digital to Analog converters from signal processing view point; Linear time-invariant systems.	6
2	**Theory of z-Transform and Applications:** Definitions & properties; Inverse z-transforms; Transfer functions; Unit sample response; Difference equations; Basic network structure for IIR & FIR systems.	6
3	**Theory of Discrete Fourier Transform (DFT):** Fourier transform of discrete-time signals; Fourier series representation of discrete-time signal; Sampling theorem; Discrete Fourier transform and its properties; Filtering of long data sequences.	6
4	**Fast Computational Methods of DFT:** Fast Fourier Transform (FFT); Decimation in time and decimation in frequency radix-2 FFT algorithms; In-place computations and bit-reversing rules; Parallel & pipeline processing of FFT radix-2 algorithms; Efficient computation of the DFT of two real sequences; Efficient computation of DFT of the DFT of a 2N-point real sequence.	8
5	**Theory of FIR filters and Design:** Properties of Finite Impulse Response (FIR) filters; Window method and Frequency sampling method of FIR filter design; Computer Aided Design of FIR filters.	8
6	**Theory of IIR filters and Design:** Properties of Infinite Impulse Response (IIR) filters; Impulse invariance method, Bilinear transform method and Matched z-transform method of IIR filter design.	6

Text Books:

1. Digital Signal Processing - Principles, Algorithms & Applications 4th Ed 2007 - John G. Manolakis and Dimitris K. Manolakis , Pearson
2. Digital Signal Processing 2014 - Tarun Kumar Rawat, Oxford University Press
3. Digital Signal Processing - Fundamentals and Applications 2008 - Li Tan, Elsevier Academic Press.
4. Discrete-Time Signal Processing 2nd Ed 1999 – Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, PHI

5. Schaum's Outlines Theory and Problems on Digital Signal Processing 2nd Ed 2011 - Monson H. Hayes, McGraw Hill
6. Digital Signal Processing - A computer based approach 4th Ed 2010 – Sanjit K. Mitra, McGraw Hill
7. Schaum's Outlines Signals and Systems 3rd Ed 2014 - H. P. Hsu, Tata McGraw Hill
8. Signals and Systems – 1st Ed 2016 – Sanjit K. Mitra, McGraw Hill

5th Semester BE (E)

Syllabus for Electrical Measurement - I (EE505)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1.	**Ammeter, Voltmeter and Ohmmeter:** Construction and working principle of PMMC & MI type instruments; Construction and working principle of Megger. Construction, operating principle & torque equation for Electrodynamometer, Electrostatic & Induction type instruments. Relative comparison among PMMC, MI, Electrodynamometer, Electrostatic & Induction type instruments.	6
2.	**Wattmeter & Energymeters**: Principle of measuring power by using Dynamometer and Induction type wattmeters; Errors and compensation; Low power factor polyphase wattmeters; Energymeter – difference between wattmeter & energymeter; Principle of construction of Induction type energymeter; Error compensation and adjustments in energymeter.	6
3.	**Special Type Meters** : Construction and working principle of Frequency meter, Synchroscope, Power factor meter, Flux meter, Maximum demand meter.	4
4.	**Instrument Transformers**: Uses of instrument transformers; Theory of CT & PT; Ratio & phase angle errors; Errors compensations; Testing of CT & PT.	6
5.	**Oscilloscope**: Block diagram representation; Cathode ray tube; Vertical and Horizontal deflection systems; Delay line; Multiple trace; CRO probe & transducers; Measurement of voltage, current, phase & frequency by CRO; Storage Oscilloscope.	8
6.	**Electronic Instruments**: (a) Electronic Voltmeters: Advantage & disadvantages of using electronic voltmeters; Different stages in AC & DC electronic voltmeters; Balanced bridge voltmeter; Principle and circuit diagrams for average responding,	6

	peak responding & RMS responding voltmeters. (b) Digital voltmeters: Classification of digital voltmeters; Principle, block diagram and signal wave form of ramp type, stair case ramp type and integrating type digital voltmeters. (c) Electronic Multimeter & Q-meter.	
7.	**Recorders**: Different types of recorders; Construction, working principle and circuit diagrams of Strip-chart & X-Y recorders.	4

Text Books:

1) A Course in Electrical and Electronic Measurements and Instrumentation 19th Ed 2011 - A. K. Sawhney and Puneet Sawhney, Dhanpat Rai & Sons.
2) A Course in Electrical and Electronic Measurements and Instrumentation 14th Ed 2014 – J. B. Gupta, S. K. Kataria & Sons.
3) Electrical Measurements and Measuring Instruments 2nd Ed 2013 – R. K. Rajput, S. Chand & Co.
4) Electronic Instrumentation and Measurements 3rd Ed 2013 – Davis A. Bell, Oxford University Press
5) Electronic Instrumentation, 3rd Ed 2010 - H. S. Kalsi, McGraw Hill
6) Electrical Measurement and Measuring Instruments 2011 - E.W. Golding and F.C Widdis, Reem Publications Pvt. Ltd.

5th Semester BE (E)

Syllabus for Power Electronics Lab (EE506)

L-0 T-0 P-2 C-1

Exp. No.	List of Experiments	No. of Lecture Hrs.
1		
2		
3		
4		
5.		

	5th Semester BE (E) Syllabus for Automatic Control System & DSP Laboratory (EE507) **L-0 T-0 P-2 C-1**	
Md No.	**Contents**	**No. of Lecture Hrs.**
	PART -I	
1	Determination of transfer function parameters of a DC servo motor	12
2	Determination of transfer function parameters of Ac servo motor	
3	Analog simulation of Type-0 and Type-1 system	
4	Digital simulation of linear systems.	
5	Design and implementation of compensators	
6	Stability analysis of linear systems	
7	Study of Synchros.	
	PART-II	

1. Fundamentals: Generation of signals, study of system properties; convolution and correlation; z-transform; DFT using FFT;
2. Linear convolution using circular convolution; aliasing due to sampling in time and frequency domains; Design of FIR and IIR filters;
3. Estimation of power spectral density using periodogram and Welch's method; Generation of discrete and continuous random variables, statistical analysis and validation, Monte-Carlo simulation.
4. Applications: Array Signal Processing, Communication Systems, Multirate Signal Processing, Image Processing, Speech Processing.

5th Semester BE (E)

Syllabus for C++ & Object Oriented Programming Laboratory (EE508)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.

C and C++ Experiments:

1. Write a program to implement the concept call by value & call by reference in C. 12
2. Write a program to display the mark sheet of N students using concept of array and structures in C.
3. Write a program to multiply two matrices using array of pointers.
4. To write a C++ program to find the sum for the given variables using function with default arguments.
5. To write a C++ program to find the value of a number raised to its power that demonstrates a function using call by value.
6. To write a c++ program and to implement the concept of Call by Address.
7. To write a program in C++ to prepare a student Record using class and object.
8. Write a program to design a class representing complex numbers and having the functionality of performing addition and multiplication of two complex numbers using operator overloading.
9. Write a program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition, multiplication and comparison of matrices.
10. To write a C++ program to implement the concept of Function Overloading.
11. To write a C++ program for implementing the inheritance concept.
12. To write a C++ program to implement the concept of Virtual functions.
13. To write a C++ program for sorting elements by bubble sort using function templates.
14. Write a C++ program to print the Fibonacci series.

15. Write a C++ program to find the number of vowels present in the given character array using pointer arithmetic.

16. Write a program to design a class to represent a matrix. The class should have the functionality to insert and retrieve the elements of the matrix.

17. Write a program to design a class representing the information regarding digital library. The class should have the functionality for adding new item, issuing, deposit etc)

18. Write a program showing data conversion between objects of different classes.

19. Write a program to copy the contents of one file to another.

20. Write a program to maintain a elementary database of employees using files.

**********END**********

SEMESTER VI

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS6-1	Introduction to Accountancy & Management	3	0	0	3	3
02	EE601	High Voltage Engineering	3	1	0	4	4
04	EE602	Power System III	3	1	0	4	4
05	EE603	Electrical Measurement II	3	0	0	3	3
06	EE604	Electrical System Design & Drawing (Electrical Workshop)	0	0	6	6	3
07	EE605	Power System Laboratory	0	0	2	2	1
08	EE606	Mini Project	0	0	4	4	2
03		Elective – I (Open)	3	0	0	3	3
	Total					**29**	**23**

List of Elective – I

1. EE607 Microprocessor and Microcontroller
2. EE608 Computer Organization
3. EE609 Advance Digital Signal Processing
4. EE610 Basic Thermal Science
5. EE611 Principles of Tele-communication Engineering
6. EE612 Solid Mechanics

6th Semester BE (E)

Syllabus for High Voltage Engineering (EE601)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Breakdown of gasses**: Basic processes in gas breakdown, generation of electron avalanche, Townsend mechanism, secondary processes, criterion for spark breakdown, Streamer mechanism, time lag for spark breakdown, breakdown in electro negative gasses.	4
2	**Breakdown in liquid dielectrics**: Liquid dielectric, origin, electrical conduction and breakdown phenomena of pure liquids, test cells, natural and induced conduction, Transformer oil; properties, purification.	4
3	**Breakdown in solid dielectrics**: Intrinsic and related forms of breakdown in solids, measurement of intrinsic strength- preparation of the specimen, surface discharge phenomenon, positive and negative Lichtenbury patterns, discharge detection, breakdown of solid insulation by Tracking, Lightening phenomena-nature and characteristic of lightening induced voltage, measuring instruments and devices, lightening protection.	6
4	**Generation of high voltage**: High voltage testing transformers, cascaded transformers, high frequency transformers, tesla coil, cascaded rectifier for d.c. high voltage, electrostatic generators, impulse generator; analysis of the basic circuit, multi-stage circuits, factors influencing design, general construction, triggering, synchronization of operation, delay cables.	8
5	**High voltage testing**: Low frequency direct current, high frequency and impulse tests, terminology; disruptive discharge, flashover and puncture, withstand voltage, 50% disruptive discharge voltage, impulse wave, full and chopped wave, impulse ratio, volt-time curve; testing of overhead insulators, bushings, cables, arrangement of the test object, various tests and test conditions.	8
6	**Measurement of high voltage**: Electrostatic voltmeters, potential dividers; resistive, capacitive and mixed resistive dividers, peak voltage measuring device, oscillographic measurements, Schering bridge, sphere and rod gaps.	4
7	**Insulation design principle**: Classification of insulating materials, material of dielectric in parallel, dielectric hysteresis, high voltage cables, thermal and electrical cables, requirements of cable design, materials used,	6

high voltage bushing types, basic applications, insulation of high voltage transformers.

High voltage laboratory: HV plants and apparatus, HV connections, laboratory earthing and safety measures.

Text Books:

1) High Voltage Technology 2006 - L. L. Alston, Oxford University Press
2) Electrical Breakdown of Gases 1978 - J.M. Meek and J.D. Craggs, John Wiley & Sons
3) High Voltage Engineering 5th Ed 2013 – M. S. Naidu and V Kamaraju, McGraw Hill
4) High Voltage Engineering 3rd Ed 2012 – C. L. Wadhwa, New Age International
5) High Voltage Engineering Fundamentals 2nd Ed 2008 – E. Kuffel, W. S. Zaengl and J. Kuffel, Elsevier
6) A Course in High Voltage Engg- R. S. Jha, Dhanpat Rai
7) An Introduction to High Voltage Experimental Technique 1978 – D. Kind, John Wiley & Sons

********** END**********

6th Semester BE (E)

Syllabus for Power System III (EE602)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**Earthing and Insulation Co-Ordination**: Neutral grounding - Effectively grounded system; Ungrounded system; Solid, resistance and reactance (Peterson coil) grounding; Arc suppression coil; Earthing transformers (Zig-zag transformer); Earth wires; Earthing of appliances; Insulation co-ordination - Determination of line insulation; Insulation levels of sub-station equipment; Co-ordination amongst items of substation equipment; Introduction to Indian Electricity rules and grounding practice; Grounding neutral breaker.	12
2	**Surge and Surge Protection Switching surges**: Lightning phenomenon; Traveling waves on transmission lines; Over voltage due to lightning; Protections against lightning; Lightning arresters; Lightning arrester selection; Surge absorbers.	6

3	**Circuit Breakers**: Functions of switch gears; Arc in oil; Arc interruption theories and processes; Current chopping; Oil Circuit Breaker (CB), Air CB; Air-blast CB; Vacuum CB; SF_6 CB; Restriking and Recovery voltage; Rating of CB; Testing of CB; Fuses: HRC fuses	6
4	**Protective Relays**: Requirement of relays; Universal torque equation; Non directional and directional over current relays; Earth fault relays; Distance relays - Impedance, Mho and Reactance relays; Differential relays; Negative sequence relays; Pilot relay - Carrier and Microwave pilot relays; Under frequency relays; Translay relays; Introduction to static relays - Microprocessor and computer based protective relaying; Apparatus and Line Protection - Alternator, transformer, Busbar and motor protection using relays; Feeder Protection – radial and ring main system.	12
5	**Substations**: Types of substations; Necessity, function and arrangement of substation equipments including reactors and bus tie breakers; Substation grounding.	4

Text Books:

1. Electrical Power Systems 6th Ed 2012 – C. L. Wadhwa, New Age International
2. Power System Protection and Switchgear 2nd Ed 2011 - Badri Ram and D. Vishwakarma, McGraw Hill
3. Power System Protection and Switchgear 2nd Ed 2011 – B. Ravindranath, and M. Chander, New Age International
4. Switchgear Protection and Power Systems 13th Ed 2008 - Sunil S. Rao, Khanna Publishers
5. Art and Science of Protective Relaying 1977 - C. Russell Mason, Wiley Eastern.
6. Computer Relaying for Power Systems 2nd Ed 2012 - Arun G. Phadke and James S. Thorp, Wiley India
7. Electrical Power System 15th Ed – S. L. Uppal and S. Rao, Khanna Publishers
8. A Text Book on Power System Engineering 2008 - A.Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and, Dhanpat Rai & Co. Pvt. Ltd.
9. Power System Analysis and Design 2005 – B. R. Gupta, S. Chand & Co.
10. Switching, Protection and Distribution in Low-Voltage Networks: Handbook with selection criteria and planning guidelines for switchgear, switchboards, and distribution systems 2nd Ed 1994 – Siemens, Wiley VCH.

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6th Semester BE (E)

Syllabus for Electrical Measurement - II (EE603)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1.	**Introduction**: D.C Potentiometer, Basic D.C Potentiometer CKT, Crompton's Potentiometer, Multirange Potentiometer, Standard Cell Dial, Volt-Ratio Box, Measurement of Voltage, Resistance and Power, Calibration of Voltmeter, Ammeter and Wattmeter, Self Balancing Potentiometer, A.C Potentiometer - Gall-Tinsley (Co-ordinate Type) A.C Potentiometer, Drysdale (Polar Type) Potentiometer, Standardization, Errors, Applications.	15
2.	**Measurement of Resistance**: Definition of Low, Medium and High Resistance, Measurement of Medium Resistance by Ammeter - Voltmeter Method, Substitution Method, Wheatstone Bridge Method, Measurement of Low Resistance by Kelvin Double Bridge Method, Difficulties of Measurement of High Resistances; Use of Guard Circuit; Loss of Charge Method; Measurement of Insulation Resistance with Power ON, Factors effecting Earth Resistance; Methods of Measuring Earth Resistance.	15
3.	**A.C Bridges**: General Form of A. C. Bridge; Maxwell's Inductance Bridge; Maxwell's Inductance/ Capacitance Bridge; Hay's Bridge; Anderson's Bridge; Owen's Bridge; High Voltage Schering Bridge, Heaviside Mutual Inductance Bridge; Campbell's Modification of Heaviside Bridge; Heaviside – Campbell Equal Ratio Bridge; Caey – Foster Bridge; Wien's Bridge; Sourcesof Errors in Bridge Circuits; Shielding of Bridge Elements; Wagner's Earthing Device.	15
4.	**Magnetic Measurements**: Magnetic Fluxmeter; Construction and Principle of Operation of Magnetic Potentiometer; Ewing Double Bar and Illiovici Permeameter Method of Measurement of Magnetic Field Intensity; Determination of B-H Curve and B-H Loop by the Method of Reversal and Step-by-Step Method; Measurement of Hysteresis Loss by Wattmeter, Bridge method and Potentiometer Method.	15
5.	**Transducers**: Classification and Selection of Transducers - Primary and Secondary Transducers; Construction, Principle of Operation and Applications of Diaphgrams, Bellows, Bourden Tubes, Springs, Capacitive, Piezoelectric and Photoelectric Transducers; Strain Gauges; Linear Variable Differential Transformer (LVDT).	20
6.	**High Voltage Measurements and Testing**: Types of High Voltage Tests; High Voltage Testing (Impulse) Transformers; Voltage Control by Variation of Alternator Field Current, Tapped Transformers; Induction Regulators; Control	20

Gear and Protective Devices; Equipments for Voltage Measurement, Measurement of R.M.S., Peak, and Instantaneous Values of Voltages; Low Frequency High Voltage Tests; High Voltage D.C. Tests; High Voltage D.C. Testing of Cables; Localization of Faults in H.V. Cables; High Frequency H.V. Testing; Surge Testing; Basic Impulse Generator; Testing of Insulating Material; Impulse Testing of Transformer; H.V. Testing of Cables; Testing of Strength of Insulating Oils; High Voltage Testing of Porcelain Insulators.

Text Books:

1. A Course in Electrical and Electronic Measurements and Instrumentation 19th Ed 2011 - A. K. Sawhney and Puneet Sawhney, Dhanpat Rai & Sons.
2. A Course in Electrical and Electronic Measurements and Instrumentation 14th Ed 2014 – J. B. Gupta, S. K. Kataria & Sons.
3. Electrical Measurements and Measuring Instruments 2nd Ed 2013 – R. K. Rajput, S. Chand & Co.
4. Electronic Instrumentation and Measurements 3rd Ed 2013 – Davis A. Bell, Oxford University Press
5. Electronic Instrumentation, 3rd Ed 2010 - H. S. Kalsi, McGraw Hill
6. Electrical Measurement and Measuring Instruments 2011 - E.W. Golding and F.C Widdis, Reem Publications Pvt. Ltd.

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6th Semester BE (E)

Syllabus for Electrical System Design & Drawing (Electrical Workshop) (EE604)

L-0 T-0 P-6 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Fundamentals of Electrical Machine Design**: Standard specification of frame size, conductors and insulation; Magnetization and loss curve; Choice of specific loading; Heating and cooling of electrical machines.	4
2	**Design of D.C. Machines**: Construction details; Output equation; Main dimension; Choice of specific loadings; Choice of number of poles; Armature design; Design of field poles and field coils; Design of commutator and brushes.	4
3	**Design of Transformers**: Construction details of core and shell type transformers; Output rating of single phase and three phase transformers; Optimum design of transformers; Design of yoke, core and winding for core and shell type transformers; Equivalent circuit parameter from designed data; Design of tank and cooling tubes of transformers.	6
4	**Design of A.C. Machines**: Construction details of A.C. machines; Output equation; Main dimensions; Choice of specific loadings; Design of stator; Design of squirrel cage and slip ring rotor; Equivalent circuit parameter from designed data; Short circuit ratio; Design of rotor of cylindrical pole and salient pole machines.	6
5	**Computer Aided Design**: Need for computer aided design; Analysis method; Synthesis method; Basics of Finite element, Shape functions, Single element computation. Assembly of elemental coefficient matrix, Global coefficient matrix, Application of FEM technique for design problems. Use of open source FEM software for 2D design. Computation of Capacitance of capacitor, cable, multi dielectric cable through FEM, Computation of electrostatic field for various geometry, skin and proximity effect in conductors. Flowcharts and programs for computer aided design of Starters, field regulators, small transformers, choke coils. 2D FEM open source software based electrical apparatus design. Flowcharts and programs for computer aided design of DC machines and Transformers. 2D FEM open source software based DC machine and Transformer part design.	14

6	Domestic wiring, Types of cables (names only); Types of wiring; Circuit layouts: single-phase A.C mains to DB; 3-phase connections; Accessories – Main switch, Ceiling rose, Fuse, MCB, DB; Megger; Testing of wiring installation; Earthing; Lamps: Fluorescent tube and its connection and operation; Indian Electricity Rules regarding electrical installation.	6

Text Books:

1. A Course in Electrical Machine Design 5th Ed 2014 – A. K. Sawhney and Chakrabarti, Dhanpat Rai & Co.
2. Computer Aided Design of Electrical Machines 2014 - V.K. Maurya, Ritu Raj Jallan and Shasya Shukla, S. K. Kataria & Sons
3. Computer aided design of electrical machines 2008 - K M Vishnu Murthy, B S Publications
4. An Introduction to the Finite Element Method 3rd Ed 2005 - J. Reddy, TMH Publication
5. Guidelines for Electrical Works in Residential Building 2008 – Suruhanjaya Tenaga, www.st.gov.my
6. Principles of Electrical Machine Design 2012 - R.K. Agarwal, S. K. Kataria & Sons
7. Design of Rotating Machines 2008 - Juha Pyrhonen, Tapani Jokinen and Valeria Hrabovcova, Wiley –Blackwell
8. Electrical Machine Design Data Book 2nd Ed 2015 - A. Shanmugasundaram, New Age International
9. Design of Electrical Machines 2009 – V. N. Mittle and Arvind Mittal, Standard Publishers Distributors
10. Electrical Machine Design 2014 - Seraj Ahamad, Vayu Education of India

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LABORATORY

6th Semester BE (E)

Syllabus for Power System Laboratory (EE605)

L-0 T-0 P-2 C-1

Md No.	Contents	No. of Lecture Hrs.
1	Power flow analysis by Newton-Raphson method and Fast decoupled method	12
2	Transient stability analysis of single machine-infinite bus system using classical machine model	
3	Contingency analysis: Generator shift factors and line outage distribution factors	
4	Economic dispatch using lambda-iteration method	
5	Unit commitment: Priority-list schemes and dynamic programming	
6	Analysis of switching surge using EMTP: Energisation of a long distributed-parameter line	
7	Analysis of switching surge using EMTP: Computation of transient recovery voltage	
8	Familiarization of Relay Test Kit	
9	Simulation and Implementation of Voltage Source Inverter	
10	Digital Over Current Relay Setting and Relay Coordination.	
11	Co-ordination of over-current and distance relays for radial line protection	

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ELECTIVE--I

6^{th} Semester BE (E)

Syllabus for Advance Microprocessor and Microcontroller (EE607)

L-3 T-0 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**INTEL 8086 Microprocessor**: Architecture of Intel 8086 Microprocessor; Register structure; Memory addressing; Addressing modes; Instruction sets; Timing methods; CPU pins and associated signals/functions; Instruction timing and execution; T-state and Machine cycle; Timing diagrams; Programmed I/O; Interrupt systems; DMA operations.	6
2	**INTEL 8086 Programming**: Assembly Language Program (ALP); Debugging of Program; Programming techniques – looping, counting and indexing, counters and time delays, stack and subroutines; Code conversion – BCD arithmetic and 16/32-bit data operations.	6
3	**Peripheral Interfacing:** General purpose programmable peripheral devices; 8155 & 8255 programmable peripheral interfaces; 8254 programmable interval timer; 8259 programmable interrupt controller; 8257 DMA controller; 8279 programmable key-board/ display controller; Key debounce; 8-bit Input/Output port 8212; Parallel versus Serial transmission; Synchronous and Asynchronous Serial data transmission; Universal Synchronous/Asynchronous Receivers/ Transmitters (USART) & Universal Asynchronous Receivers/Transmitters (UART); 8251 Programmable communication interface; ADC & DAC interfacing; Interfacing standard; IEEE 488 parallel interface bus; RS-232C Serial interface; ISA & PCI Bus; 80X87 Arithmetic Processor.	12
4	**Advanced Microprocessors:** Brief discussion & comparison of INTEL 8088, 80186, 80188, 80286, 80386, 80486 & Pentium processors.	8
5	**8031/8051 Microcontroller**: Architecture and Programming of 8031/8051 Microcontroller.	8
	Microprocessor and Microcontroller Based Applications: Digital clock; Traffic light controller; Hex key-board interface; Seven segment display interface; Stepper motor control; Washing machine controller; Microprocessor based protective relays; Measurement of electrical quantities; Measurement & control of non-electrical quantities.	

Text Books:

1. Microprocessor Theory and Applications - M. Raffiqzzaman, McGraw-Hill
2. 8085 Microprocessor Architecture, Programming & Applications – R. S. Gaonkar
3. Fundamentals of Microprocessors and Microcomputers – B. Ram
4. Intel Microproc 8086 8088 80X86 80188 n Pentium - Architechture Programming and Interfacing 4thEd – B. B. Brey, PHI, 1997.

6th Semester BE (E)

Syllabus for Computer Organization (EE608)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Computer Evolution & Arithmetic (8 Hours)**: A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection, Scalar Data Types, Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm, Hardware Implementation, Division, Restoring and Non Restoring algorithms, Floating point representations, IEEE standards, Floating point arithmetic	8
2	**The Central Processing Unit (8 Hours)**: Machine Instruction characteristics, types of operands, types of operations, Addressing modes, Instruction formats, Instruction types, Processor organization, Intel 8086 as example, Programmers model of 8086, max/min mode, Register Organization, Instruction cycles, Read Write cycles, 8086 assembly instruction examples to explain addressing modes	6
3	**The Control Unit (6 Hours)**: Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer. Hardwired Control: Design methods – State table and classical method, Design Examples - Multiplier CU. Micro-programmed Control: Basic concepts, Microinstructions and microprogram sequencing	6
4	**Memory Organization (6 Hours)**: Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM High-	8

	Speed Memories: Cache Memory, Organization and Mapping Techniques, Replacement Algorithms, Cache Coherence, MESI protocol. Virtual Memory: Main Memory allocation, Segmentation, Paging, Address Translation Virtual to Physical. Secondary Storage: Magnetic Disk, Tape, DAT, RAID, Optical memory, CDROM, DVD	
5	**I/O Organization (6 Hours)**: Input/Output Systems, Programmed I/O, Interrupt Driven I/O,8086 Interrupt structure, Direct Memory Access (DMA), 8237 features Buses and standard Interfaces: Synchronous, Asynchronous, Parallel I/O 8255 features, Serial I/O 8251 features, PCI, SCSI, USB Ports Working mechanisms of Peripherals: Keyboard, Mouse, Scanners, Video Displays, Touch Screen panel, Dot Matrix, Desk-jet and Laser Printers.(features and principles)	6
6	**Parallel Organization (8 Hours)**: Instruction level pipelining and Superscalar Processors, Multiple Processor Organizations, Closely and Loosely coupled multiprocessors systems, Symmetric Multiprocessors, Clusters, UMA NUMA, Vector Computations, RISC: Instruction execution characteristics,, RISC architecture and pipelining. RISC Vs CISC	6

Text Books:

1. Computer Organization and Architecture: Designing for performance, 6thEd - W. Stallings, Prentice Hall of India, 2003.
2. Computer Organization, 5thEd - C. Hamacher, V. Zvonko, S. Zaky, McGraw-Hill, 2002.
3. Computer Architecture and Organization, 2ndEd - J. Hays, McGraw-Hill, 1988.
4. Computer Organization and Architecture: Principles of Structure and Function, 2ndEd - W. Stallings, Maxwell Macmillan Editions, 1990.
5. Structured Computer Organization, 4thEd - A. Tanenbaum, Prentice Hall of India, 1991.
6. Computer Organization: Hardware and Software, 2ndEd - G. George, Prentice Hall of India, 1986.
7. Computer Organization and Design: The Hardware Software Interface, 2ndEd - D. Paterson, J. Hennesy, Morgan Kauffman, 2000.

6th Semester BE (E)

Syllabus for Advance Discrete Time Signal Processing (EE609)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Review of Signals and Systems**: Introduction, Continuous time and discrete time signals, Transformations of independent variable, Exponential and Sinusoidal Signals, Unit impulse and unit step functions, basic properties. LTI Systems: Introduction, Convolution sum, Convolution integral, Properties of LTI systems.	8
2	**Multirate Signal Processing & Filter Banks**: Introduction, Decimation, Interpolation, Fractional rate conversion, Multistage Filter implementation. Interpolated FIR filter (IFIR), IFIR technique for decimation filter and interpolation filter. Analysis and Synthesis banks. Poly phase structures – Polyphase structure for decimation and interpolation filters.	8
3	**Applications of Multirate Signal Processing**: Filter banks, digital audio, analog voice privacy system, trans multiplexers, Multirate adaptive filters, Sub band coding – spectral analysis, amplitude and phase analysis, simple and M channel QMF	8
4	**Adaptive Filtering**: Principles of adaptive filtering, LMS and RMS algorithms. Applications in noise and echo cancellation.	6
5	**Homographic Signal Processing**: Homograph systems for convolution, properties of complex spectrum, application of homographic deconvolution.	4
6	**Time Frequency Analysis**: Need for time frequency analysis, Time frequency distributions, short time Fourier transform, Wigner distribution, Introduction to wavelet transformation.	6

Text Books:

1. Digital Signal Processing - Principles, Algorithms & Applications 4th Ed 2007 - John G. Manolakis and Dimitris K. Manolakis , Pearson
2. Digital Signal Processing 2014 - Tarun Kumar Rawat, Oxford University Press
3. Multirate Systems and Filter Banks 1st Ed 1992 – P. P. Vaidyanathan, Prentice Hall
4. Digital Signal Processing: A Practical Approach 2nd Ed 2004 - Emmanuel Ifeachor and Barrie Jervis, Prentice Hall.

5. Discrete-Time Signal Processing 2nd Ed 1999 – Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, PHI
6. Adaptive Signal Processing 1985 - Bernard Widrow and Peter N. Stearns, Pearson
7. Adaptive Filter Theory 5th Ed 2013 - Simon Haykin, Pearson
8. Wavelets and Filter Banks 2nd Ed 1996 - G Strang and T Nguyen, Wellesley-Cambridge Press
9. Time Frequency analysis: Theory and Applications 1994 - Leon Cohen, Prentice Hall
10. Optimum Signal Processing: An Introduction 2nd Ed 1988 - Sophocles J Orfanidis, Collier Macmillan

6th Semester BE (E) Syllabus for Basic Thermal Science (EE610) **L-3 T-0 P-0 C-3**		
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**System and Continuum:** Intensive and Extensive properties – Thermodynamic state, pressure, energy, work and heat – process and cycle – Macroscopic and Microscopic points of view – Kinetic theory of gases.	4
2	**Laws of thermodynamics:** Zeroth law – Concept of equilibrium – Principles of thermometry – Fixed points. First law of thermodynamics and its application to open and closed systems – Concept of internal energy – Steady flow energy equation – Processes of closed systems. Second law of thermodynamics – Various statements – Carnot cycle – Irreversible and Irreversible processes – Thermodynamic efficiency and temperature scales – Concept of entropy – Entropy changes in various processes.	12
3	**Properties of steam:** Latent heat – Saturation pressure and temperature – Dryness fraction – Degree of superheat – Total heat; Rankine cycles.	6
4	**Air standard cycles:** Otto, Diesel – Principles of working and description of two and four stroke SI and CI engines – Representations of processes on T-S and p-v diagrams.	6
5	**Fuels and Combustions:** Classification of fuels; HCV, LCV, Bomb Calorimeter, Boy's gas calorimeter; Combustion of fuels; Minimum air required (by weight and by volume); Conversion of volumetric analysis into weight analysis and vice versa; excess air and Orsat apparatus.	12

Text Books:

1. Engineering Thermodynamics: P.K. Nag
2. Thermodynamics, an Engineering Approach : Yunus Cengel and Michale Boles
3. Thermodynamics: YVC Rao

6th Semester BE (E) Syllabus for Principles of Tele-communication Engineering (EE611) **L-3 T-1 P-0 C-4**		
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Introduction**: An over view of communication process-electronic communication; Typical communication channels, Distortion less transmission, Signal transmission through BPF - pre envelope and complex envelope. **Electromagnetic wave propagation**: Electromagnetic radiation, Propagation modes of EM waves-ground wave, Sky wave, Space wave, Tropospheric scatter, Extra terrestrial communication, Dipole antenna, Resonant antenna, Non resonant antenna, Marconi and Hertz antenna, Antenna coupling at medium frequencies, Directional high frequency antenna, Microwave antenna, Wide band antenna.	10
2	**Random signals and noise**: Review of probability theory, Random variables, Probability distribution functions & probability density function, Joint probability density function, Gaussian distribution, Raleigh's distribution and exponential distribution, Error function, Random processes, Average and variance of random processes, Source of noise, Noise as a random process, White noise, Noise transmission through LTI system, SNR, Noise temperature, Available power of a noise source, Calculation of rms noise voltage, Noise equivalent resistance of an amplifier, Noise figure.	6
3	**Carrier Wave modulation and detection**: Need for modulation, Amplitude modulation (AM), AM modulators-low level and high level modulation techniques, AM detectors, Superheterodyne reciever principles, ICIC receiver for AM, Frequency modulation (FM) – Narrow Band (NB) FM & Wide Band (WB) FM, FM modulators, FM detectors, Noise in FM systems, Phase modulation, Suppressed Carrier (SC) modulation – Double Side Band (DSB)-SC & Single Side Band (SSB)-SC, Generation and detection of SC modulation system, Phase and frequency error in SC modulation system, Frequency Division Multiplexing (FDM).	6

4	**Pulse modulation**: Nyquist sampling theorem, Pulse modulation systems – Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Phase Modulation (PPM), Aliasing, Natural sampling and flat top sampling, Quantization, Quantization error, Pulse Code Modulation (PCM), Companding, Time Division Multiplexing (TDM), Cross top, Differential PCM, Delta modulation (DM), Adaptive DM.	6
5	**Digital Data Transmission:** Coherent and Non-coherent Techniques, Base band data transmission & reception, Binary matched filter, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Phase Shift Keying (QPSK), Differential Phase Shift Keying (DPSK), Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK), Error probability, Gaussian Minimum Shift Keying (GMSK), M-ary Communication, Timing & synchronization.	6
6	**Information Theory and Coding:** Information content of a signal, Information rate, Shannon's Capacity theorem, Channel capacity, Shannon Limit, Coding: Entropy coding, Error detection & correction codes, Parity check codes, Block codes, Algebraic codes, Convolutional codes.	6

Text Books:

(1) Communication Systems (Analog and Digital) 6th Ed 2012 – Dr Sanjay Sharma, S. K. Kataria & Sons.
(2) Communication Systems 4thEd 2001 - Simon Haykin, John Wiley & Sons
(3) Communication Systems 5thEd 2009 - Simon Haykin, John Wiley & Sons
(4) Modern Digital and Analog Communication Systems 4th Ed 2009 - B P Lathi and Zhi Ding, Oxford University Press
(5) Communication Systems 1968 - B. P. Lathi, John Wiley & Sons
(6) Principles of Communication Systems 4th Ed 2013 - Herbut Taub, Donald L. Schilling, Goutam Saha, McGraw Hill.
(7) Electronic Communication Systems 4th Ed 1992 - George Kennedy and Bernard Davis, McGraw Hill
(8) Analog and Digital Communication Systems 5th Ed 2003 - Martin S. Roden, Discovery Press.
(9) Digital Transmission Engineering 2ndEd 2005 - John B Anderson, John Wiley and Sons

SEMESTER VII

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	EE701	Power System Interconnection and Control	3	0	0	3	3
02	EE702	Computer Methods of Power System Analysis	3	0	0	3	3
03	EE703	Seminar Presentations	0	0	2	2	1
04	EE704	Project I	0	0	12	12	6
05		Elective – II	3	0	0	3	3
06		Elective – III	3	0	0	3	3
07		Elective - IV (Open)	3	0	0	3	3
	Total					**29**	**22**
08	AC701	Industrial Training	0	0	0	0	0

List of Elective – II, III

1. EE705 Utilization of Electric Power and Machine Drives
2. EE706 Flexible AC Transmission Systems
3. EE707 Advance Control System
4. EE708 VLSI Circuits Design
5. EE709 Speech Processing
6. EE710 Advances in Tele-communication Engineering
7. EE711 Embedded Systems
8. EE712 Computer Architecture
9. EE713 Biomedical Instrumentation

Elective—IV (Open)

1. EE714 Digital Image Processing
2. EE715 Prime Movers
3. EE716 Illumination Engineering
4. EE717 Optimisation Techniques
5. EE718 Operating System Design
6. EE719 Ultrasonic & High Frequency Instrumentation
7. EE720 MEMS & NEMS Data Communication & Networks
8. EE721 Opto-electronics

7th Semester BE (E)

Syllabus for : Power System Interconnection and Control (EE701)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**Economic Dispatch of Thermal Units and Methods of Solution**: Economic dispatch problem and system constrains, Lamda iteration method, first order gradient method, second order gradient method, base point and participation factors, transmission loss co-ordination, penalty factors ,B-matrix loss formula and its derivation, calculation of B coefficients by approximate method, exact transmission loss formula, reference bus and load centre penalty factor, relation between loss matrix penalty factor and reference bus penalty factors, optimal unit commitment by dynamic programming, reliability considerations, Patton's security function, security constrained, optimal unit commitment, start-up considerations, optimal load flow solution by Dommel and Tinney's method.	14
2	**Hydro Thermal Co-ordination**: Long range and short range Hydro scheduling, hydro Electric plant models, scheduling energy, short term hydro thermal scheduling problem, Lamda-Gamma iteration method, short term hydro thermal scheduling problem by a gradient approach, hydro units in series i.e. hydraulically coupled units, pumped storage hydro plants, scheduling of pumped storage hydro thermal plants by Lamda-Gamma iteration method and by a gradient method, Dynamic programming solution to multiple hydro plant problem.	14
3	**System Interconnection and Control**: Types of inter connection, advantages of interconnection, philosophy of real and reactive power	12

	control, control area concept, single area load frequency control system, integral or supplementary control, two areas connected by a tie line and load frequency control, power frequency control of the tie line, types of automatic load frequency control for inter connected power systems, load frequency and economic load dispatch control, automatic voltage regulators, automatic excitation control

Text Books:

1. Power System Operation & Control – Murthy (TMH)
2. Power System Analysis & Stability – S.S Vadhera
3. Modern Power System Analysis – Nagrath & Kothari (TMH)
4. Power System Operation & Control – J. Wood and wollenberg (TMH)

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7th Semester BE (E)

Syllabus for Computer Methods of Power System Analysis (EE702)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**Graph of a Network and Incidence Matrices**: Graph of a network and its parts; Oriented graph; Tree; Co-tree; Loops; Tie-set; Cut-set matrix; Incidence matrices; Network equilibrium equations.	4
2	**Formation of Impedance/Admittance matrices for Single-phase Network**: Formation of the Bus Admittance matrix (Y-BUS), Bus Impedance matrix (Z-BUS), Loop Impedance matrix (Z-LOOP), Loop Admittance matrix (Y-LOOP), Branch Admittance matrix (Z-BR) and Branch Impedance matrix (Y-BR) by graph theory approach; Algorithm for the formation of Z-BUS and its modification; Formation of Y-BUS by inspection; algorithmic approach, Network reduction by matrix algebra (i.e. Node elimination- Krone reduction). Representation of transformer: Fixed tapped transformer, Tap-changing under load transformer and Phase shifting transformer; Tie line control. Y Bus with tap changing Transformer.	6
3	**Three Phase Power System Elements**: Definition and matrix representation of rotating and stationary elements; Symmetrical components, Clark's components and Park's components transformation matrices and their applications.	6

4	**Short Circuit Studies using Z-BUS**: Short circuit studies for balanced three phase networks for all types of shunt faults (LG, LL, LLG, LLL and LLLG).	4
5	**Load Flow Studies**: Power system equations; Solution techniques; Gauss-Siedel iterative method; Newton-Raphson (Polar and Rectangular co-ordinates) method; Acceleration of convergence; Comparison of methods; Voltage control; Representation of transformer: Fixed tapped transformer, Tap-changing under load transformer and Phase shifting transformer; Tie line control.	12
6	**Transient Stability Studies**: Machine dynamics, Swing equation; Critical clearing angle, Small signal disturbances, Stability analysis for SMIB using swing equation, equal area criteria, Machine equation for synchronous and induction machines; Solution techniques of Swing equation (Modified Euler and Runge-Kutta method and their comparison); Effect of Exciter and Governor on transient stability.	8

Text books:

1. Power System Analysis 1st Ed 2003 - John Grainger, William Stevenson Jr., TMH
2. Computer Methods in Power System Analysis 1968 - G. W. Stagg and El-Abiad, McGraw Hill.
3. Operation in Control in Power System 2008 – P.S. R. Murty, B.S. Publications
4. Modern Power System Analysis 4th Ed 2011 – I. J. Nagrath and D. P. Kothari, Tata McGraw Hill.
5. Power Generation Operation and Control, 2ndEd 1996 - Allen J Wood and Bruce F Wollenberg, John Wiley & Sons
6. Advanced Power System Analysis & Dynamics - L. P. Singh, Willey Eastern
7. Economic Operation of Power Systems 1st Ed 1958 – Leon K. Kirchmeyer, John Wiley & Sons
8. Power System Operation in Control 1984 – P.S. R. Murty, Tata McGraw Hill
9. Power System Analysis & Stability 2009 - S. S. Vadhera, Khanna Publishers
10. Power System Dynamics Stability and Control 2nd Ed 2003 – K. R. Padiyar, B.S. Publications
11. Power System Stability and Control 1st Ed 2006 – Prabha Kundur, McGraw Hill
12. Power System Stability Vol I, II, III 2007 – Edward Wilson Kimbark, Wiley
13. Power System Control and Stability 2nd Ed 2008 - P.Manderson and A.A. Fouad, Wiley India Pvt. Ltd.
14. Power System Analysis and Design 2005 – B. R. Gupta, S. Chand & Co.
15. Power System Stability: Analysis by the Direct Method of Lyapunov 1981 - M. A. Pai, Elsevier Science Ltd
16. Power Quality: VAR Compensation in Power Systems 2008 - R. Sastry Vedam and Mulukutla S. Sarma, CRC Press
17. An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems 2010 – A. Chakrabarty, PHI
18. Thyristor-Based FACTS Controllers for Electrical Transmission Systems 2011 - Rajiv K. Varma R. Mohan Mathur, Wiley

7th Semester BE (E)

Syllabus for **Elective II & III& IV**

: VLSI Circuits Design (EE705)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Review of Design of Digital Systems (8 lectures)**: MUX based digital design (1); Design using ROM, Programmable Logic Arrays (PLA) and Programmable Array Logic (PAL) (2); Sequential circuits and timing: Setup and hold times (1); Sequential circuit design: Design of Moore and Mealy circuits (2); Design of a pattern sequence detector using MUX, ROM and PAL (1); Design of a vending machine controller using PAL (1).	8
2	**Introduction to Verilog coding (6 lectures)**: Introduction to Verilog (1); Realization of Combinational and sequential circuits (2); RTL coding guidelines (1); Coding organization and writing a test bench (2).	8
	Simulation, Synthesis, Place and Route, and Back Annotation (12 lectures): Design flow (1); Simulation using Modelsim (4); Synthesis using Synplify (4); Place and Route, and Back Annotation using Xilinx (3).	
3	**Design using Algorithmic State Machine Charts (7 lectures)**: Derivation of ASM charts (1); Design examples such as dice game, etc. using ASM charts (3); Implementation of ASM charts using microprogramming (2); and Verilog design of bus arbitrator (1).	8
	Design of memories (3 lectures): Verilog realization of Read Only Memory (ROM) (1); Verilog realization of Random Access Memory (RAM); and Verilog coding of controller for accessing external memory (2).	
4	**Design of Arithmetic functions (5 lectures):** Pipelining concept, Verilog design of a pipelined adder/subtractor (1); Design of Multipliers (3); and Verilog design of a pipelined multiplier (1).	4
5	**Design for testability (3 lectures)**: Testing combinational and sequential logic (1); Boundary scan testing, and Built-in self test (2).	12
	Design Applications (4 lectures): Design of a traffic light controller using Verilog (1); and Design of discrete cosine transform and quantization processor for video compression using Verilog (3).	

Hardware implementation using FPGA board (2 lectures): Features of FPGA board and demonstration of traffic light controller design (1); and Universal, asynchronous, receiver-transmitter design using FPGA board (1).

Text Books:

1. Algorithms for VLSI physical design automation - Naveed Sherwani, Kluwer academic publisher, 1993.
2. Principles of CMOS VLSI Design: A Systems Perspective, 2ndEd - Neil E. Weste and Kamran Eshraghian, Addison-Wesley, 1994.
3. Application-Specific Integrated Circuits: An Introduction to VHDL & Verilog HDL - Michael John Sebastian Smith, Addison-Wesley, 2001.
4. Analog Integrated Circuit Design - D. A. Johns and K. W. Martin, John Wiley & Sons, 1997.
5. Design of Analog CMOS Integrated Circuits - B. Razavi, McGraw-Hill, New York, 2001.
6. Analysis and Design of Analog Integrated Circuits, 4thEd - Paul Gray, Robert Meyer and Paul Hurst and S. Lewis, John Wiley & Sons, 2003.
7. CMOS Circuit Design, Layout, and Simulation - R. J. Baker, H. W. Li and D. E. Boyce, IEEE Press, 1998.
8. Low-Voltage Low-Power Integrated Circuits - E. Sanchez-Sinencio and A. Andreou (Editors), IEEE Press, 1999.

Reference: NPTEL Lectures

7th Semester BE (E)

Syllabus for **Elective II,III &IV**: Speech Processing (EE706)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: Spoken Language System Architecture and Structure; Sound and Human Speech System; Phonetics and Phonology; Syllables and Words; Syntax and Semantics; Probability Theory; Estimation Theory; Significance Testing.	6
2	**Speech Representation and Coding**: Short Time Fourier Analysis; Filter bank analysis, Spectrographic analysis, Cepstral Analysis; Pitch and Formant frequencies; Formant extraction, Pitch extraction, Analysis - Synthesis systems; Acoustic Model of Speech Production; Linear Predictive Coding; Perceptually Motivated Representations; Scalar Waveform Coders; Scalar Frequency Domain Coders; Vector Quantization (VQ); Code excited linear Prediction; Low-bit rate Speech coders.	12
3	**Speech Recognition**: Hidden Markov Models (HMM); Practical Issues in Using HMMs; HMM Limitations Acoustic Modeling; Phonetic Modeling; Language Modeling; Dynamic Time Warping (DTW); Signal Enhancement for Mismatched Conditions.	6
4	**Speaker Recognition and Verification**: End-point detection; Silence detection and removal; Pre-emphasis; Framing; Windowing; Extraction of speech features: Linear Predictive Cepstral Coefficients (LPCCs) and Mel-Frequency Cepstral Coefficients (MFCCs); Speaker Recognition/Verification Algorithms using HMM, Gaussian Mixer Model (GMM) and UBM-GMM; Close-set, Open-set, Text-dependent and Text-independent; Equal Error Rate (EER); Normalization methods; Language and Dialect recognition.	12
5	**Speech Synthesis**: Formant Speech Synthesis; Concatenative Speech Synthesis; Prosodic Modification of Speech; Source Filter Models For Prosody Modification; Evaluation of Text-To-Speech (TTS) System.	4

Text Books:

1. Discrete-Time Speech Signal Processing 2002 - Thomas F. Quatieri, Pearson Education

2. Spoken Language Processing 2001 - Xuedong Huang, Alex Acero, Hsiad, Wuen Hon, Prentice Hall
3. Speech and Audio Signal Processing 2000 - B.Gold and N.Morgan, John Wiley & Sons
4. Computer Speech 1999 – Recognition, Compression, Synthesis - M.R.Schroeder, Springer Series in Information Sciences
5. A Brief Introduction to Speech Analysis and Recognition, An Internet Tutorial - http://www.mor.itesm.mx/~omayora/Tutorial/tutorial.html
6. Speech and Language Processing 2000 - Daniel Jurafsky & James H.Martin, Pearson

7th Semester BE (E)

Syllabus for **Elective II,III &IV**: Digital Image Processing (EE707)

L-3 T-0 P-0 C-3

Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Introduction**: Digital image representation, fundamental steps in image processing, elements of image processing systems, geometry of image formation, image acquisition, color image sensing, stereo imaging, range sensing, tesselation, sampling and quantization.	6
	Image transforms: Fourier, Walsh, Hadamard, Discrete Cosine, Hotelling, Discrete Wavelet Transforms and their properties.	
2	**Image enhancement and restoration**: Spatial and frequency domain enhancement Techniques (Histogram based techniques, smoothing, filtering, sharpening, Homomorphic filtering), Unconstrained and Constrained Restoration, Inverse filtering, Wiener filter.	4
3	**Image compression**: Coding, Interpixel and Psychovisual Redundancy; Image compression models; Error free compression – Huffman, Arithmetic and LZW, Bit-Plane coding (Constant Area coding, 1-D & 2-D Run length coding), Lossless predictive coding; Lossy compression – Lossy predictive coding (Delta modulation, Optimal predictors – Differential Pulse Code Modulation), Transform coding – (Discrete Fourier Transform, Walsh-Hadamard Transform, Discrete Cosine Transform, and Discrete Wavelet Transform methods), Sub-image size selection, Bit Allocation, Zonal & Threshold coding, Image compression standards – CCITT Group 3 & 4 Binary Image 1-D & 2-D	12

Compression standards, JPEG using DCT & DWT Continuous Tone Still Image Compression standard, Basics of MPEG Video Compression standard.

4	**Digital geometry and its application in image processing**: Neighbourhood, connectedness, path, holes and surroundness, Borders, distances, Medial axis transformation, shrinking and expanding, thinning, Morphological operations- Erosion, Dilation, Opening, Closing, Parallel implementation, Smoothing, Component labelling, Thinning.	6
5	**Image segmentation**: Edge detection – Roberts, Prewitt, Sobel & Laplacian Operators, Edge linking and Boundary Detection – Local Processing, Global Processing via the Hough Transform to detect straight lines and parameterised curves, Global Processing via Graph-Theoretic Techniques; Pixel Classification via Grey Level Thresholding – Optimal Global and Adaptive Thresholding, Multispectral Thresholding; Region based segmentation - Region growing, Region splitting & merging; Segmentation by Morphological Watersheds; Use of motion in segmentation; Frequency domain techniques.	6
6	**Representation and Description**: Representation: Chain codes, Polygonal Approximations, Signatures, Boundary Segments, Skeletons; Boundary Descriptors – length, diameter, major axis, minor axis, basic rectangle, eccentricity, curvature, shape numbers; Fourier Descriptors; Statistical Moments; Regional Descriptors – area, perimeter, compactness; Topological Descriptors- number of holes, connected component, Euler number, Euler formula; Texture – statistical, structural and spectral description; Moments of Two dimensional functions; Use of Principal Components for Description; Relational Descriptors.	6

Text Books:

1) Digital Image Processing - R C Gonzales and R E Woods, PHI.
2) Fundamental of Digital Image Processing - Anil K Jain, PHI.
3) Computer Vision - D H Ballard and C M Brown, PHI.

7th Semester BE (E) Syllabus for **Elective II,III &IV**: Advance Tele-communication Engineering (EE708) **L-3 T-0 P-0 C-3**		
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Telephone System**: Telephone exchange, automatic strowger dialing; Hierarchy of switching offices; Cross bar switch; Switching matrices; Multiple Stage switching; Time Division Multiplexing (TDM) in telephone; Time slot interchanging; Space array for digital signals; Combined space & time switching; Mobile phone; Cellular phone; Pager; Global positioning satellites; Fax; Videotext.	10
2	**Computer Communication Systems**: Design features of computer communication networks; Local Area Network (LAN); Packet Radio & Satellite; ALOHA; Time Division Multiple Access (TDMA); Frequency Division Multiple Access (FDMA); Collision Sensing Multiple Access (CSMA), Code Division Multiple Access (CDMA), Computer communication protocols: ISO/OSI 7 layer architecture.	12
3	**Microwave Systems**: Rectangular and circular wave guide; Wave guide coupling; Cavity resonators; Directional couplers; Isolators; Circulators; Mixers; Detectors switches; Microwave tubes - Microwave triodes, Klystron, Magnetron, Travelling wave tube; Cross field amplifier; Backward wave oscillators; Semiconductor microwave devices - Passive microwave components, Microwave transistors, Microwave ICs, Varactor diodes, Step recovery diodes, Parametric amplifier, Tunnel diode, Gunn effect diode, TRAPATT diodes, PIN diodes, Schottkey barrier diode, Backward diode, MASERS & LASERS; Introduction to optical communication.	12
4	**RADAR Systems**: Introduction; Pulsed RADAR; MTI; RADAR beacons; CW doppler RADAR; FM RADAR; Phased array RADAR; Planar array RADAR.	6
	Television Fundamentals: TV systems and standards; B/W TV transmission and reception; Colour TV.	
Text Books:		

1) Principles of Communication Systems - Taub & Schilling
2) Analog and Digital Communication Systems – Martin S Roden

3) Electronic Communication Systems - George Kennedy
4) Principle of RADAR – Meril Skolnik.
5) Digital Transmission Engineering, 2ndEd - John B Anderson, John Wiley and Sons, 2005
6) Communication Systems, 4thEd, Simon Haykin, John Wiley & Sons, 2001
7) Modern Digital and Analog Communication Systems, 3rdEd - B P Lathi, Oxford University Press, 1998
8) Color Television – Gulati & Gulati
9) Digital and Analog Communication Systems 5thEd 2004 Leon W Couch

7th Semester BE (E)

Syllabus for **Elective II,III &IV**: Optimization Techniques (EE709)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: Concept of optimization; Direct approach; Indirect method; Optimization with constrains.	10
	Indirect Methods: Maxima minima functions of several variables; necessary and sufficient conditions; equality constraints and solution of Lagrangian multipliers.	
2	**Direct Optimum Search for Scalar Case**: Unimodal functions; Resolution; Implicit and Explicit functions; Simultaneous search using even and odd number of experiments; Sequential search; Fibonacci & Golden section search; Searches using quadratic & cubic interpolation.	8
3	**Multivariable Optimization**: Concept of hill climbing; Method of steepest ascent; Newton-Raphson & D.F.P.; Direct search method programming.	8
4	**Multi-Stage Optimization**: Introduction; Principle of optimality; Solution for simple multi-stage problems; Discrete dynamic programming.	8
5	**Optimization With Constrains**: Formulation of optimization problems with equality and inequality constrains; Special case of linear constraints and linear objective functions; Introduction to non-linear problems.	6

Text Books:

1) Optimization : Theory & Applications - S. S. Rao, Wiley Eastern
2) Operation Research - Introduction to Optimization, 4thEd – J. C. Pant

	7th Semester BE (E) Syllabus for **Elective II,III &IV**: Operating System Design (EE710) **L-3 T-0 P-0 C-3**	
Md No.	**Contents**	**No. of Lecture Hrs.**
1	**Purpose of Operating Systems (OS)**: Virtualization of Resources; Handling of Resource Sharing; Providing Common Services. **Scheduling and Process Management**: Interrupts; Basics of Scheduling (Time slices, Pre-emptive Queueing, Common Scheduling Algorithms); Basics of Process Management (Context Switching, Process Swapping, Threads).	8
2	**Basics of Synchronization**: Deadlock (Meaning and causes, common prevention mechanisms, common detection and recovery mechanisms); Critical Sections; Semaphores, Monitors; Spin Locks.	6
3	**Virtual Memory**: Basic Concept of Address Spaces; Segmentation; Paging (Working Set Concept, Common Paging Algorithms); Interactions with Hardware. **Caching and Buffering**: Basics of cache design (Hit ratio, LRU and Other Common Cache replacement strategies); Purpose of I/O Buffers and their use.	8
4	**Basics of OS Architecture**: Kernels, Microkernels and Layering; Out-of-Kernel Services. **Basics of Interprocess Communications**: Shared Memory Mechanisms; Messages; Remote Procedure Calls (RPCs).	8
5	**Basics of File Systems**: Directories; Basic Issues of File System Layout on Disk; Basic File System Protection Mechanisms. **Basics of Security**: Access control mechanisms (Access Control Lists, Capabilities); Basic Ideas of Encryption and Authentication (Fundamentals of Encryption, Keys, Digital Signatures).	10
Text Books: 1. Operating Systems: A Modern Perspective 2ndEd - G. Nutt, Addison-Wesley, 2000.		

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7th Semester BE (E)

Syllabus for **Elective II,III &IV**:: Flexible AC Transmission Systems (EE711)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: Reactive power control in electrical power transmission lines; Uncompensated transmission line; Series compensation; Basic concepts of static VAR Compensator (SVC); Thyristor Switched Series capacitor (TCSC); Unified power flow controller (UPFC).	8
2	**Static VAR Compensator (SVC)**: Voltage control by SVC; Advantages of slope in dynamic characteristics; Influence of SVC on system voltage; Design of SVC voltage regulator; Applications: Enhancement of Transient stability, Steady state power transfer, Enhancement of power system damping; Prevention of voltage instability.	8
3	**Thyristor Controlled Series Capacitor (TCSC)**: Different modes of operation of TCSC; Modeling of TCSC: Variable reactance model, Modeling for stability studies; Applications: Improvement of the system stability limit, Enhancement of system damping, Voltage collapse prevention.	8
4	**Emerging FACTS Controllers**: Static Synchronous Compensator (STATCOM): Principle of operation, V-I Characteristics; Unified Power Flow Controller (UPFC): Principle of operation, Modes of Operation, Modeling of UPFC for Power Flow Studies.	12
5	**Coordination of FACTS Controllers**: Controller interactions; SVC-SVC interaction; Co-ordination of multiple controllers using linear control techniques; Control coordination using genetic algorithms.	4

Text Books:

1. Thyristor Based Facts Controllers for Electrical Transmission Systems - Mohan Mathur, R. Rajiv and K.Varma, IEEE press and John Wiley & Sons, Inc.
2. Understanding FACTS - Concepts and Technology of Flexible AC Transmission Systems - Narain G. Hingorani, Standard Publishers Distributors, New Delhi.

Reference:

Flexible A.C. Transmission Systems - A. T. John, IEEE Press, 1999.

7th Semester BE (E)

Syllabus for **Elective II,III &IV**: Power System Interconnection and Control (EE712)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	Economic Dispatch of Thermal Units and Methods of Solution: Economic despatch problem and system constrains, Lamda iteration method, first order gradient method,second order gradient method, base point and participation factors, transmission loss co-ordination, pnalty factors ,B-matrix loss formula and its derivation, calculation of B coeffecients by approximate method, exact transmission loss formula, reference bus and load centre penalty factor, relation between loss matix penalty factor and reference bus penalty factors, optimal unit commitment by dynamic programming, reliability considerations, Patton's security function,security constrained optimal unit commitment, start-up considerations, optimal load flow solution by Dommel and Tinney's method.	14
2	Hydro Thermal Co-ordination :Long range and short range Hydro scheduling, hydro Electric plant models,s cheduling energy,short term hydro thermal scheduling problem, Lamda-Gamma iteration method, short term hydro thermal scheduling problem by a gradient approach,hydro units in series i.e hydraulically coupled units, pumped storage hydro plants, scheduling of pumped storage hydro thermaal plants by Lamda-Gamma iteration method and by a gradient method, Dynamic programming solution to multiple hydro plant problem	12
3	System Interconnection and Control: Types of inter connection, advantages of interconnection, philosophy of real and reactive power control, control area concept, single area load frequency control systeem, integral or supplementary control, two areas connected by a tie line and load frequency control, power frequency control of the tie line, types of automatic load frequency control for inter connected power systems, load frequency and economic load despatch control, automatic voltage regulators, automatic excitation control	14

. REF.BOOKS:

1) Power System Operation & Control – Murthy (TMH)
2) Power System Analysis & Stability – S.S Vadhera
3) Modern Power System Analysis – Nagrath & Kothari (TMH)

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7th Semester BE (E)

Syllabus for **Elective II,III &IV**: Prime Movers (EE713)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction to Thermodynamics**: Laws and Principles; Thermodynamics Cycles Related to Power Plants: Carnot Cycle, Rankine Cycle, Reheat Cycle, Regenerative Cycle (Feed Water Heating), Binary Vapour Cycle, Reheat-Regenerative Cycle.	8
	Diesel Power Plant: Introduction; Operating Principle; Basic Types of IC Engines: Two-Stroke, Spark Ignition Gas Engines/Petrol Engines; Diesel Engines/Heavy Oil Engines; Duel Fuel Engines; High Compression Gas Engines; Advantage of Diesel Power Plant; Disadvantage of Diesel Power Plant; Application of Diesel Power Plant; General Layout of Diesel Power Plant; Performance of Diesel Engine; Indicated Mean Effective Pressure (IMEP); Indicated Horse Power (IHP); Brake Horse Power (B.H.P.); Frictional Horse Power (F.H.P.); Indicated Thermal Efficiency; Brake Thermal Efficiency (Overall Efficiency); Mechanical Efficiency; Fuel System of Diesel Power Plant; Lubrication System of Diesel Power Plant; Liquid Lubricants or Wet Sump Lubrication System; Solid Lubricants or Dry Sump Lubrication System; Mist Lubrication System; Air Intakes and Admission System of Diesel Power Plant; Supercharging System of Diesel Power Plant; Types of Supercharger; Advantages of Supercharging; Exhaust System of Diesel Power Plant; Cooling System of Diesel Power Plant; Open Cooling System; Natural Circulation System; Forced Circulation Cooling System; Diesel Plant Operation; Efficiency of Diesel Power Plant; Heat Balance Sheet; Sensors to measure the important parameters.	
2	**Steam Turbine Power Plants**: Layout diagram of Steam Turbine Power Plant, Fuels: Pulverised Coal & Oil; Working Principle, Description and functions of the components: Boiler, Superheater, Turbine, Condenser, Reheater (Characteristics of Reheat Turbines)/Preheater, Water Cooling Tower; Sensors to measure the important parameters.	8

	Gas Turbine Power Plants: Layout diagram of Gas Turbine Power Plant; Classification of Gas Turbine Power Plant: Open Cycle Gas Turbine Power Plant, Closed Cycle Gas Turbine Power Plant; Elements of Gas Turbine Power Plants: Compressors, Intercoolers and Heat Exchangers, Combustion Chambers, Gas Turbines; Regeneration and Reheating; Cogeneration; Auxiliary Systems: Starting Systems, Ignition Systems, Lubrication System, Fuel System and Controls; Control of Gas Turbines: Prime Control and Protective Controls; Gas Turbine Efficiency: Effect of Blade Friction, Improvement in Open Cycle; Operations and Maintenance Performance; Troubleshooting and Remedies; Combined Cycle Power Plants (waste-heat recovery); Applications of Gas Turbine; Advantages and Disadvantages of Gas Turbine Power Plant; Sensors to measure the important parameters.	
3	**Nuclear Power Plant**: Layout diagram of Nuclear Power Plant; General History and Trends; Major Events; The Atomic Structure; Nuclear Energy Concepts and Terms: Features, Fission, Critical Mass, Alpha Radiation, Beta Particles, Gamma Particles, Uranium Fission, Half Life; Ethical Problems in Nuclear Power Regulation, Chemical and Nuclear Equations, Nuclear Fusion and Fission; Energy From Fission and Fuel Burn Up; Radioactivity; Nuclear Reactor: Nuclear Fuel, Moderator, Moderating Ratio, Reflector, Reactor Vessel, Biological Shielding, Coolant, Coolant Cycles, Reactor Core; Conservation Ratio; Neutron Flux; Classification of Reactors; Cost of Nuclear Power Plant; Nuclear Power Station in India; Light Water Reactor (LWR) and Heavy Water Reactor (HWR); Importance of Heavy Water; Site Selection; Comparison of Nuclear Power Plant and Steam Power Plant; Multiplication Factor; Uranium Enrichment; Reactor Power Control; Nuclear Power Plant Economics; Safety Measures for Nuclear Power Plants; Site Selection and Commissioning Procedure; Major Nuclear Power Disasters; Chernobyl Nuclear Power Plant: Reactor Design: RBMK-1000, Control of the Reactor, Chernobyl Reactor Operations, Accident/Safety Plans, Evacuation; Safety Problems in Chernobyl Reactor Design: System Dynamics, Another Safety Problem with the Design; Other, Earlier, Soviet Nuclear Accidents; Sensors to measure the important parameters.	8
4	**Hydel Power Plants**: Layout diagram of Hydel Power Plants; Run-Off; Hydrograph and Flow Duration Curve; The Mass Curve; Selection of Site for a Hydro-Electric Power Plant; Essential Features of a Water-Power	8

	Plant; Calculations of Water Power Plants; Classification of Hydro-Plant: Storage Plants, Run-of-River Power Plants, Pumped Storage Power Plants; Power House and Turbine Setting; Advantages and Disadvantages of Underground Power-House; Prime-Movers; Specific Speed of Turbine; Draft Tubes: Methods to Avoid Cavitation, Types of Draft Tubes, Different Types of Draft Tubes; Models and Model Testing; Selection of Turbine; Sensors to measure the important parameters.	
5	**Wind Power Plants**: Layout diagram of Wind Power Plant, Working Principle, Description and functions of the components; Wind Turbines; Battery-storage systems; Sensors to measure the important parameters.	8
	Solar Power Plants: Layout diagram of Solar Power Plant, Working Principle, Description and functions of the components; Battery-storage systems; Sensors to measure the important parameters.	
	Other Non-conventional/Renewable Energy Sources: Bio-mass, Bio-Diesel, Geo-thermal Energy, Sea-water temperature gradient, Tidal and Wave power, Layout diagrams.	
6	**Applications**: In-land, On-ship, Sub-marine and Space applications.	4

Text Books:

1. Power Plant Engineering - A. K. Raja, Amit P. Srivastava and Manish Dwivedi, New Age International (P) Ltd., 2006
2. Biofuels - Production Application and Development - A. H. Scragg, Cambridge University Press, 2009
3. Renewable Energy in Power Systems - Leon Freris and David Infield, John Wiley & Sons, 2008

7th Semester BE (E)

Syllabus for **Elective II,III &IV**:: Multiple View Projection Geometry (EE714)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: The ubiquitous projective geometry; Camera projections; Reconstruction from more than one view; Three-view geometry; Four view geometry and n-view reconstruction; Transfer; Euclidean reconstruction; Auto-calibration; 3D graphical models; Video augmentation	4
2	**Basics of Projective Geometry, Transformations and Estimation: Projective Geometry and Transformations of 2D:** Planar geometry; 2D projective plane; Projective transformations; Hierarchy of transformations; 1-D Projective geometry; Topology of the projective plane; Recovery of affine and metric properties from images; Properties of Conics; Fixed points and lines; **Projective Geometry and Transformations of 3D:** Points and projective transformations; Representing and transforming planes, lines and quadrics; Twisted cubics; Hierarchy of transformations; Plane at infinity; Absolute conic; Absolute dual quadric; **Estimation - 2D Projective Transformations:** The Direct Linear Transformation (DLT) algorithm; Different cost functions; Statistical cost functions and Maximum Likelihood estimation; Transformation invariance and normalization; Iterative minimization methods; Experimental comparison of the algorithms; Robust estimation; Automatic computation of a homography; **Algorithm Evaluation and Error Analysis:** Bounds on performance; Covariance of the estimated transformation; Monte Carlo estimation of covariance.	10
3	**Camera Geometry and Single View Geometry: Camera Models:** Finite cameras; The projective camera; Cameras at infinity; Other camera models; **Computation of the Camera Matrix** P: Basic equations; Geometric error; Restricted camera estimation; Radial distortion; **More Single View Geometry:** Action of a projective camera on planes, lines, and conies; Images of smooth surfaces; Action of a projective camera on quadrics; The importance of the camera centre; Camera calibration and the image of the absolute conic; Vanishing points and vanishing lines; Affine 3D measurements and	6

	reconstruction; Determining camera calibration K from a single view; Single view reconstruction; The calibrating conic.	
4	**Two-View Geometry: Epipolar Geometry and the Fundamental Matrix:** Epipolar geometry; The fundamental matrix F; Fundamental matrices arising from special motions; Geometric representation of the fundamental matrix; Retrieving the camera matrices; The essential matrix; **3D Reconstruction of Cameras and Structure:** Outline of reconstruction method; Reconstruction ambiguity; The projective reconstruction theorem; Stratified reconstruction; Direct reconstruction - using ground truth; **Computation of the Fundamental Matrix** F: Basic equations; The normalized 8-point algorithm; The algebraic minimization algorithm; Geometric distance; Experimental evaluation of the algorithms; Automatic computation of F; Special cases of F-computation; Correspondence of other entities; Degeneracies; A geometric interpretation of F-computation; The envelope of epipolar lines; Image rectification; **Structure Computation:** Problem statement; Linear triangulation methods; Geometric error cost function; Sampson approximation (first-order geometric correction); An optimal solution; Probability distribution of the estimated 3D point; Line reconstruction; **Scene planes and homographies:** Homographies given the plane and vice versa; Plane induced homographies given F and image correspondences; Computing F given the homography induced by a plane; The infinite homography HQO; **Affine Epipolar Geometry:** Affine epipolar geometry; The affine fundamental matrix; Estimating F_A from image point correspondences; Triangulation; Affine reconstruction; Necker reversal and the bas-relief ambiguity; Computing the motion.	10
5	**Three-View Geometry: The Trifocal Tensor:** The geometric basis for the trifocal tensor; The trifocal tensor and tensor notation; Transfer; The fundamental matrices for three views; **Computation of the Trifocal Tensor** T: Basic equations; The normalized linear algorithm; The algebraic minimization algorithm; Geometric distance; Experimental evaluation of the algorithms; Automatic computation of T; Special cases of T-computation.	4
6	**N-View Geometry: N-Linearities and Multiple View Tensors:** Bilinear relations; Trilinear relations; Quadrilinear relations; Intersections of four planes; Counting arguments; Number of independent equations; Choosing equations; TV-**View Computational Methods:** Projective reconstruction - bundle adjustment; Affine reconstruction - the factorization algorithm; Non-rigid factorization; Projective factorization; Projective reconstruction using planes; Reconstruction from sequences; **Auto-Calibration:** Introduction; Algebraic framework and problem statement; Calibration using the absolute dual quadric; The Kruppa equations; A stratified solution; Calibration from rotating cameras; Auto-calibration from planes; Planar motion; Single axis rotation - turntable	10

motion; Auto-calibration of a stereo rig; **Duality:** Carlsson-Weinshall duality; Reduced reconstruction; **Cheirality:** Quasi-affine transformations; Front and back of a camera; Three-dimensional point sets; Obtaining a quasi-affine reconstruction; Effect of transformations on cheirality; Orientation; The cheiral inequalities; Which points are visible in a third view; Which points are in front of which; **Degenerate Configurations:** Camera resectioning; Degeneracies in two views; Carlsson-Weinshall duality; Three-view critical configurations.

Text Books:

1. Multiple View Geometry in Computer Vision 2ndEd - R Hartley and A Zisserman, Cambridge University Press, 2003.
2. Projective Geometry Vol 1 - O Veblen and J W Young, Blaisedell Publishing Co., New York, USA, 1938.
3. Projective Geometry Vol 2 - O Veblen and J W Young, Blaisedell Publishing Co., New

7th Semester BE (E)

Syllabus for Elective **II, III &IV**:

Advance Control System (EE715)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
ADAPTIVE CONTROL SYSTEM		
1	*Introduction:* Basic approaches to adaptive control. Applications of adaptive control.	4
2	*Gradient and least-squares algorithms*: Linear error equation. Gradient and normalized gradient algorithms. Least-squares algorithms (batch, recursive, recursive with forgetting factor). Convergence properties.	8
3	*Identification*: Identification of linear time-invariant systems. Adaptive observers .Sufficient richness condition for parameter convergence. Equation error and output error methods.	8
4	*Indirect adaptive control*: Pole placement adaptive control. Model reference adaptive control Predictive control. Singularity regions and methods to avoid them.	8
OPTIMAL CONTROL SYSTEM		
5	Basic mathematical concepts, Conditions for optimality, Calculus of variations, Pontryagin's maximum principle, Hamilton Jacobi-Bellman theory, dynamic programming,	12

structures and properties of optimal systems, various types of constraints, singular solutions, minimum time problems, optimal tracking control problem

BOOKS:-

1. K.J. Astrom and B. Wittenmark, *Adaptive Control*, Addison-Wesley, 2nd edition, 1995.
2. G.C. Goodwin and K.S. Sin, *Adaptive Filtering, Prediction, and Control*, Prentice-Hall, 1984.
3. P. Ioannou& B. Fidan, *Adaptive Control Tutorial*, SIAM, Philadelpia, PA, 2006.
4. P.A. Ioannou& J. Sun, *Robust Adaptive Control*, Prentice Hall, Upper Saddle River, NJ, 1996. The book is available (for free) in PDF form through the web page: http://www-bcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust_Adaptive_Control.pdf.
5. I.D. Landau, R. Lozano, and M. M'Saad, *Adaptive Control*, Springer Verlag, London, 1998.
6. K.S. Narendra and A.M. Annaswamy, *Stable Adaptive Systems*, Prentice-Hall, 1989.
7. D. E. Kirk, Optimal Control Theory: An Introduction, Prentice-Hall, 2004.
8. B.D.O. Anderson and J.B. Moore, Optimal Control: Linear Quadratic Methods, 2007.
9. M. Krstic, P. V. Kokotovic, I. Kanellakopoulos, Nonlinear and Adaptive Control Design, John Willey and Sons, 1995.
10. K. J. Astrom and B. Wittenmark, Adaptive Control, 2/e, 2008.
11. G. Feng and R. Lozano, Adaptive Control Systems, Oxford University Press, 19992. Sage A. P, White C. C, Optimum Systems Control, 2nd Edition, prentice Hall, 1977.

7th Semester BE (E)

Syllabus for **Elective II,III &IV**::

Biomedical Instrumentation (IN705)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1.	**Introduction** : Basic concepts of medical instrumentation, Introduction to the physiology of cardiac, nervous , mascular & respiratory systems, Sources of bioelectric potentials.	6

2.	**Biopotential Electrodes:** Electrode theory ; Different types of biopotential electrodes-Microelectrodes, Skin surface electrodes and needle electrodes, Biochemical transducers – Reference Electrodes-Hydrogen, Silver silver chloride and calomel , PH Electrodes , PO2 and PCO2 Electrodes.	8
3.	**Cardiovascular measurement** : The heart and other cardiovascular systems; Measurement of blood pressure; Blood flow cardiac output and cardiac rate; Electrocardiography; Phonocardiography; Ballistocardiography; Plethysmography; Magneto-cardiography; Cardiac pacemaker; Computer applications. Respiratory System Measurement: Respiratory Mechanism, Measurement of gas volumes & flow rate; Carbon dioxide and Oxygen concentration in inhaled air; Respiratory controllers.	14
4	**Instrumentation for clinical laboratory** : Measurement of pH values of blood; ESR measurement; Haemoglobin measurement; Measurement of oxygen & carbon dioxide concentration in blood; GSR measurement; Polarographic measurements; Computer applications.	6
5	**Medical Imaging** : Ultra sound imaging ; X Ray , CT Scan , MRI . **Biotelemetry**-Transmission & reception aspects of biological signals via long distance ; Aspect of patient care monitoring.	6

Texts

1. Webster JS – Medical Instrumentation Applications & Design
2. Cromwell L – Biomedical Instrumentation (PHI)
3. Khandpur RS – Hand Book of Biomedical Instrumentation (TMH)
4. Astor BR – Introduction to Biomedical Instrumentation & Measurement (Mc Millan)
5. Introduction to Biomedical Equipment Technology 4thEd – J. J. Carr and J. M. Brown, Pearson Education, 2008.

7th Semester BE (E)

Syllabus for **Elective II,III &IV**:: MEMS and NEMS (IN706)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.

1	**Nano- and Microengineering, and Nano- and Microtechnologies**: Historical background of Nano- and Micro Electro Mechanical Systems (NEMS and MEMS) and micro-machining; Biological Analogies; Applications of Nano- and Microelectromechanical Systems; Introduction to MEMS Fabrication, Assembling, and Packaging; Bulk micromachining; Isotropic etching and Anistropic etching; Wafer bonding; High aspect ratio processes (LIGA).	8
2	**Mathematical Models and Design of Nano- and Microelectromechanical Systems**: Nano- and Microelectromechanical Systems Architecture; Electromagnetics and its Application For Nano- and Microscale Electromechanical Motion Devices; Classical Mechanics and its Application; Newtonian Mechanics; Lagrange Equations of Motion; Hamilton Equations of Motion; Atomic Structures and Quantum Mechanics; Molecular and Nanostructure Dynamics; Schrödinger Equation and Wavefunction Theory; Density Functional Theory; Nanostructures and Molecular Dynamics; Molecular Wires and Molecular Circuits; Thermoanalysis and Heat Equation.	14
	Structural Design, Modeling and Simulation: Nano- and Microelectromechanical Systems; Carbon Nanotubes and Nanodevices; Microelectromechanical Systems and Microdevices; Structural Synthesis of Nano- and Microelectromechanical Actuators and Sensors; Configurations and Structural Synthesis of Motion Nano and Microstructures (actuators and Sensors); Algebra of Sets; Direct-Current Micromachines; Induction Motors; Two-Phase Induction Motors; Three-Phase Induction Motors; Microscale Synchronous Machines; Single-Phase Reluctance Motors; Permanent-Magnet Synchronous Machines; Microscale Permanent-Magnet Stepper Motors; Mathematical Model in the Machine Variables; Mathematical Models of Permanent-Magnet Stepper Motors in the Rotor and Synchronous Reference Frames; Nanomachines: Nanomotors and Nanogenerators.	
3	**Surface Micromachining**: One or two sacrificial layer processes; Surface micromachining requirements; Polysilicon surface micromachining; Some Compatible materials: Silicon Nitride, Piezo electric materials; Surface micro machined systems; Micro motors; Gear Trains and Mechanisms.	8
	Physical Micro Sensors: Classification of Physical sensors: Integrated, Intelligent or Smart sensors; Sensor principles and examples: Thermal sensors, Electrical sensors, Mechanical sensors, Chemical and Biosensors.	
4	**Microactuators**: Electromagnetic and thermal micro actuation; Mechanical design of Microactuators; Microactuator examples: Microvalves, Micropumps, Micromotors; Micro actuator systems: Ink Jet printer heads, Micro-Mirror TV Projector.	4
5	**Control of Nano- and Microelectromechanical Systems**: Fundamentals of Electromagnetic Radiation and Antennas in Nano- and Microscale Electromechanical Systems; Design of Closed-Loop Nano- and Microelectromechanical Systems using the Lyapunov Stability Theory;	6

Introduction to Intelligent Control of Nano- and Microelectromechanical Systems.

Application Areas: All mechanical miniature devices; 3D electromagnetic actuators and sensors; RF electronic devices: Optical/Photonic devices; Medical devices: DNA-chip, Micro arrays.

Text Books:

1. Nano- and Microelectromechanical Systems: Fundamentals of Nano- and Microengineering- Sergey Edward Lyshevski, CRC Press, London, 2001.
2. Micro System Design - Stephen D. Senturia, Kluwer Academic Publishers, 2001.
3. Micro Electro Mechanical Systems - Tsu, 2006.

References:

1. Fundamentals of Microfabrication - Marc Madou, CRC Press, 1997.
2. Micromachined Transducers Sourcebook - WCB McGraw Hill, Boston, 1998.
3. Micromechanical Transducers: Pressure Sensors, Accelerometers and Gyroscopes - M. H. Bao, Elsevier, New York, 2000.
4. MEMS and Nanotechnology-based Sensors and Devices for Communications, Medical and Aerospace Applications - A. R. Jha, CRC Press, London, 2008.
5. MEMS and NEMS - Systems, Devices and Structures - Sergey Edward Lyshevski, CRC Press, London, 2002.
6. MEMS/NEMS Handbook - Techniques and Applications Vol 1: Design Methods in MEMS/NEMS – C. T. Leondes, Springer, 2006.
7. Modeling MEMS and NEMS - J. A. Pelesko and D. H. Bernstein, Chapman & Hall/CRC, London, 2003.
8. Smart Material Systems and MEMS - Design and Development Methodologies - V. K. Varadan and K. J. Vinoy, John Wiley & Sons, 2006.
9. Smart Sensors and MEMS - Sergey Y. Yurish and Maria Teresa S. R. Gomes, Kluwer Academic Publishers, Boston, 2004.
10. RF MEMS: Theory Design and Technology - Gabriel M Rebeiz, John Wiley & Sons, 2003.
11. RF MEMS Circuit Design for Wireless Communications - Héctor J De Los Santos, Arctech House, Boston, 2002.
12. MEMS - MOEM Packaging – Concepts, Designs, Materials and Processes – K. Gilleo, McGraw-Hill, 2005.
13. MEMS Mechanical Sensors Microelectromechanical Systems Series – S. Beeby, Artech House, Inc., 2004.

7th Semester BE (E)

Syllabus for **Elective II,III &IV**:: Ultrasonic & High Frequency Instrumentation (IN707)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	Ultrasonic waves, principles & propagation of various waves, characterization of ultrasonic transmission—reflection & transmission coefficients, intensity & attenuation of sound beam; Power level, medium parameters; Generation of ultrasonic waves.	6
2	(a) Ultrasonic Instrumentation: Ultrasonic wave propagation in material media, velocity, acoustic impedance, reflection at interface, Doppler frequency shift; (b) Transducers; piezoelectricity -inverse piezoelectricity, generation and reception of ultrasonic wave, resonance frequency, continuous and pulse excitation of PET.	10
3	(a) Ultrasonic test methods—pulse echo, transit time, resonance, direct contact and immersion type; (b) Non-destructive testing of materials, interference, sing around method. Transmission reflection methods of flow measurements; Doppler shift flow measurement.	8
4	(a) Imaging pulse excitation, Different types of scans (A,B,C,D,TM scan) and other applications. Laser Instrumentation: Properties of LASER, Coherence, directionality, monochromaticity, interference, fringe. LASER generation, population inversion feedback, He-Ne, Ruby, semiconductor LASER. Measurement of distance, Velocity and other physical variables. Holography Generation of holograms, application of real time, time average holography; (b) Infra Red Instrumentation: Source, window and buses, photoelectric thermal detector, Solar Bolometer, Thermo junction, Pyroelectric. Quantum detector - Vacuum photocell, Photo multiplier, Photo-transistor, Charge-coupled device, Thermal radiation imaging.	14

Text Books:

1. Krauthsamer J and Krauthsamer H---- Ultrasonic Testing Of Materials—Springer
2. Wells N T --- Biomedical Ultrasonics--- Academic Press

7th Semester BE (E)

Syllabus for **Elective II,III &IV**::

Data Communication & Networking (IN709)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction to Data Communication and Computer Network Concepts**:	
	Introduction to Computer Networks: Network Goals/Motivation; Application of Networks; Point-to-Point or Switched Networks; Circuit Switched Networks; Packet Switched Networks; Message Switched Networks; Broadcast Networks; Packet Radio Networks; Satellite Networks; Local Area Networks (e.g., E-net, Giga-enet, FDDI, Token Ring); Network Protocols; Wireless LANs (e.g., Packet Radio, WaveLAN); Wireless Cellular Networks (e.g., GSM, CDMA); OSI Reference Model; Knowledge of Internet protocol suite (e.g. RIP, BGP, TCP/IP, RTP);	14
	Data Transmission: Transmission Terminology; Simplex, Half Duplex and Full Duplex Networks; Spectrum and Bandwidth, Analog and Digital Data Transmission; Transmission Impairments; Attenuation Distorion and Delay Distortion; Noise; Transmission Media; Twisted Pair, Coaxial Cable, Optical Fibre, Terrestial Microwave, Satellite Microwave, Radio.	
	Data Encoding and Communication Techniques: Pulse Code Modulation (PCM); Amplitude Modulation (AM); Frequency Modulation (FM); Phase Modulation (PM); Asynchronous and Synchronous Transmission; Interfacing; RS-232; X.21; Digital Interface.	
	Multiplexing and Communication Hardware: Frequency Division Multiplexing (FDM); Time Division Multiplexing (TDM); Synchronous and Statistical TDM; Modems; Multiplexers; Demultiplexers; Concentrator; Front End Processes.	
2	**Media Access Control and Data Link Layer**:	12
	Data Link Layer Fundamentals: Framing; Basics of Error Detection; Forward Error Correction; Cyclic Redundancy Check Code for Error Detection.	

	Retransmission Strategies: Stop and Wait ARQ; Go-Back-N ARQ; Selective Repeat ARQ; Pipelining. **Contention Based Media Access Protocols**: Advantages of Multiple Access Sharing of Channel Resource; Pure ALOHA, Slotted ALOHA; Carrier Sense Multiple Access (CSMA); CSMA with Collision Detection (CSMA/CD).	
	Polling Based Media Access Control Protocols: Token Ring, Token Bus.	
	Media Access Control Protocols for High Speed Networks: FDDI-1 and FDDI-2; DQDB with Bandwidth Balancing for Fair Access; Asynchronous Transfer Mode (ATM).	
3	**Network Layer**:	6
	Connection Oriented and Connectionless Services; Addressing; Concept of Congestion and Congestion Control; Routing Techniques; X.25; Internet Protocol (IP); Fragmentation of Assembly; Internetworking; Bridge (Spanning Tree and Source Routing); X.75; Gateways.	
4	**Transport Layer and Application Layer Services**:	8
	Types and Qualities of Transport Layer Services and Mechanism; Data Transfer; Connection Management; Transport Control Mechanism; Addressing; Multiplexing; Flow Control and Buffering; Connection Establishment; Crash Recovery; TCP/UDP (Standards, Specifications and Fields of Header); **Remote Procedure Call (RPC)**: Client-Server Model, Implementation of RPC, XTR (Presentation Layer Problem); **Application Layer Services**: Web, HTTP, DNS, FTP, TELNET, E-mail, X.400/X.500.	

Text Books:

1. Computer Networks – Andrew S. Tanebaum, Prentice Hall of India

2. Data and Computer Communication – William Stalling, Prentice Hall of India

3. Computer Networks: A Systems Approach 2ndEd - B. Davie, L. Peterson and D. Clark, Morgan Kaufmann, 2000 (Home page: http://www.mkp.com/books_catalog/catalog.asp)

4. Computer Networking: A Top-Down Approach Featuring the Internet - J. Kurose and K. Ross, Addison Wesley Longman, 1999. (Home page: http://occ.awlonline.com/bookbind/pubbooks/kurose-ross1/)

7th Semester BE (E)

Syllabus for **Elective II,III &IV**

ADVANCE PROCESS DYNAMICS & CONTROL(IN702)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Design of feed back controllers** : Selection criterion for type of controllers, controller tuning-process reaction curve, Zeigler-Nichol's method, Cohen and Coon method and frequency domain method.	8
2	**Multi loop control systems:** Cascade control, override control, split-range control, feed-forward control and ratio control systems.	8
3	**Programmable logic controller**, Concept of Ladder diagram, Ladder programming,	6
4	**Direct digital control** , DCS and SCADA systems.	6
5	**State space representation of physical systems**, State transition matrix, eigen values and eigen vectors, concept of controllability and observability of linear system , Concept of multivariable control and Nonlinear control, Lyapunov Stability. .	12

Ref. Books:

1) Stephinopoulos G- Chemical process control (PHI).
2) Pollard A –Process control.
3) Coughanowr – Process System Analysis and Control (MH).
4) Hariot P-Process Control (TMH).
5) Johnson-Process Control Instrumentation Technology (JW).
6)M Gopal- Control Systems Principles and design(TMH)

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SEMESTER VIII

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	EE801	Generating Station & Sub-Station Practice	3	0	0	3	3
03	EE802	Project II	0	0	20	20	10
05		Elective-V	3	0	0	3	3
06		Elective-VI	3	0	0	3	3
07		Elective-VII	3	0	0	3	3
	Total					**32**	**22**

List of Elective – V , VI & VII

1. EE803 Utilization of Electric Power and Machine Drives
2. EE804 Dynamic Modelling & Analysis of Electrical Machines
3. EE805 Adaptive Signal Processing
4. EE806 Computer Vision
5. EE807 Computer Graphics
6. EE808 Intelligent Control System
7. EE809 Discrete Time Control System
8. EE810 High Voltage Direct Current Transmission
9. EE811 Artficial Intelligence
10. EE812 VLSI Signal Processing
11. EE813 Illumination Engineering
12. EE814 Electrical System Installation & Professional Practice
13. IN803 Power Plant Instrumentation
14. IN804 Optoelectronics and Optical Communication Engineering

8th Semester BE (E)

Syllabus for Generating Station & Sub-Station Practice (EE801)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
	Generating Station Practice	
1	**Introduction: Importance of Electrical Energy, Comparison with forms of energy, Global energy scenario.**	4
2	**Thermal Power Plant:** Location and Site selection, General layout and working of plant, Brief description of Boilers, Economizers, Super heaters, Draft equipments, Fuel and Ash handling plant, Governing of turbine.	12
	Gas Turbine Power Plant: Layout, Working and Components of Gas Turbine Power Plant, Combined Gas and Steam Turbine Plant, Governing of turbine.	
3	**Hydro Electric Plant:** Location and site selection, General layout and Operation of plant, Impulse, Reaction, Francis and Kaplan turbines, Governing of turbines.	8
	Diesel Power Plant: Layout and components of plant auxiliary equipments.	
4	**Nuclear Power Plant:** Location and site selection, General layout and Operation of plant, Brief description of Reactors, Moderators and Reflectors.	6
5	**Substation Practice**	
	Substation Layout: Types of substations, Designing of substation, Typical Layout of Substations Bus-bar, Bus Duct, Switchgear arrangements, Neutarl grounding system, Substation earthing, earth pit, earthing grid, Control circuit and emergency power, DC Battery bank, Safety and Fire protection devices. Power factor improvement equipment. Placement of Reactor.	10

Text Books:

1. Elements of Electric Power Station Design - M. V. Deshpande, Wheeler Publishing Co.
2. Generation of Electrical Energy - B. R. Gupta, Eurasa Publishing House.
3. Power Station Engineering and Economy - B. G. A. Skrotzki & W. A. Vopat, Tata McGraw Hill.
4. Electrical Power - S. L. Uppal, Khanna Publishers.
5. A Course in Electrical Power - M. L. Soni, P. V. Gupta and U. S. Bhatnagar, Dhanpat Rai & Sons.
6. Power Plant Engineering - A. K. Raja, Amit P. Srivastava and Manish Dwivedi, New Age International (P) Ltd., 2006
7. CEGB, Modern Power Station Practice, Vol 6 & 8—Pergamon Press
8. Electric Power System – B. M. Weedy, Wiley

8th Semester BE (E)

Syllabus for Utilization of Electrical Power & Machine Drives (EE803)

L-3 T-1 P-0 C-4

Md No.	Contents	No. of Lecture Hrs.
1	**Electric Drives**: Concept of drives; factors influencing the selection of motors & their control; Classification of loads; Speed-torque characteristics of motors; Dynamics of load–motor combination; Four–quadrant operation of motor loads.	12
	Starting & Braking: Electric braking methods-speed torque characteristics under different braking conditions of d.c. shunt, series and induction motors; Automatic open-loop drives control with relay contactors; Automatic acceleration methods- current limit acceleration scheme for d.c. shunt motor using series relays and voltage relays; Time limit acceleration with time limit relay/ contactors; Starting of d.c. motors with thyristors ; Automatic starter for Induction Motor (IM) relay with definite time and frequency; Transient conditions in a.c. & d.c. drives during starting and braking; Energy losses; Selection of ratings.	
2	**Solid State Controllers for Electric Drives**: Review of conventional speed control methods; 1-ph and 3-ph semi and full converters d.c. drives-waveform, torque-speed curve, firing and control circuits; Closed-loop control scheme with converter; speed and current measurement; Chopper controlled d.c. drives-various configurations, analysis and performances; Thyristor a.c. motor drives-comparison with d.c. motor drives, speed control methods of Induction Motor (IM) with thyristor, stator voltage control, variable frequency operation of IM with constant flux and constant current; Voltage source inverter fed IM drives; Cycloconverter fed IM and Synchronous motor.	8
3	**Electric Drives for Industrial Applications**: Different types of steel mills and drives used in steel mills; Requirements of paper mill drives-types paper mill drives; Comparison between line shaft and sectional drives; Cement factory, Textile mill, Sugar mill and Coal mine drives; Machine Tools applications; Drives for numerically controlled machines.	8
	Electric Traction: Choice of traction systems in India; Traction motors- general features, starting and speed control, Control gear; Tramway and Trolley buses; Power transmission equipments; Type of services; Speed-time curves & speed-distance curves; Energy conversion; Mechanics of train movements.	

4	**Electric Heating & Welding** : Electric heating-relative cost, advantages, Types and applications; Transfer of heat; Temperature control of resistance furnace; Design of heater element; Resistance oven- construction, Losses & Efficiency; Control equipments, Radiant heating, Salt bath heating; Induction heating- Principles, Types of furnaces; Indirect heating methods; High frequency eddy current heating; Electric welding – Classification: Resistance, Arc, Atomic Hydrogen, Electron Beam, Ultrasonic, LASER type; Power supply & Control methods.	8
5	**Air Conditioning**: Water coolers; Air conditioning systems; Air conditioning cycle; Classification of air conditioning systems; Central system; Unitary systems; Load estimation; Heating of building.	4

Text Books:

1) Fundamentals of Electric Drives 2nd Ed 2010 - Gopal K. Dubey, Narosa Book Distributors
2) A First Course on Electric Drives 3rd Ed 2012 - S. K. Pillai, New Age International
3) Utilization of Electric Power 2nd Ed 2016 – R. K. Rajput, Laxmi Publications
4) Utilization Electric power and Electric Traction 2012 - J. B. Gupta, S. K. Kataria & Sons
5) Art and Science of Utilisation of Electrical Energy 2014 - H. Partab, Dhanpat Rai & Co.
6) Utilization of Electric Power 2014 - N. V. Suryanarayan, New Age International
7) Generation, Distribution and Utilization of Electric Energy 3rd Ed 2015 - C. L. Wadhwa New Age International
8) Utilization of Electric Energy 1961 - E. Openshaw Taylor, English Universities Press
9) Electric Traction 2000 - J. Upadhyay and S.N. Mahendra, Allied Publishers
10) Electric Traction 4th Ed 1965 - A. T. Dover, Sir Isaac Pitman & Sons
11) Electric Traction: A Treatise on the Application of Electric Power to Tramways and Railways - Primary Source Edition 2014 - Alfred Thomas Dover, Nabu Press

7th Semester BE (E)

Syllabus for **Elective V & VI**

Dynamic Modelling & Analysis of Electrical Machines

(EE 805)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	Principles of Electro-mechanical Energy Conversion: Magnetic circuits; Stored magnetic energy; Co-energy; Force and Torque; Singly and Doubly excited system; MMF pattern for DC and AC machines; Calculation of air gap mmf and per phase machine inductance using physical machine data.	8
2	DC Machines: Voltage and torque equations; Dynamic characteristics of Permanent Magnet and Shunt DC motors; State equations; Solution of dynamic characteristics by Laplace transformation.	8
3	**Reference Frame Theory**: Static and rotating reference frames; Transformation of variables; Reference frames; Transformation between reference frames; Transformation of a balanced set; Balanced steady state phasor and voltage equations; Variables observed from several frames of reference.	8
4	**Induction Machines**: Voltage and torque equations in machine variables; Transformation in arbitrary reference frame; Voltage and torque equation in reference frame variables; Analysis of steady state operation; Free acceleration characteristics; Dynamic performance for load variations; Computer simulation.	8
5	**Synchronous Machines**: Voltage and torque equation in machine variables; Transformation in rotor reference frame (Park's equation); Voltage and Torque equation in reference frame variables; Analysis of steady state; Dynamic performance for load variations; Computer simulation.	8

Text Books:

1. Analysis of Electrical Machinery and Drive Systems 2ndEd - Paul C. Krause, Oleg Wasyzczuk, Scott D. Sudhoff, IEEE Press, 2005.

2. Electrical Motor Drives, Modelling, Analysis and Control - R. Krishnan, Prentice Hall of India, 2002.

References:

1. Electric Machinery 5thEd - A. E. Fitzgearald, Charles Kingsley, Jr. and Stephen D. Umans, Tata McGraw Hill, 1992.
2. Thyristor Control of Electric Drives – V. Subramanyam, Tata McGraw Hill Publishing Company Limited, New Delhi, 1998.

8th Semester BE (E)

Syllabus for **Elective V & VI**

Adaptive Signal Processing (EE 806)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: The adaptive linear combiner; Introduction to gradient search algorithms, steepest-descent algorithm, Convergence properties, Newton algorithm.	8
2	**Adaptive algorithms**: LMS algorithm, Recursive Least Squares algorithm, LMS/Newton algorithm.	4
3	Frequency domain and Sub-band adaptive filters; Square root adaptive filters; Order recursive adaptive filters; Finite precision effects; IIR adaptive filters.	8
4	**Applications of adaptive signal processing**: a) Adaptive modeling and system identification b) Inverse adaptive modeling, deconvolution and equalization c) Adaptive control systems d) Adaptive interference canceling - Canceling noise, Canceling periodic interference; Canceling interference in ECG signals, etc.	12
5	**Linear optimum filtering**: a) Wiener filters	8

b) Kalman filters

Text Books:

1) Adaptive Signal Processing - B. Widrow and S. Stearns, Prentice Hall, 1985.

2) Adaptive Filter Theory, 3rdEd - S. Haykin, Prentice Hall, 1996.

8th Semester BE (E)

Syllabus for **Elective V & VI**

Computer Vision (EE 807)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Image Formation (Sources, Shadows and Shading)**: Radiometric Properties of Light Sources; Qualitative Radiometry; Sources and their Effects; Point Sources; Line Sources; Area Sources; Gourad & Phong Shading models; Shadows; Ambient Illumination; Photometric Stereo; Normal and Albedo from Many Views; Shape from Normals; Interreflections: Global Shading Models.	8
2	**Image Models**: Coordinate Systems and Homogeneous Coordinates; Perspective Projection.	4
3	**Shape from Texture**: Representing Texture; Extracting Image Structure with Filter Banks; Analysis (and Synthesis) Using Oriented Pyramids; The Laplacian Pyramid; Shape from Texture: Planes and Isotropy; Recovering the Orientation of a Plane from an Isotropic Texture; Recovering the Orientation of a Plane from an Homogeneity Assumption; Shape from Texture for Curved Surfaces; Shape from Texture.	8
4	**The Geometry of Multiple Views**: Two Views; Epipolar Geometry; Three Views; Trifocal Geometry; More than 3 Views; **Stereopsis**: Reconstruction; Camera Calibration; Image Rectification; Human Vision: Stereopsis; Binocular Fusion; Correlation; Multi-Scale Edge Matching; Dynamic Programming; Using More Cameras; Trinocular Stereo; Multiple-Baseline	8
5	**Affine Structure from Motion**: Elements of Affine Geometry; Affine Structure from Two Images; The Affine Structure-from-Motion	8

	Theorem; Regularization theory; Optical computation; Optical flow; Motion estimation;	
6	**Projective Structure from Motion**: Motion Estimation from Trifocal Tensors; Motion Estimation from Multiple Views	4

Text Books:

1. Robot Vision - Berthold Klaus Paul Horn, MIT Press, McGraw-Hill
2. Computer Vision 2ndEd PHI 1982 Ballard n Brown
3. Computer Vision A Modern Approach - Forsyth, Ponce
4. Computer Vision and Applications A Guide for Students and Practitioners 2000 - Jahne n Hausecker
5. Fundamentals of Computer Vision 1997 Mubarak Shah
6. Image Processing Analysis and Machine Vision 3rdEd 2008 Sonka, Hlavac and Boyle

8th Semester BE (E)

Syllabus for **Elective V & VI**:

Computer Graphics (EE 808)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction to Computer Graphics:** Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays.	12
	Scan conversion – Lines, Circles and Ellipses; Filling polygons and clipping algorithms: Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.	
2	**Two-Dimensional Transformations**: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and	14

	Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.	
	Three-Dimensional Transformations: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections.	
	Viewing in 3D: Stages in 3D viewing, Canonical View Volume (CVV), Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar Geometric Projections, Combined transformation matrices for projections and viewing, Coordinate Systems and matrices, camera model and viewing pyramid.	
3	**Plane Curves and Surfaces**: Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, A Procedure for using Conic Sections, The General Conic Equation; Representation of Space Curves, Cubic Splines, Bezier Curves, B-spline Curves, B-spline Curve Fit, B-spline Curve Subdivision, Parametric Cubic Curves, Quadric Surfaces; Bezier Surfaces.	8
5	**Visible-Surface Determination**: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting).	6
	Illumination and Shading: Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenutation, Phong's model, Gouraud shading, some examples.	

Text Books:

1. Computer Graphics (C Version) - D. Hearn and M. Pauline Baker, Pearson Education, 2nd Edition, 2004.

2. Mathematical Elements for Computer Graphics, 2ndEd - D. F. Rogers and J. A. Adams, McGraw-Hill International Edition, 1990.

3. Procedural Elements for Computer Graphics, 2ndEd - D. F. Rogers and J. A. Adams, McGraw-Hill International Edition, 1990.

8th Semester BE (E)

Syllabus for **Elective V & VI**: Intelligent Control Systems(EE 809)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction**: Approaches to intelligent control; Architecture for intelligent control; Symbolic reasoning system; Rule-based systems; AI approach; Knowledge representation; Expert systems.	4
2	**Artificial Neural Network (ANN)**: Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model: Simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron; Learning and Training the neural network; Data Processing: Scaling, Fourier transformation, Principal Component Analysis (PCA) and Wavelet transformations; Hopfield network; Self-organizing network; Recurrent network;Stability analysis of Neural Network Interconnection Systems; System Identification and Control of Linear and Nonlinear Dynamic Systems using Neural Network.	12
3	**Intelligent Optimization Algorithms**: Gradient Search and Non-gradient search algorithms;Genetic Algorithm (GA): Basic concept of Genetic algorithm and detailed algorithmic steps; Adjustment of free parameters; Stochastic GA; Tabu search; Ant Colony Search; Evolutionary Programming: Operators, Search Algorithms; Particle Swarm Optimization; Applications to Solution of Control System Optimizationproblems.	12
4	**Fuzzy Logic Systems**: Introduction to crisp sets and fuzzy sets; Basic fuzzy set operation and approximate reasoning; Introduction to fuzzy logic modelling and	12

control: Fuzzification, Inferencing and Defuzzification;Fuzzy Knowledge and Rule Bases; Fuzzy modelling and control schemes for nonlinear systems; Self-organizing fuzzy logic control; Fuzzy logic control for nonlinear time-delay system; Stability analysis of Fuzzy Control Systems; Application of Fuzzy Logic Controllers to Inverted Pendulum.

Text Books:

1. Fundamentals of Neural Networks - LauranceFausett, Englewood cliffs, N.J., Pearson Education, 1992.
2. Neural Networks and Fuzzy Systems – B. Kosko, Prentice-Hall of India Pvt. Ltd., 1994.
3. Fuzzy Logic with Engineering Applications - Timothy J. Ross, Tata McGraw Hill, 1997.
4. Introduction to Fuzzy Control – Driankov and Hellendroon,Narosa Publishers.
6. Genetic Algorithms and Machine learning - David Goldberg, PHI

References:

1. Introduction to Artificial Neural Systems - Jacek M. Zurada, Jaico Publishing Home, 2002.
2. Fuzzy Sets, Uncertainty and Information – G. J. Klir and T. A. Folger, Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory & its Applications - H.J. Zimmermann, Allied Publication Ltd., 1996.
3. Neural Networks - Simon Haykin, Pearson Education, 2003.
4. Fuzzy Logic – Intelligence Control & Information - John Yen & Reza Langari, Pearson Education, New Delhi, 2003.
5. Genetic Algorithms + Data Structures = Evolution Programs, 3rdEd - Z Michalewicz, Springer, 1996.
6. Evolutionary Computation Vol 2 Advanced Algorithmsand Operators - T Baeck, D B Fogeland Z Michalewicz, Institute of Physics Publishing, Bristol, UK, 2000.

8th Semester BE (E)

Syllabus for **Elective V & VI**: Discrete Time Control Systems(EE 810)

L-3 T-0 P-0 C-3

1	**Introduction**: Discrete time system representation, Mathematical modeling of sampling process, Data reconstruction.	2
2	**Modeling discrete-time systems by pulse transfer function**: Review of Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph.	4
3	**Stability analysis of discrete time systems**: Jury stability test, Stability analysis using bi-linear transformation.	2
4	**Time response of discrete systems**: Transient and steady state responses, Time response parameters of a prototype second order system.	4
5	**Design of sampled data control systems**: Root locus method, Controller design using root locus, Root locus based controller design using MATLAB, Nyquist stability criteria, Bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.	6
6	**Deadbeat response design**: Design of digital control systems with deadbeat response, Practical issues with deadbeat response design, Sampled data control systems with deadbeat response.	4
7	**Discrete state space model**: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation.	4
8	**Controllability, observability and stability of discrete state space models**: Controllability and observability, Stability, Lyapunov stability theorem.	4
9	**State feedback design**: Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer.	4
10	**Output feedback design**: Output feedback design Theory, Output feedback design Examples.	2
11	**Introduction to optimal control**: Basics of optimal control, Performance indices, Linear Quadratic Regulator (LQR) design.	4

Text Books:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.

2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2/e, 1995.

3. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.

4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, Asia, 3/e, 2000.

5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3/e, 1997.

6. Discrete-time Sliding Mode Control - A Multirate Output Feedback Approach, B. Bandyopadhyay and S. Janardhanan, Springer-Verlag 2006.

7. Digital Self-tuning Controllers - Algorithms, Implementation and Applications, V. Bobal, J, Bohm, J. Fessl and J. Machacek, Springer-Verlag 2005

8th Semester BE (E)

Syllabus for **Elective V & VI**: Artificial Intelligence(EE 812)

	L-3 T-0 P-0 C-3	
1	**Introduction to the object and goals of Artificial Intelligence**: Aim and scope of the AI; Problem space and problem characteristics; State space representation.	4
2	**Problem solving techniques**: Generate-and-Test and Hill-climbing search algorithms; Problem reduction techniques; Constraint propagation; Means-End-Analysis; Heuristic search techniques and Heuristic for problem solving.	6
3	**Game Playing**: AND-OR (AO) graph search; Game trees and associated searching techniques; Minimax and alpha-beta pruning; Some case studies.	4
4	**Knowledge representation and inferencing**: Procedural and deductive approaches; Production system formalism; Predicate logic (first and second order); Rule based systems; Semantic nets; Conceptual dependencies; Conceptual graph; Frames; Scripts and associated inferencing mechanisms; Resolution in predicate logic; Unification; Question answering; Natural deduction and Theorem proving; Forward and backward deduction.	8
5	**Different techniques for reasoning under uncertainity**: Monotonic and non-monotonic reasoning; Constraint satisfaction problem.	4
6	**Rule based systems and expert systems**: Domain exploration; Meta language; Expertise transfer; Self-explaining systems; Case studies: DENDRAL, MYCIN.	4
7	**Introduction to Neural Networks**: Definition and representation of artificial neuron and its analogy with Biological neuron; Basic concept of three-layer-net and learning by error back-propagation; Basic properties of Arificial Neural Net (ANN).	6
8	**LISP and PROLOG**: Basic syntax and semantics of LISP and PROLOG; AI Programming in LISP and PROLOG.	4

Text Books:

1. Principles of Artificial Intelligence – N. J. Nilsson, Springer-Verlag, 1980
2. Artificial Intelligence 2ndEd – E Rich and K Knight, Tata McGraw-Hill, 1991
3. Introduction to Artificial Intelligence and Expert Systems – Patterson
4. Common LISP: A Tutorial – Milner, PHI, 1988
5. Programming in PROLOG – W. F. Clockshin and C. S. Mellish, Narosa Publishing House
6. Micro-Prolog – K. L. Clark and F. G. McCabe, PHI, 1987
7. Expert System Programming in Turbo-Prolog – Marcellus, PHI

Syllabus for VLSI Signal Processing (EE813)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction to DSP System**: Typical DSP algorithms, DSP application demands and scaled CMOS technology, Representation of DSP algorithms. **Iteration Bound**: Data-flow graph representations, Loop bound and iteration bound, Algorithms for computing iteration bound, Iteration bound of multirate data-flow graphs.	8
2	**Pipelining and Parallel Processing**: Pipelining of FIR digital filters, Parallel processing, Pipelining and parallel processing for low power.	4
3	**Retiming**: Definitions and properties, Solving systems of inequalities, Retiming techniques. **Unfolding**: An algorithm for unfolding, Properties of unfolding, Critical path, unfolding and retiming, Applications of unfolding. **Folding**: Folding transformation, Register minimization techniques, Register minimization in folding architectures, Folding of multirate systems.	12
4	**Systolic Architecture Design**: Systolic array design methodology, FIR systolic arrays, Selection of scheduling vector, Matrix-matrix multiplication and 2D systolic array design, Systolic design for space representations containing delays.	6
5	Scaling and round off noise; Digital lattice filter structures; **Bit-Level Arithmetic Architecture**: Parallel multipliers, Interleaved floor-plan and bit-plane-based digital filters, Bit-serial multipliers, Bit-serial filter design and implementation, Canonic signed digit arithmetic, Distributed arithmetic; Bit level arithmetic architecture; Redundant arithmetic.	6
6	Numerical strength reduction – Synchronous, Wave and Asynchronous pipe lines; Low power design; **Programmable Digital Signal Processors**: Evolution of programmable digital signal processors, Important features of DSP processors, DSP processors for	4

mobile and wireless communications, Processors for multimedia signal processing.

Text Books:

1. VLSI Digital Signal Processing Systems, Design and Implementation - K. K. Parhi, Wiley Interscience, New Delhi, 1999.
2. VLSI Digital Signal Processing Systems: Design and Implementation - K. P. Keshab, Jacaranda Wiley, 1999.
3. Digital Signal Processing in VLSI - Richard J, Higgins, Prentice Hall.
4. VLSI Design Methodology for DSP Architectures - M.A. Bayoumi, Kluwer, 1994.
5. Analog VLSI signal and information processing - Mohammad Isamail and Terri Fiez, McGraw-Hill
6. VLSI and Modern Signal Processing - S.Y. Kung, H.J. White House, T. Kailath, Prentice Hall, 1985.

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Syllabus for High Voltage Direct Current Transmission (EE814)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**DC Power Transmission Technology**: Introduction; Comparison of AC and DC transmission; Application of DC transmission; Description of DC transmission system planning for HVDC transmission; Modern trends in DC transmission.	10
2	**Analysis of HVDC Converters**: Pulse number; Choice of converter configuration; Simplified analysis of Graetz circuit; Converter bridge characteristics; Characteristics of a twelve pulse converter; Detailed analysis of converters.	8
3	**Converter and HVDC System Control**: General principles of DC link control; Converter control characteristics; System control hierarchy; Firing angle control; Current and Extinction angle control; Starting and Stopping of DC link; Power control; Higher level controllers; Telecommunication requirements.	8
4	**Harmonics and Filters**: Introduction-generation of harmonics; Design of AC filters; DC filters; Carrier frequency and Radio Interference (RI) noise.	6
5	**Simulation of HVDC Systems**: Introduction to System Simulation; Philosophy and tools of HVDC system simulation; Modeling of HVDC systems for digital dynamic simulation.	8

Text Books:

1. HVDC power transmission system, 1stEd – K. R. Padiyar, Wiley Eastern Limited, New Delhi, 1990.

2. Power System Stability and Control - P. Kundur, Tata McGraw-Hill Publishing Company Ltd., USA, 1994.

3. High Voltage Direct Current Transmission – J. Arrillaga, Peter Pregrinus, London, 1983.

References:

1. Direct Current Transmission, Vol. I - Edward Wilson Kimbark, Wiley Interscience, New York, London, Sydney, 1971.

2. Extra High Voltage AC Transmission Engineering - Rakosh Das Begamudre, New Age International (P) Ltd., New Delhi, 1990.

8th Semester BE (E)

Syllabus for **Elective V & VI**: Power Plant Instrumentation(IN801)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	**Introduction to power plant** : Indian energy scenario; Only principles & working of---Hydroelectric, Nuclear, Gas turbine plants; Safety aspect; Significance of Instrumentation in Power Plants.	6
2	**Combined operation of different power plants :** Introduction; Advantages of combined working; Load division between plants; Storage type Hydro-electric power plant in combination with steam plant; Coordination of Hydro-electric and Gas turbine station; Coordination of Hydro-electric and Nuclear station.	8
3	**Instrumentation and control in power plants :** Importance of measurement and instrumentation in power plant; Measurement of--- water purity, gas analysis, oxygen, carbon-di-oxide, moisture etc; Nuclear measurement; Control for—boiler, condenser, steam heater, pumps, compressor, generator cooling system; Control in nuclear plants.	8
4	**Turbine monitoring and control** : Turbine supervisory system for monitoring of Mechanical parameters--- speed, vibration, eccentricity etc; Turbine trip condition	4
5	**Auxiliaries in power plants**: Blowers; Precipitator; Oil automation system; Water treatment plant; Cooling towers ; ID, FD fans; Economisers ; Air preheater ; Superheater etc.	6
6	**Instrumentation for Transmission** Instrumentation schemes used for HVDC & EHVAC transmission systems. Energy management: Electronic instrumentation schemes adopted for energy conservation and energy audit.	8

LABORATORY/ FIELD EXPERIENCES (Suggested)

1. Preparation of layout of instrumentation and control schemes in a power plant
2. Study of computerized load dispatch system
3. Study of instrumentation scheme for HVDC & EHVAC transmission systems.
4. Study of computer control scheme for data acquisition and supervisory control ofa power plant.
5. Case study of an energy audit in a small/medium industry.

BOOK RECOMMENDED

1. Economic Control of Interconnected Systems, L.K. Kirchmeyar, John Wiley, NewYork, 1958.
2. Electric Energy Systems Theory: An Introduction, O.I. Elgerd, 2nd Edn TataMcGraw Hill, New Delhi ,1982.
3. Power system stability and control: Anderson and Fouad, Galgotia publications,New Delhi, 2003.
4. Economic scheduling; S. Mukhopadhyay, Wiley Eastern

8th Semester BE (E)

Syllabus for **Elective V & VI**:

Optoelectronics & Optical Communication Engineering(IN805)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1.	**Introduction: Optical Fiber:** Structures, Wave guiding and Fabrication- Nature of light, Basic optical laws and Definition, Optical fiber modes and Configuration, Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber optic cables, Basic Optical Communication System, Advantage of Optical Communication System.	6
2.	**Attenuation in Optical Fibers:** Introduction, Absorption, scattering, Very Low Loss Materials, All Plastic & Polymer-Clad-Silica Fibers. **Wave Propagation:** Wave propagation in Step-Index & Graded Index Fiber, Overall Fiber Dispersion-Single Mode Fibers, Multimode Fibers, Dispersion-Shifted Fiber, Dispersion, Flattened Fiber, Polarization.	8
3.	**Sources & Detectors:** Design of LED's for Optical Communication and their types, Semiconductor Lasers for Optical Fiber Communication System and their types, Semiconductor Photodiode Detectors, Avalanche Photodiode Detector & Photo multiplier Tubes. Source to fiber power launching-Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling. Optical detectors-Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.	12
4.	**Optical Fiber Communication Systems:** Data Communication Networks–Network Topologies, Mac Protocols, Analog System. Advanced Multiplexing Strategies–Optical TDM, Sub carrier Multiplexing, WDM Network. Architectures: SONET/SDH. Optical Transport Network, Optical Access Network, Optical Premise	8

Network. **Applications**-Military Applications, Civil, Consumer & Industrial Applications.

5. **Optical Fiber Sensors**: Introduction, Fiber optic sensor for industrial applications, Displacement, Pressure, Acceleration, Force, Velocity and Flow sensor, Fiber optic Voltage and current sensor. 6

Texts

1. J. Gowar, "Optical Communication System", IEEE Press – 2nd Edition.
2. R.P.Khare, "Fiber Optics and Opto Electronics", Oxford Publication
3. C. K. Sarkar, D. C. Sarkar, "Optoelectronics and Fiber Optics Communication", New Age International Publishers
4. John M. Senior, "Optical Fiber Communications", Pearson, 3rd Edition, 2010.
5. Culshame and Dakim, "Optical Fiber sensors".
6. P. Bhattacharjee, "Semiconductor Optoelectronics", PHI.
7. Wilson and Hawkas, "Optoelectronics and Introduction", PHI.
8. A. Ghatak, K. Thyagarajan, "An Introduction to Fiber Optics", Cambridge University Press.
9. G. P. Agrawal, Fiber optic Communication Systems, John Wiley & sons, New York, 1992

Syllabus for Elective I & II: Illumination Engineering (EE 814)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
1	Radiation & Colour (2 Lectures) Eye & Vision (2 Lectures) Different Entities of Illuminating Systems (2 Lectures) Light sources: Daylight, Incandescent Lamps, Halogen Lamps, Discharge Lamps, HID Lamps, High Pressure Mercury Vapor Lamps, Metal Halide Lamps, High Pressure Sodium Lamps, Xenon Lamps, Fluorescent Lamps, Linear Fluorescent Lamps, Compact Fluorescent Lamps (CFLs), LEDs (Light-Emitting Diodes), Common Lamp Luminances, Common Lamp Efficacies and LASERs, Phosphors, Ballasts, Start Modes, Lamp life issues, Life enhancement, High efficiency lamps – (4 Lectures)	10
2	Basic Radiometric and Photometric Quantities, Spectral Response, Solid Angle, Radiant and Luminous Energy and Energy Density, Radiant and Luminous Flux, Spectral Luminous Efficacy, Radiant Exitance, Irradiance (Radiant Incidence), Illuminance, Radiance and Luminance, Radiant and Luminous Intensity, Basic Radiometric and Photometric Measurement, Laws of illumination: The Inverse Square Law, Lambert's Cosine Law, Lambertian Emission and Reflection; Illumination from Point, Line and Surface Sources – (2 Lectures) Photometry and Spectrophotometry; Photocells – (2 Lectures) Environment and Glare – (2 Lectures.)	6
3	Luminaries; Wiring; Switching & Control Circuits – (3 Lectures)	3

4	General Illumination Design – (2 Lectures) Interior Lighting – Industrial, Residential, Office Departmental Stores, Indoor Stadium, Theatre and Hospitals – (4 Lectures) Exterior Lighting- Flood, Street, Aviation and Transport Lighting, Lighting for Displays and Signaling - Neon Signs, LED-LCD Displays Beacons and Lighting for Surveillance – (4 Lectures)	10
5	Utility Services for Large Building/Office Complex & Layout of Different Meters and Protection Units, Symbols & Abbreviations – (3 Lectures) Optical Modeling: Ray Tracing: Sequential Ray Tracing, Nonsequential Ray Tracing, Computer Modeling Design Steps – (2 Lectures) Energy Consideration of using Sunlight; Sunlight Characteristics; Daylight Design Configurations, Considerations and Effect –Bright Llight; Overcast, Sky and Side Lighting, Daylight factor method – (1 Lecture) Different Type of Loads and Their Individual Protections – (2 Lecture) Selection of Cable/Wire Sizes; Potential Sources of Fire Hazards and Precautions; Emergency Supply – Stand-by & UPS – (3 Lectures)	11

Reference:

1. Illumination Fundamentals - Alma E F Taylor, Rensselaer Polytechnic Institute, 2000.

2. Illumination Engineering from Edison's Lamp to the Laser 2ndEd - Joseph B Mtndoch, 1994.

3. IESNA Lighting Handbook 8thEd, 1993.

4. NPTEL Video Lectures by **Prof. N. K. Kishore**, Department of Electrical Engineering, Indian Institute of Technology, Kharagpur-721302, West Bengal.

8th Semester BE (E)

Syllabus for Electrical System Installation & Professional Practice (EE 815)

L-3 T-0 P-0 C-3

Md No.	Contents	No. of Lecture Hrs.
	Electrical System Installation, Commissioning and Testing	
1	**Transformers** a) **Installation**: Location & site; Foundation; code of practice for terminal plates; polarity & phase sequence; Oil tanks; Drying of windings with & without oil; General inspection. b) **Commissioning Tests**: Voltage ratio; Earthing resistance; Oil strength; Buchholz & other relays; Tap changing gear; Fans & pumps: Insulation tests; Impulse test; Load & temperature rise tests. c) **Specific Tests**: Determination of performance & efficiency.	10
2	**Induction Motors** a) **Installation**: Location of motor & control apparatus; Foundation & lavelling; Shaft alignment for various coupling; Drying out of windings. b) **Commissioning Tests**: Mechanical tests for alignment; Air-gap symmetry; bearings; Vibrations & balancing. Electrical tests- Insulation test; Earthing; High voltage test; Starting up; Ability to speed up and take load. c) **Type & Routine Tests**: In accordance with ISI Test code. d) **Specific Tests**: Performance & temperature rise tests; stray load losses; shaft currents. e) Maintenance Schedule.	10
3	**Synchronous Machines** a) **Installation**: Physical inspection & alignment check; excitation system; cooling & control gear; Drying out. b) **Commissioning Tests**: Insulation resistance; Resistance of armature & field windings; Polarity & phase sequence; Shaft current; Waveform & telephone interference factor; over speed test; Line charging capacity.	12

c) **Performance Tests**: Various tests to estimate the performance for generator and motor operation; Sudden short circuit tests and transient and sub-transient parameters; measurement of sequence impedances; separation of losses; Retardation test; temperature rise test.

d) **Factory Tests**: Gap length; Magnetic centrity ; Balancing; Vibration; Bearing currents; Electrical tests.

4	**Estimating and Costing**	4
5	**Professional Practice**	4

Text Books:

1) Design & Testing of Elect. Machines - M. V. Deshpande, Wheeler
2) Elect. Installation Works 6th Ed 1996 – T. G. Francis and R. J. Cooksley, Longman Higher Education, ELBS
3) Electrical Installation and Workshop Technology (Vol-1 & 2) 4th Ed 1992 - F. G. Thompson, Longman Higher Education, ELBS
4) Installation, Commissioning & Maintenance of Electrical Equipment – P. P. Gupta, Dhanpat Rai Publications
5) Installation, Commissioning & Maintenance of Electrical Equipment 2013 - Tarlok Singh, S. K. Kataria & Sons
6) Testing, Commissioning, Operation & Maintenance Of Electrical Equuipments 2016 – S. Rao
7) A Course in Electrical Installation Estimating and Costing 2013 – J. B. Gupta, S. K. Kataria & Sons
8) Electrical Wiring Estimating & Costing 2008 – S. L. Uppal, Khanna Publishers
9) Electrical Substation Engineering & Practice: EHV-HVDC & SF-GIS (Principle, Practice, Design and Reference Data) 2003 – Sumathi Rao, Khanna Publishers
10) Electrical Workshop: Safety, Commissioning, Maintenance & Testing of Electrical Equipment 3rd Ed 2012 – R. P. Singh, I K International Publishing House Pvt. Ltd