J. S. University, Shikohabad

B.Tech

2^{nd} , 3^{rd} & 4^{th} Year

(Electrical Engineering)

SCHEME

&

SYLLABUS

[Effective from the session 2015-16]

STUDY AND EVALUATION SCHEME FOR

B.Tech. (Electrical Engineering)

SEMESTER - III

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTAS-31	Engg. Mathematics-III	4	1	-	-	50	100	150	3
2	BTME-35	Thermal & Hydraulic Machines	4	1	-	-	50	100	150	3
3	BTEE-31	Electro-Mechanical Energy Conversion–I	4	1	-	-	50	100	150	3
4	BTEE-32	Electrical Measurement & Measuring Instruments	4	1	-	-	50	100	150	3
5	BTEE-33	Basic System Analysis	4	1	-	-	25	50	75	2
6	BTIP-31	Industrial Psychology	4	1	-	-	25	50	75	2
7	BTAC-31	Human Value & Professional Ethics*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTME-35P	Thermal & Hydraulic Machines Lab	-	-	2	-	20	30	50	2
9	BTEE-31P	Electromechanical Energy Conversion- I Lab	-	-	2	-	20	30	50	2
10	BTEE-32P	Electrical Measurement Lab	-	-	2	-	20	30	50	2
11	BTCS-33P	Numerical Technique Lab	-	-	2	-	20	30	50	2
12	BTGD-30	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Human values & Professional Ethics will be offered as a compulsory audit course for which passing
Marks are 30% in End Semester Examination and 40% in aggregate.

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.

STUDY AND EVALUATION SCHEME FOR

B.Tech (Electrical Engineering).

SEMESTER - IV

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-41-BTOE-49	Science Based Open Elective	4	1	-	-	50	100	150	3
2	BTEE-41	Analog & Digital Electronics	4	1	-	-	50	100	150	3
3	BTEE-42	Electro-Mechanical Energy Conversion–II	4	1	-	-	50	100	150	3
4	BTEE-43	Network Analysis and Synthesis	4	1	-	-	50	100	150	3
5	BTEE-44	Instrumentation & Process Control	4	1	-	-	25	50	75	2
6	BTIS-41	Industrial Sociology	4	1	-	-	25	50	75	2
7	BTAC-41	Cyber Security*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTEE-41P	Electronics Lab	-	-	2	-	20	30	50	2
9	BTEE-42P	Electro-Mechanical Energy Conversion – II Lab.	-	-	2	-	20	30	50	2
10	BTEE-43P	Network Lab	-	-	2	-	20	30	50	2
11	BTEE-44P	Electrical Instrumentation Lab	-	-	2	-	20	30	50	2
12	BTGD-40	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester
Examination and 40% in aggregate.

List of Open Electives for B. Tech. Courses

SCIENCE BASED OPEN ELECTIVE

BTOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
BTOE-042	Nano Sciences
BTOE-043	Laser Systems and Applications
BTOE-044	Space Sciences
BTOE-045	Polymer Science & Technology
BTOE-046	Nuclear Science
BTOE-047	Material Science
BTOE-048	Discrete Mathematics
BTOE-049	Applied Linear Algebra

STUDY AND EVALUATION SCHEME FOR

B.Tech (Electrical Engineering).

SEMESTER - V

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTEE-51	Elements Of Power System	4	1	-	-	50	100	150	3
2	BTEE-52	Power Electronics	4	1	-	-	50	100	150	3
3	BTEC-53	Microprocessor	4	1	-	-	50	100	150	3
4	BTEC-54	Control System-I	4	1	-	-	50	100	150	3
5	BTEC-56	Fundamentals of E.M. Theory	4	1	-	-	25	50	75	2
6	BTMB-51	Engineering Economics	4	1	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
7	BTEE-52P	Power Electronics Lab	-	-	2	-	20	30	50	2
8	BTEC-54P	Control System Lab	-	-	2	-	20	30	50	2
9	BTEE-53P	Simulation Based Minor Project	-	-	2	-	20	30	50	2
10	BTEC-53P	Microprocessors Lab	-	-	2	-	20	30	50	2
11	BTGD-50	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

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(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilized for revision etc.

STUDY AND EVALUATION SCHEME FOR

B.Tech (Electrical Engineering).

SEMESTER - VI

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTEE-61	Power System Analysis	4	1	-	-	50	100	150	3
2	BTEE-62	Switchgear & Protection	4	1	-	-	50	100	150	3
3	BTEE-63	Special Electric Machine	4	1	-	-	50	100	150	3
4	BTEC-66	Fundamentals of Digital Signal Processing	4	1	-	-	50	100	150	3
5	BTEE-64	Conventional & CAD of Electrical Machines	4	1	-	-	25	50	75	2
6	BTMB-61	Industrial Management	4	1	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTEE-61P	Power System Lab	-	-	2	-	20	30	50	2
9	BTEE-64P	Electrical CAD Lab	-	-	2	-	20	30	50	2
10	BTEE-65P	Minor Project	-	-	2	-	20	30	50	2
11	BTEE-66P	Seminar	-	-	2	-	50	-	50	2
12	BTGD-60	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilized for revision etc.

STUDY AND EVALUATION SCHEME FOR

B.Tech (Electrical Engineering).

SEMESTER - VII

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-71	Quality Management	4	1	-	-	50	100	150	3
2	BTEE-71	Electric Drives	4	1	-	-	50	100	150	3
3	BTEE-72	Analog & Digital Communication	4	1	-	-	50	100	150	3
4	BTEE-73	Power Station Practice	4	1	-	-	50	100	150	3
5	BTEE-74	Power System Operation and Control	4	1	-	-	50	100	150	3
PRACTICA/DRAWING SUBJECTS										
8	BTEE-71P	Electric Drives Lab	-	-	2	-	20	30	50	2
9	BTEE-72P	ADC Lab		-	2	-	20	30	50	2
10	BTEE-73P	Industrial Training & Viva	-	-	2	-	50	-	50	2
11	BTEE-74P	Project	-	-	2	-	50	-	50	2
12	BTGD-70	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

STUDY AND EVALUATION SCHEME FOR

B.Tech (Electrical Engineering).

SEMESTER - VIII

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-81	Non Conventional Energy Resources	4	1	-	-	50	100	150	3
2	BTEE-81	Electrical & Electronics Engineering Materials	4	1	-	-	50	100	150	3
3	BTEE-82	Utilization of Electrical Energy and Traction	4	1	-	-	50	100	150	3
4	BTEE-83	Power Quality	4	1	-	-	50	100	150	3
PRACTICA/DRAWING SUBJECTS										
8	BTEE84P	Project	-	-	2	-	100	250	350	3
12	BTGD-80	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.

SEMESTER- III

Engg. Mathematics-III

Unit – I: Function of Complex variable

Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy'sintegral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities,Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type

Unit – II: Integral Transforms

Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems,Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensionalheat transfer equations, wave equations and Laplace equationsZ- transform and its application to solve difference equations.

Unit – III: Statistical Techniques

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of leastsquares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non – linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests ofsignifications: Chi-square test, t-test

Unit – IV: Numerical Techniques – I

Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi methodand Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's andNewton's divided difference formula for unequal intervals**.**

Unit – V: Numerical Techniques –II

Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss-Seidal method.Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third andthree-eight rules,Solution of ordinary differential equations (first order,second order and simultaneous) byEuler's, Picard's and fourth-order Runge- Kutta methods.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.

2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House,.

2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.

THERMAL AND HYDRAULIC MACHINES

UNIT-I :
Thermodynamic equilibrium, cyclic process, enthalpy, Zero, first and second laws of thermodynamics,
Carnot cycle, concept of entropy, properties of steam, processes involving steam in closed and open systems, Enthalpy.
Vapour Pressure Cycles: Rankine cycle, reheat cycle, Regenerative cycle

UNIT-II:
Steam Turbine: Theoretical approach only of Classification, impulse and reaction turbines their velocity diagrams and related calculations, work done and efficiencies, re-heat factor, staging, bleeding and governing of turbines**.**
Gas Turbine: Theoretical approach only of Classification, Brayton cycle, working principle of gas turbine,
gas turbine cycle with intercooling, reheat and regeneration, stage and polytrophic efficiencies**.**

UNIT-III:
Otto, Diesel .and Dual cycles, introduction to 2-stroke and 4-stroke SI and CI engines

UNIT-IV
Impact of Jet: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve).
Hydraulic Turbines: Classification, heads and efficiencies, construction, working, work done and efficiency of impulse turbines.

UNIT-V
Centrifugal Pump: Classification, construction, working.
Reciprocating Pump: Classification ,construction, working.

Text Books:
1. Onkar Singh "Applied Thermodynamics" New Age International, 2006.
2. Steam & Gas Turbine by R.Yadav, CPH Allahabad
3. R.K.Rajput" A Text Book of Hydraulic Machines" S. Chand & Co.,2008.
Reference Books:
4. P.L.Ballany "Thermal Engineering " Khanna Publishers, 2003
5. R.K.Bansal "A Text Book of Fluid Mechanics and Hydraulic Machines" Laxmi Publications, 2006.
6. Gas Turbine, by V. Ganeshan, Tata McGraw Hill Publishers.

ELECTRO-MECHANICAL ENERGY CONVERSION –I

Unit – I
Principles of Electro-mechanical Energy Conversion- Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems (defining energy & Co-energy), Singly excited systems; Determination of mechanical force, Mechanical energy, Torque equation, Doubly excited Systems; Energy stored in magnetic field, Electromagnetic torque , Generated emf in machines; Torque in machines with cylindrical air gap.

Unit – II
D.C. Machines- Construction of DC Machines, Armature winding, Emf and torque equations, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of D.C. generators.

Unit –III

D.C. Machines (Contd.)- Performance characteristics of D.C. motors, Starting of D.C. motors; 3 point and 4 point starters, Speed control of D.C. motors; Field control, Armature control and Voltage control (Ward Lenonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

Unit – IV

Single Phase Transformer- Phasor diagram, Efficiency and voltage regulation, All day efficiency.
Testing of Transformers- O.C. and S.C. tests, Sumpner's test, Polarity test.
Auto Transformer- Single phase and three phase auto transformers, Volt-amp relation, Efficiency, Merits & demerits and applications.

Unit – V

Three Phase Transformers - Construction, Three phase transformer, Phasor groups and their connections, Open delta connection, Three phase to 2 phase, 6 phase or 12 phase connections and their applications, Parallel operation of single phase and three phase transformers and load sharing, Excitation phenomenon and harmonics in transformers, Three winding transformers.

Text Books:

1 I.J. Nagrath & D.P.Kothari, " Electrical Machines", Tata McGraw Hill
2 Husain Ashfaq , " Electrical Machines", Dhanpat Rai & Sons
3 P.S.Bimbhra, "Electrical Machinery", Khanna Publisher

Reference Books:

4 Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
5 M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.

ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

UNIT I

(1) Philosophy of Measurement- Methods of measurement, Measurement system**,** Classification of instrument systems, Characteristics of instruments & measurement systems**,** Errors in measurement & its analysis, Standards.
(2) Analog Measurement of Electrical Quantities- Electrodynamic, Thermocouple, Electrostatic & Rectifier type ammeters & voltmeters, Electrodynamic wattmeter, Three Phase wattmeter, Power in three phase systems, Errors & remedies in wattmeter and energy meter.

UNIT II

Instrument Transformers:CT and PT; their errors, Applications of CT and PT in the extension of instrument range, Introduction to measurement of speed, frequency and power factor.

UNIT III

Measurement of Parameters- Different methods of measuring low, medium and high resistances**,** measurement of inductance & capacitance with the help of AC Bridges, Q meter.

UNIT IV

(1) AC Potentiometers- Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement.
(2) Magnetic Measurement- Ballistic galvanometer, Flux meter**,** Determination of hysteresis loop, measurement of iron losses**.**

UNIT V

(1) Digital Measurement of Electrical Quantities- Concept of digital measurement, Block diagram, Study of digital voltmeter, Frequency meter, *Spectrum analyzer,* Electronic multimeter.

(2) Cathode Ray Oscilloscope- Basic CRO circuit (block diagram), Cathode Ray Tube (CRT) & its components**,** Applications of CRO in measurement, Lissajous Pattern, Dual trace & dual beam oscilloscopes.

Text Book:

1. E. W. Golding & F. C. Widdis, "Electrical Measurement &Measuring Instrument", A. W. Wheeler & Co. Pvt. Ltd. India
2. A. K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH

Reference Books:

4. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
5. M. B. Stout , "Basic Electrical Measurement", Prentice Hall of India

BASIC SYSTEM ANALYSIS

UNIT I

Introduction to Continuous Time Signals and Systems- Basic continuous time signals, Unit step, Unit ramp, Unit impulse and periodic signals with their mathematical representation and characteristics. *Inversion, Shifting and Scaling of signals,* Introduction to various types of systems, *Causal, Stable, Linear and Time invariant systems.*

Analogous System- Linear mechanical elements, Force-voltage and force-current analogy, Modeling of mechanical and electro-mechanical systems.

UNIT II

Fourier Transform Analysis- Exponential form and *compact* trigonometric form of Fourier series, Fourier symmetry, Fourier Transform: Properties, Applications to network analysis.

UNIT III

Laplace Transform- Review of Laplace Transform, Initial and Final Value theorems, Inverse Laplace Transform, Convolution theorem, Application of Laplace Transform to analysis of networks, Waveform synthesis and Laplace Transform of complex waveforms.

UNIT IV

State – Variable Analysis- Introduction, State Space representation of linear systems, Transfer Function and State Variables, State Transition Matrix, Solution of State Equations for homogeneous and non-homogeneous systems, Applications of State-Variable technique to the analysis of linear systems.

UNIT IV

Z-Transform Analysis- Concept of Z-Transform, Z-Transform of common functions, Inverse Z Transform, Initial and Final Value theorems, Applications to solution of difference equations, Pulse Transfer Function.

Text Books:

1. Oppenhiem, Wilsky, Nawab, "Signals & Systems", PHI
2. M E Van-Valkenberg; " Network Analysis", Prentice Hall of India
3. A. Anand Kumar, " Signals & Systems", PHI
4. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.

Reference Books:

5. David K. Cheng; "Analysis of Linear System", Narosa Publishing Co
6. Donald E. Scott, "Introduction to circuit Analysis" Mc. Graw Hill
7. B. P. Lathi, "Linear Systems & Signals" Oxford University Press, 2008

[BTIP-31] Industrial Psychology

Unit-I

Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments

Unit-II

Individual in Workplace Motivation and Job satisfaction , stress management. Organizational culture, Leadership & group dynamics.

Unit-III

Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

Unit –IV

Performance Management : Training & Development.

References :

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.

2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.

3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A

4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill

[BTAC-31] Human Value & Professional Ethics

Module-1

Course introduction, Needs Basic guidelines

1 Understand the need , basic , guidelines content for process value education.
2. Self Exploration what is it? It content and process, Natural Acceptence and experiential Validation as the mechanism for self exploration.
3 Continues happiness and Prosperty- A look at continues human Aspiration.
4 Understanding Happiness and Prosperty correctly- A critical appraisal of the current senerio.
5 Method to fulfilled the human aspiration

Module -2

Understanding Harmony in human Being (Harmony in Myself)

1. Understanding Harmony as a co – existence of the sentient I and the Material Body.
2. Understanding the need of self (I) and body sukh and suvidha.
3. Understanding the body of an instrument of I (being Doar, seer and enjoyer.
4. Understanding the Charactersticks and activities of (I)

Module -3

Understanding harmony in the Family and Society

1. Understanding harmony in the Family and basic unit of Human interaction.
2. Understanding values in human – Human relationship meaning of nayaya and program for the fulfillment of ensure abhay and tripti.
3. Understanding the meaning of Vishvas difference between intension and competence.
4. Understanding the Harmony in the society (society being an Extension of family - samadhan , Samriddi , Abhay,sahastitva and comprehension of Human goals.

Module -4

Understanding the harmony in the Nature and existence – whole Existence as Co-existence.

1 Understanding the harmony in the Nature.
2 Interconnectedness and mutual fulfillment among the four order of Nature – recyclability ,and self regulation in nature.
3 Holistic prception of Harmony at all levels of existence.

Module – 5 Implication of the above Holistic understanding of Harmony on professional ethics.

1 Natural acceptance of human values.
2 Deffinativeness of ethical human conduct.
3 Basic for humanistic education. Humanstick constitution and human universal order.
4 Case studies of typical holistic technologies , Management model and Production system.
5 Strategy for transition from the presnt stage of universal order.
A - At the level of individual : as socialy and ecologically responsible engineers technologist and manager.
B- At the Level of Society as mutually enriching institution and organisations

ELECTROMECHANICAL ENERGY CONVERSION- I LAB

Note : Minimum eight experiments are to be performed from the following list:

1 To obtain magnetization characteristics of a d.c. shunt generator.
2 To obtain load characteristics of a d.c. shunt generator and compound generator
(a) Cumulatively compounded (b) Differentially compounded.
3 To obtain efficiency of a dc shunt machine using Swinburn's test.
4 To perform Hopkinson's test and determine losses and efficiency of DC machine.
5 To obtain speed-torque characteristics of a dc shunt motor.
6 To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control
7 To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/Static Ward –Leonard method.
8 To study polarity and ratio test of single phase and 3-phase transformers.
9 To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using C.C. and S.C. tests.
10 To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.
11 To obtain 3-phase to 2-phase conversion by Scott connection.
12 To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O.

ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS LAB

Note : Minimum eight experiments are to be performed from the following list:

1. Calibration of ac voltmeter and ac ammeter.
2. Measurement of form factor of a rectified sine wave and determine source of error if r.m.s.value is measured by a multi-meter.
3. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.
4. Measurement of power and power factor of a single phase inductive load and to study effect of capacitance connected across the load on the power factor.
5. Measurement of low resistance by Kelvin's double bridge.
6. Measurement of voltage, current and resistance using dc potentiometer.
7. Measurement of inductance by Maxwell's bridge.
8. Measurement of inductance by Hay's bridge.
9. Measurement of inductance by Anderson's bridge.
10. Measurement of capacitance by Owen's bridge.
11. Measurement of capacitance by De Sauty bridge.
12. Measurement of capacitance by Schering bridge.
13. Study of frequency and differential time counter.

NUMERICAL TECHNIQUE LAB

Note: Minimum eight experiments are to be performed from the following list:
S/W Based Experiments using MATLAB or Equivalent software.

1. Solution of linear equations for under damped and over damped cases.
2. Determination of Eigen values and eigenvectors of a square matrix.
3. Determination of roots of a polynomial.
4. Determination of polynomial using method of least square curve fitting.
5. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
6. Solution of differential equations using 4th order Runge-Kutta method.
7. Solution of differential equation using revised Euler method.
8. Solution of difference equations.
9. Determination of time response of an R-L-C circuit.

Thermal & Hydraulic M/c Lab

Experiments : Minimum 10 experiments out of following:

1. Study and working of Two stroke petrol Engine
2. Study and working of Four stroke petrol Engine
3. Study and working of two stroke Diesel Engine
4. Study and working of four stroke Diesel Engine.
5. Study of compounding of steam turbine
6. Study of Impulse & Reaction turbine
7. Impact of Jet experiment.
8. Turbine experiment on Pelton wheel.
9. Turbine experiment on Francis turbine.
10. Turbine experiment on Kaplan turbine.
11. Experiment on Reciprocating pump.
12. Experiment on centrifugal pump.

SEMESTER- IV

ANALOG AND DIGITAL ELECTRONICS

ANALOG ELECTRONICS:
UNIT-I:
Special Diodes-
LED, Varactor diode, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications.
Transistors as a switch.

UNIT-II
Frequency Response:
Amplifier transfer function, low and high frequency response of common emitter and common source
amplifiers.
Feedback:
General feedback structure; properties of negative feedback; series-series, series-shunt, shunt-series and
shunt-shunt feedback amplifiers.

UNIT-III:
Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, tuned oscillators-
Collpits and Hartley; Crystal oscillator

DIGITAL ELECTRONICS:
UNIT-IV
Combinational Logic Circuits: Multiplexers/Demultiplexures, Encoders/Decoders.
Sequential Logic Circuits: latches, flip-flops- S-R, T, D, J-K.
Shift Registers: Basic principle, serial and parallel data transfer, shift left/right registers, universal shift
register.
Counters: Mode N Counters, ripple counters, synchronous counters, ring/Johnson counters.

UNIT-V
OP-AMP applications - Astable, Monostable and Bistable multivibrators, Schmitt trigger, IC-555 Timer,
A/D and D/A converters.
Voltage Regulators: Series, shunt and switching regulators, op-amp based configurations.
Memories: Introduction to ROM, RAM; Sequential Memory, Memory organization.

Text Books:
1. A.S. Sedra and K.C. Smith "Microelectronics Circuits" Oxford University Press (India)
2. Malvino & Leach, "Digital Principles and applications" Tata Mc. Graw Hill
3. R.A. Gayakwad "Op amps and Linear Integrated Circuits" Prentice Hall of India.
4. Balbir Kumar and Shail B.Jain, "Electronic Devices and Circuits" Prentice Hall of India,2007
Reference Books:
1. Taub & Schilling "Digital Electronics"- Tata Mc Graw Hill
2. Anil K. Maini, "Digital Electronics: Principles and Integrated circuits" Wiley India Ltd, 2008.

ELECTRO-MECHANICAL ENERGY CONVERSION - II

UNIT - I

Synchronous Machine I - Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.

UNIT - II

Synchronous Machine II - Two reaction theory, Power flow equations of cylindrical and salient pole machines, Operating characteristics.

Synchronous Motor - Starting methods, Effect of varying field current at different loads, Vcurves, Hunting & damping, Synchronous condenser.

UNIT - III

Three phase Induction Machine – I

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque- slip characteristics, No load & blocked rotor tests, Efficiency, Induction generator & its applications.

UNIT - IV

Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed control (with and without emf injection in rotor circuit).

UNIT - V

Single phase Induction Motor - Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, Repulsion motor.

AC Commutator Motors - Universal motor, Single phase a.c. series compensated motor, Stepper motors.

Text Books:

1. D.P.Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw Hill
2. Ashfaq Hussain "Electric Machines", Dhanpat Rai & Company
3. Fitzerald,A.E.,Kingsley and S.D.Umans "Electric Machinery", MC Graw Hill.
4. P.S.Bimbhra, "Electrical Machinery", Khanna Publisher

Reference Books:

5. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers 6**.** M.G.Say, "Alternating Current Machines", Pitman & Sons

NETWORK ANALYSIS AND SYNTHESIS

Unit – I

Graph Theory- Graph of a network, Definitions, Tree, Co tree, Link, basic loop and basic cut set, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analyses.

Unit – II:

Network Theorems (Applications to AC Networks)- Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's theorem.

Unit – III

Transient Circuit Analysis- Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

Unit – IV

Network Functions- Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions.

Two Port Networks- Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Interconnections of two port networks, Ladder and Lattice networks: T & Π representation.

Unit – V

(a) Network Synthesis- Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters- Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. C. L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill
3. M. E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T. S. K. V. Iyer, "Circuit Theory", Tata McGraw Hill

ELECTRICAL INSTRUMENTATION AND PROCESS CONTROL

Unit-I

Transducer – I

Definition, Advantages of electrical transducers, Classification, Characteristics, Factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT, RVDT

Unit-II

Transducer – II

Capacitive, Piezoelectric, Hall effect and Opto electronic transducers. Measurement of motion, force, pressure, temperature, flow and liquid level.

Unit-III

Telemetry

General telemetry system, Land line & radio frequency telemetering systems, Transmission channels and media, Data receiver & transmitter.

Acquisition System

Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

Unit-IV

Display Devices and Recorders

Display devices, Storage oscilloscope, Spectrum analyzer, Strip chart & X-Y recorders, Magnetic tape & digital tape recorders.

Process Control

Principle, Elements of process control system, Process characteristics, Electronic, pneumatic & digital controllers.

Text Books:

1. A. K. Sawhney, "Advanced Measurements & Instrumentation", Dhanpat Rai & Sons
2. B.C. Nakra & K.Chaudhry, "Instrumentation, Measurement and Analysis", Tata Mc Graw Hill 2nd Edition.
3. Curtis Johns, "Process Control Instrumentation Technology", Prentice Hall

Reference Books:

4. E. O. Decblin, "Measurement System – Application & design", Mc Graw Hill.
5. W. D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International
6. Rajendra Prasad, "Electronic Measurement and Instrumentation Khanna Publisher

[BTIS-41] Industrial Sociology

Unit-I Industrial Sociology: Nature,Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organization in Industry- Bureaucracy,Scientific Management and Human Relations**.**

Unit-II Rise and Development of Industry: Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, The domestic or putting-out system,and the Factory system. Characteristics of the factory system.Causes and Consequences of industrialization.Obstacles to and Limitations of Industrialization**.**

Unit-III Industrialization in India: Industrial Policy Resolutions – 1956.Science.Technology andInnovation Policy of India 2013.

Unit-IV Contemporary Issues: Grievances and Grievance handling Procedure. Industrial Disputes:causes,Strikes and Lockouts.Preventive Machinery of Industrial Disputes:Schemes of Workers Participation in Management- Works Committee,Collective Bargaining, Bi-partite & Tri-partite Agreement,Code of Discipline,Standing Orders. Labour courts & Industrial Tribunals.

References :

1. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.
2. SCHNEIDER ENGNO V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.
3. MAMORIA C.B. And MAMORIA S., Dynamics of Industrial Relations in India.

[BTAC-41] Cyber Security

UNIT-1

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

UNIT-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion

Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce-Electronic Payment System, eCash,Credit/Debit Cards. Digital Signature, public KeyCryptography.

UNIT-3

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control,CCTV and intrusion Detection Systems, Backup Security Measures.

UNIT-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, PolicyReview Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement ofthe Policies.Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; ITAct 2000 Provisions,Intellectual Property Law: Copy Right Law, Software License, Semiconductor Lawand Patent Law.

References :

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3.Dr. Surya Prakash Tripathi, RitendraGoyal, Praveen kumar Shukla ,"Introduction to Information Security and
Cyber Law" Willey Dreamtech Press.

SCIENCE BASED OPEN ELECTIVES
[BTOE-41] INTRODUCTION TO SOFT COMPUTING (Neural Networks, Fuzzy Logic and Genetic Algorithm)

Unit-I : Neural Networks-1(Introduction & Architecture)
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions,Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.
Unit-II : Neural Networks-II (Back propagation networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back operation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.
Unit-III : Fuzzy Logic-I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.
Unit-IV : Fuzzy Logic –II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications&Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V : Genetic Algorithm(GA)

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:

3. SimanHaykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

[BTOE-42] NANO SCIENCES

UNIT -1 :

Introduction:

Difinition of Nano-Science and Nano Technology, Applications of Nano-Technology.

Introduction to Physics of Solid State:

Structure: Size dependence of properties; crystal structures, face cantered cubicnanoparticles; Tetrahedral bounded semiconductor structures; lattice vibrations.

Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energybands and gaps of semiconductors; effective masses; Fermi Surfaces.

Localized Particles: Acceptors and deep taps; mobility; Exactions.

UNIT-2

Quantum Theory For Nano Science:

Time dependent and time independent Schrodinger wave equations.Particle in a box, Potential step: Refelection and tunneling(Quantum leak). Penetration ofBarrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane(Nanosheet), Quantum confinerment effect in nano materials.

Quantum Wells, Wires and Dots

Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermigas;Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infraredetectors; Quantum dot laser Superconductivity.

Properties of Individual Nano particles

Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nanopraticles;geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters;Bulle to Nano structure.

Semi conducting Nanoparticles: Optical Properties; Photofragmentation; Coulmbicexplosion.

Rare Gas & Molecular Clusters: Inert gas clusters; Superfluid clusters molecularclusters.

UNIT-3

Growth Techniques of Nanomaterials:

Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glowdischarge, DC sputtering technique(p-$CuAlO_2$ deposition). Thermal evaporationtechnique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbonnano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecularbeam Epitoxy, Sol-Gel Techniuqe (No chemistry required), Synthesis of nanowires/rods,Electrodeposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid–Solid (VLS) method of nanowires.

UNIT -4

Methods of Measuring Properties:

Structure: Crystallography, particle size determination, surface structure,

Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM),Field Ion Microscopy, Scanning Electron Microscopy, Transmission ElecrtronMicroscopy (TEM)

Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magneticresonance, Optical and Vibrational Spectroscopy, Luninscence.

UNIT-5

Buckey Ball:
Nano structuresofcarbon(fullerene):
Carbon nano-tubes: Fabrication , structure. electrical, mechanical, and vibrationalproperties and applications.Nano diamond, Boron Nitride Nano-tubes, single elecron transistors, Moelcularmachine, Nano-Biometrics, Nano Robots.

Text/Reference Books:
1. C.P.Poole Jr F.J. Owens, "Introduction to Nanotechnology".
2. "Introduction to S.S. Physics" - (7th Edn.) Wiley 1996.

[BTOE-43] LASER SYSTEMS AND APPLICATIONS

UNIT-I & II
Introduction:
Review of elementary quantum physics, Schrodinger equation, concept of coherence,absorption, spontaneous emission and stimulated emission processes, relation betweenEinstein's A and B coefficients, population inversion, pumping, gain, optical cavities.
UNIT-III & IV
Lasers & Laser Systems:
Main components of Laser, principle of Laser action, introduction to general lasers andtheir types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular,excimer, liquid and solid state Lasers and systems, short pulse generation andMeasurement.
UNIT-V
Applications:
Laser applications in medicine and surgery, materials processing, opticalcommunication, metrology and LIDAR and holography.
Text/ Reference Books:
1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S. A. Ahmad, "Laser concepts and Applications" New Age Internati

[BTOE-44] SPACE SCIENCES

1. Introduction:
Introduction to space science and applications, historical development
2. Solar System:
Nebular theory of formation of our Solar System.Solar wind and nuclear reaction as the source of energy.
Sun and Planets: Brief description about shape size, period of rotation about axis andperiod of revolution, distance of planets from sun, Bode's law, Kepler's Laws ofplanetary motion, Newton's deductions from Kepler's Laws, Newton's Law ofgravitation, correction of Kepler's third law, determination of mass of earth,determination of mass of planets with respect to earth.Brief description of Asteroids, Satellites and Comets.
3. Stars:
Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation ofelements.
Classification of stars: Harvard classification system, Hertzsprung-Russel diagram,
Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, blackhole, star clusters, supernova and binary stars); Chandrasekhar limit.
4. Galaxies:
Galaxies and their evolution and origin, active galaxies and quasars.
5. Creation of Universe:
Early history of the universe, Big-Bang and Hubble expansion model of the universe,cosmic microwave background radiation, dark matter and dark energy.
Text Books / Reference Books:
1. K. S. Krishnaswami, "Astrophysics: A modern Perspective" New Age International.
2. K. S. Krishnaswami, "Understanding cosmic Panorama" New Age International.

[BTOE-45] POLYMER SCIENCE AND TECHNOLOGY

UNIT –I & II

POLYMERS:

Introduction, chemistry of polymer synthesis, polymer reaction kinetics, physical properties andcharacterization of polymers, effect of structure on properties of polymers, organic polymers.Introduction to high performance polymers and composites and their processing.

UNIT –III & IV

POLYMERIZATION:

Introduction, step-growth polymerization, free radical chain growth polymerization, emulsionpolymerization, ionic and cationic polymerization, chain statistics and rubber elasticity.

UNIT – UNIT –V & VI

PREPARATION AND APPLICATIONS:

Preparation, properties and technical applications of thermo-plastics (PVC, PVA), thermostats(PF, UF) and elastomers (SBR, GR-N), silicones.Application of polymers in space, ocean,electronics, medical, agriculture, automobile, sports and building construction.

[BTOE-46] NUCLEAR SCIENCE

UNIT-I

Nucleus and Its Basic Features:

Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and itsmeassurement, nuclear spin, nuclear magnetic and electrical moments.

UNIT-II

Nuclear Models:

Single particle model, liquid drop model and semi-emperical mass formula, nuclear potentialand shell model, collective model.

UNIT-III

Nuclear Reaction:

Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclearreaction, nuclear fission & binuclear fusion and their explanation by liquid drop model.

UNIT-IV

Nuclear Decay:

Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay,interaction of nuclear radiation with matter.

Nuclear Instruments-I

Mass spectrograph,: General principle, Aston's Mass Spectrograph.

UNIT-V

Nuclear Instruments-II

Accelerators: Van de Graph Generator, Cyclotron, Synchrotron.

Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production anddetection of neutrons and Gamma-photon.

Application of Nuclear Techniques: Nuclear magnetic resonance, positron emissiontopography, radiotracer techniques and applications in material science and agriculture.

Text Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. S.N. Ghosal, "Nuclear Physics" S. Chand & Co.

Reference Books:

6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.
7. W.E. Burcham, "Nuclear Physics" Longmans Publications.

[BTOE-47] MATERIAL SCIENCE

UNIT-I

Introduction: Historical perspective, importance of materials, Brief review of modern & atomicconcepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding.

Crystallography and imperfections:

Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packingfactor and density. Miller indices.X-ray crystallography techniques, imperfections, Defects &Dislocations in solids. .

UNIT-II

Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stressVs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing,Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT)

Micro Structural Exam: Microscope principle and methods, Preparation of samples andmicrostructure exam and grain size determination, comparative study of microstructure ofvarious metals and alloys, such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Uniary and Binary diagrams, Phase rules, Types ofequilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbonequilibrium diagram.

UNIT-III

Ferrous materials: Iron and steel manufacture, furnaces, various types of carbon steels, alloysteels and cast irons, its properties and uses.

Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching,Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys: Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and itsapplications. Various types of Brass, Bronze bearing materials their properties and uses.Aluminum alloys, such as Duralumin, Other advanced materials/alloys.

UNIT-IV

Magnetic properties: Concept of magnetism- Dia, para, ferro magnetic materials, Hysteresis,Soft and hard magnetic materials, Magnetic Storages.

Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsicand extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications.diffusion of Solid

Super conductivity and its applications, Messier effect. Type I& II superconductors. HighTemp. superconductors.

UNIT-V

Ceramics: Structure, types, properties and applications of ceramics. Mechanical/Electricalbehaviour and processing of ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behaviour andprocessing of plastics, Future of plastics.

Other Materials: Brief description of other materials, such as optical and thermal materials,concrete, composite materials and their uses.

Other Materials: Brief description of other materials, such as optical and thermal materials,concrete, composite materials and their uses.

Performance of materials in service: Brief theoretical consideration of fracture, fatigue, andcorrosion and its control.

Text / Reference Books:

1. W.D. Callisster Jr. “Material Science & Engineering Addition” - Wesly Publishing Co.
2. Van Vlash, “Elements of Material Science & Engineering”, John Wiley & Sons

[BTOE-48] DISCRETE MATHEMATICS

UNIT-I

Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, powersets, counting principle, cardinality and countability (Countable and Uncountable sets),proofs of some general identitites on sets, pigeonhole principle.

Relation: Definition, types of relation, composition of relations, domain and range of arelation, pictorial representation of relation, properties of relation, partial ordering relation.

Function: Definition and types of function, composition of functions, recursively definedfunctions.

UNIT-II

Propositional logic: Proposition logic, basic logic, logical connectives, truth tables,tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens andmodus tollens, validity, predicate logic, universal and existential quantification.

Notion of proof: proof by implication, converse, inverse, contrapositive, negation, andcontradiction, direct proof, proof by using truth table, proof by counter example.

UNIT-III

Combinatories: Mathematical induction, recursive mathematical definitions, basics ofcounting, permutations, combinations, inclusion-exclusion, recurrence relations (n_{th} orderrecurrence relation with constant coefficients, Homogeneous recurrence relations,Inhomogeneous recurrence relation), generating function (closed form expression, propertiesof G.F., solution of recurrence relation using G.F, solution of combinatorial problem usingG.F.)

Unit-IV

Algebraic Structure: Binary composition and its properties definition of algebraic structure;Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, PermutationGroups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).

UNIT-V

Graphs:

Graph terminology, types of graph connected graphs, components of graph, Euler graph,Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree(rooted, binary), properties of trees, binary search tree, treetraversing (preorder, inorder, postorder).

Finite Automata: Basic concepts of Automation theory, Deterministic finiteAutomation(DFA), transition function, transition table, Non Deterministic Finite Automata(NDFA), Mealy and Moore Machine, Minimization of finite Automation.

Text/Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
2. V. Krishnamurthy, "Combinatories:Theory and Applications", East-West Press.

[BTOE-49] APPLIED LINEAR ALGEBRA

UNIT-1

Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence.Basis, dimensions and coordinates (each and every fact to be illustrated by suitable examples).

UNIT-2

Linear-transformation, definition and examples, matrix representation, similarity, range andkernel, rank-nullity theorem and its consequences.

UNIT-3

Singular and non singular linear transformations, sum and product of linear transformations,vector space of linear transformations, nilpotent linear transformations.

UNIT-4

Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality,Minkowski Inequality, polarization Identity, complete ortho normal set, Bessel's Inequality,Gram-Schmidt's orthogonalization process.

UNIT-5

Linear functional, definition and examples, vector space of linear functional, dual vector spaces,adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values andeigen vectors, diagonalisation of linear operators, quadratic forms, principle axistheorem(without proof), some applications to engineering problems.

TEXT/REFERENCE BOOKS

1. Dym, H. Linear Algebra in action, University Press.2012
2. Halmos, P.R.: Finite Dimensional Vector Spaces (1990) Narosa.

ELECTRO-MECHANICAL ENERGY CONVERSION – II LAB

Note: Minimum eight experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
(i) Torque -speed characteristics
(ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
6. To determine V-curves and inverted V-curves of a three phase synchronous motor.
7. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and to draw the power-angle curve.
8. To study synchronization of an alternator with the infinite bus by using:
(i) dark lamp method (ii) two bright and one dark lamp method.

Software based experiments (Develop Computer Program in 'C' language or use MATLAB or Equivalent software)

9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
10.To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
11. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
13. To determine steady state performance of a three phase induction motor using equivalent circuit.

NETWORK LABORATORY

Note: Minimum eight experiments are to be performed from the following list.

1. Verification of principle of superposition with ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.
3. Verification of Tellegin's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage input.
5. Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically damp and overdamp cases.
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input.
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD Parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests.
10. Verification of parameter properties in inter-connected two port networks : series, parallel and cascade also study loading effect in cascade.
11. Determination of frequency response of a Twin – T notch filter.
12. To determine attenuation characteristics of a low pass / high pass active filters.

ELECTRICAL INSTRUMENTATION LAB.

Minimum eight experiments are to be performed from the following list.

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers
10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer

ELECTRONICS LAB

ANALOG ELECTRONICS:

Note: Select at least any four out of the following:

1. To Plot V-I characteristics of junction diode and zener diode.
2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge rectifiers.
3. To Plot input / output characteristics for common base transistor.
4. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.
5. To determine voltage gain, current gain, input impedance and output impedance of common emitter amplifier.
6. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C coupled common emitter amplifier.
7. To design R-C Phase shift / Wein Bridge oscillator and verify experimentally the frequency of oscillation.
8. To study transistor as a switch and determine load voltage and load current when the transistor is ON.

ANALOG IC & DIGITAL ELECTRONICS:

Note: Select at least any four out of the following:

9. To study application of Operational Amplifier as summer integrator and voltage comparator.
10. To study operation of Op-Amp based astable and monostable multivibrators.
11. To study operation IC 555 based astable and monostable multibrators.
12. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.
13. To study operation of Adder / Subtractor using 4 bit / 8 bit IC 7483.
14. To study operation of (a) J K Master – slave flip – flop using IC 7476 (b) Modulo N counter using programmable counter IC74190.
15. To verify experimentally output of A/D and D/A converters.
16. To study regulation of unregulated power supply using IC 7805/7812 voltage regulator and measure the load and line regulations

SEMESTER- V

ELEMENTS OF POWER SYSTEM

Unit-I

Power System Components:

Single line Diagram of Power system,

Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar,

circuit breaker and isolator

Supply System

Different kinds of supply system and their comparison, choice of transmission voltage

Transmission Lines:

Configurations, types of conductors, resistance of line, skin effect, Kelvin's law.Proximity effect

Unit-II

Over Head Transmission Lines

Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit

transmission lines,

Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge

impedance loading

Unit-III

Corona and Interference:

Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting

corona, methods of reducing corona and interference.

Electrostatic and electromagnetic interference with communication lines

Overhead line Insulators:

Type of insulators and their applications, potential distribution over a string of insulators, methods of

equalizing the potential, string efficiency

Unit-IV

Mechanical Design of transmission line:

Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration

dampers

Insulated cables:

Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance

of single phase and three phase cables, dielectric loss, heating of cables.

Unit-V

Neutral grounding:

Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding

practices

Electrical Design of Transmission Line:

Design consideration of EHV transmission lines, choice of voltage, number of circuits, conductor configuration, insulation design, selection of ground wires.

EHV AC and HVDC Transmission:

Introduction to EHV AC and HVDC transmission lines.

Text Books

1.W. D. Stevenson, "Element of Power System Analysis", McGraw Hill,

2.C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition

3.Asfaq Hussain, "'Power System", CBS Publishers and Distributors,

4.B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.

5.M. V. Deshpande, "Electrical Power System Design" Tata Mc Graw Hill.

Reference Books

6.Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & sons,

7.S. L. Uppal, “Electric Power”, Khanna Publishers
8.S.N.Singh, “ Electric Power Generation, Transmission& distribution.” PHI Learning

POWER ELECTRONICS

Unit-I

Power semiconductor Devices:

Power semiconductor devices their symbols and static characteristics, specifications of switches, types of power electronic circuits,Operation, steady state & switch characteristics & switching limits of Power Transistor Operation and steady state characteristics of Power MOSFET and IGBT **Thyristor** – Operation V- I characteristics, two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC

Unit-II

Power Semiconductor Devices (Contd.)

Protection of devices, Series and parallel operation of thyristors Commutation techniques of thyristor

DC-DC Converters:

Principles of step-down chopper, step down chopper with R-L load Principle of step-up chopper, and operation with RL load, classification of choppers and their various applications.

Unit-III

Phase Controlled Converters

Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters. Performance Parameters Three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source impedance Single phase and three phase dual converters

Unit-IV

AC Voltage Controllers

Principle of On-Off and phase controls Single phase ac voltage controller with resistive and inductive loads Three phase ac voltage controllers (various configurations and comparison only) Single phase transformer taps changer, industrial applications.

Cyclo Converters

Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation and their applications.

Unit-V

Inverters

Single phase series resonant inverter,Single phase bridge inverters,Three phase bridge inverters Voltage control of inverters,Harmonics reduction techniques,Single phase and three phase current source
inverters

Text Books:

1. M.H. Rashid,“Power Electronics: Circuits, Devices & Applications”, Prentice Hall of India Ltd. 3rd Edition,2004.
2. M.D. Singh and K.B.Khanchandani, “Power Electronics”Tata MC Graw Hill, 2005
3. V.R. Moorthy, “ Power Electronics : Devices, Circuits and Industrial Applications” Oxford University Press.

Reference Books:

4. M.S. Jamil Asghar, “Power Electronics” Prentice Hall of India Ltd.
5. Chakrabarti & Rai, “Fundamentals of Power Electronics &Drives”Dhanpat Rai & Sons.
6. Ned Mohan, T.M.Undeland and W.P.Robbins, “Power Electronics:Converters, Applications and Design”, Wiley India Ltd,2008.
7. S.N.Singh, “A Text Book of Power Electronics” Dhanpat Rai & Sons

[BTEC-53] MICROPROCESSORS

Unit1

Evolution of microprocessors, Microprocessor architecture and its operations, 8085 pins description, programming model, basic interfacing concepts, input and output devices, logic devices and memory interfacing, addressing modes, Concept of instruction cycle, machine cycle and T-states, Concept of interrupts, Classification of 8085 instructions.

Unit 2

8086 architecture- functional diagram, register organization, memory segmentation, programming model, memory address, physical memory organization, pins description, clock generator 8284A, maximum mode and minimum mode signal descriptions, timing diagrams, introduction to DOS and BIOS interrupts.

Unit 3

Instruction formats, addressing modes, classification of instruction set, assembler directives (debug, TASM & MASM), macros, Programs techniques and assembly language programs: simple programs involves data transfer operation, arithmetic operation, logical operation, branch operation, machine control operation, string manipulations, stack and subroutine operations.

Unit 4.

8255 Programmable peripheral interfacing various mode of operation to 8086, interfacing keyboard and seven segment display, stepper motor interfacing, D/A and A/D converter, 8254 (8253) programmable interval timer, Direct Memory Access and 8237 DMA controller.

Unit 5

Memory interfacing to 8086. Interrupt structure of 8086, interrupt handling, vector interrupt table and interrupt Service routine. Interfacing interrupt controller 8259 and DMA Controller 8257 to 8086. Serial communication standards, Serial data transfer schemes.

Text Book:

1. Ramesh Gaonkar, "Microprocessor architecture, programming and applications with the 8085",5th Edition, Penram International Publication(India) Pvt. Ltd.
2. DouglasV.Hall, "Microprocessors and Interfacing",2ndEdition,TataMcGrawHill.

Reference Books:

1. SivaramaP. Dandamudi, "Introduction to Assembly Language Programing From 8086 to Pentium Processors",Springer.
2. Walter A. Triebeland Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing Software,HardwareandApplications",Pearson.
3. A.K.RayandK.M.Bhurchandi,"AdvancemicroprocessorsandPeripherals"TataMcGrawHill.
4. LylaB.Das,"TheX86Microprocessors, Architecture, Programming andInterfacing(8086toPentium)", Pearson.

[BTEC-54] Control System–I

Unit 1

Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems:

electrical networks, mechanical systems elements, equations of mechanical systems, sensors and encoders in control systems, DC motors in control systems.

Unit 2

State-Variable Analysis: Vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions. Similarity Transformation, Decomposition of transfer functions, Controllability and observability.

Unit 3

Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time- domain specifications, Steady-State error, time response of a first order system, transient response of a prototype second order system.

Unit 4

Stability of Linear Control Systems: Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, methods of determining stability, Routh Hurwitz criterion. Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci

Unit 5

Frequency Domain Analysis: M_r (resonant peak) and ω_r (resonant frequency) and bandwidth of the prototype Second order system, effect so fading a zero to the forward path, effect so fadding a pole to the forward path, Nyquist ability criterion, relative stability: gain margin and phase margin, stability analysis with The Bode plot.

Text Book:

1. B.C. Kuo & Farid Golnaraghi, "AutomaticControlSystems",8th Edition, John Wiley India.

Reference Books:

1. WilliamA.Wolovich,"AutomaticControlSystems",OxfordUniversityPress.
2. Joseph J. DistefanoIII, AllenR.Stubberud,Ivan J.Williams,"FeedbackandControlSystems"Schaums Outlines Series,3rdEdition, Tata Mc Graw Hill.
3. I.J.Nagrath&M.Gopal,"ControlSystemEngineering",NewAgeInternationalPublishers.

FUNDAMENTALS OF E.M.THEORY

Review of Vector analysis, Rectangular, Cylindrical and Spherical coordinates and their transformation, divergence, gradient and cvrl in different coordinate systems, Electric field intensity, Electric Flux density, Energy and potential.

Unit-II
Current and conductors, Dielectrics and capacitance, Poisson's and Laplace's equations.

Unit-III
Steady magnetic field, magnetic forces, materials and inductance, Time varying field and Maxwell's equation.

Unit-IV
Uniform Plane waves, Plane wave reflection and dispersion

Text Books:
1. Hayt, W.H. and Buck, J.A., "Engineering Electromagnetic" Tata Mc.Graw Hill Publishing
2. Mathew Sadiku, "Electromagnetic Field Theory", Oxford University Press.
Reference Books:
3. Jordan E.C. and Balmain K.G., "Electromagnetic Wave and radiating Systems" Prentice Hall International , 2nd Edition.
4. Kraus, F. "Electromagnetic" Tata Mc. Graw Hill 5th Edition.
5. Ramo S, Whinnery T.R. and Vanduzer T, "Field and Waves in Communication Electronics" John Wiely and Sons 3rd Edition.

[BTMB-51] Engineering Economics

Unit-1 Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Unit-2 Market Structure Perfect Competitions Imperfect- Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Unit-3 Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break-Even Analysis.

Unit-4 Management Aspects Functions of Management, Project Management, Value Engineering, Project Evaluation, Decision Making.

POWER ELECTRONICS LABORATORY

Note: The minimum of 10 experiments is to be performed out of which at least three should be software based.

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without free wheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with esistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cyclo-converter
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
9. To study operation of IGBT/MOSFET chopper circuit
10. To study MOSFET/IGBT based single-phase series-resonant inverter.
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments(PSPICE/MATLAB)

12. To obtain simulation of SCR and GTO thyristor.
13. To obtain simulation of Power Transistor and IGBT.
14. To obtain simulation of single phase fully controlled bridge rectifier and draw load voltage
and load current waveform for inductive load.
15. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and
load current waveforms for inductive load.
16. To obtain simulation of step down dc chopper with L-C output filter for inductive load and
determine steady-state values of output voltage ripples in output voltage and load current.
17.

Text/Reference Books:

1. M.H.Rashid, “Power Electronics: Circuits, Devices and Applications”, 3rd Edition, prentice
Hall of India.
2. D.W. Hart, “Introduction to power Electronics” Prentice hall Inc.
3. Randal Shaffer, “Fundamentals of Power Electronics with MATLAB” Firewall Media,

[BTEC-54P] Control System Lab

1. Different Tool boxes in MATLAB, Introduction to Control Systems Toolbox.
2. Determine transpose, inverse values of given matrix.
3. Plot the pole-zero configuration in s-plane for the given transfer function.
4. Determine the transfer function for given closed loop system in block diagram representation.
5. Plot unit step response of given transfer function and find peak overshoot, peak time.
6. Plot unit step response and to find rise time and delay time.
7. Plot locus of given transfer function, locate closed loop poles for different values of k.
8. Plot root locus of given transfer function and to find out S, Wd, Want given root & to discuss stability.
9. Plot bode plot of given transfer function.
10. Plot bode plot of given transfer function and find gain and phase margins
11. Plot Nyquist plot for given transfer function and to compare the irrelative stability
12. Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

Note:-In addition, Institutes may include more experiments based on the expertise.

[BTEC-53P] Microprocessors Lab

1. Write a program using 8085/8086 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085/8086 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085/8086.
4. To find the large stand smallest number in an array of data using 8085/8086 instruction set.
5. To write a program to arrange an array of data in ascending and descending order using 8085/8086.
6. To convert given Hexadecimal number in to its equivalent ASCII number and vice versa using 8085/8086 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085/8086 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085/8086 to demonstrate the generation of square, sawtooth and triangular wave.
10. Serial communication between two 8085/8086 through RS-232 C-port.

SEMESTER- VI

POWER SYSTEM ANALYSIS

Unit-I

Representation of Power System Components:

Synchronous machines, Transformers,Transmission lines, One line diagram, Impedance and reactance diagram, per unit System

Symmetrical components:

Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Unit-II

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions

Unsymmetrical faults:

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.

Formation of Z_{bus} using singular transformation and algorithm, computer method for short circuit calculations

Unit-III Load Flows:

Introduction, bus classifications, nodal admittance matrix (Y_{BUS}), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method

Unit-IV

Power System Stability:

Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement

Unit-V Traveling Waves:

Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipments and line against traveling waves.

Text Books:

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Chakraborthy, Soni,Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press,2007.

Reference Books:

5. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.

SWITCHGEAR AND PROTECTION

Unit I:

Introduction to Protection System:

Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays:

Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

Unit-II:

Relay Application and Characteristics:

Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

Static Relays:

Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Unit-III

Protection of Transmission Line:

Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing,

Unit-IV:

Circuit Breaking:

Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.

Testing Of Circuit Breaker:

Classification, testing station and equipments, testing procedure, direct and indirect testing

Unit-V

Apparatus Protection:

Protection of Transformer, generator and motor.

Circuit Breaker:

Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

Text Books:

1. S. S. Rao, “Switchgear and Protection”, Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear,Wiley Eastern Ltd.

Reference Books:

3. B. Ram and D. N. Vishwakarma, “Power System Protection and Switchgear”, Tata Mc. Graw Hill
4. Y. G. Paithankar and S R Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India.

SPECIAL ELECTRICAL MACHINES

UNIT-I

Poly-phase AC Machines:

Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power)

UNIT-II

Single phase Induction Motors:

Construction, starting characteristics and applications of split phase, capacitor start, capacitor run, capacitor-start capacitor-run and shaded pole motors.

Two Phase AC Servomotors:

Construction, torque-speed characteristics, performance and applications.

UNIT-III Stepper Motors:

Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications.

Switched Reluctance Motors:

Construction; principle of operation; torque production, modes of operation, drive circuits.

UNIT-IV

Permanent Magnet Machines:

Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM ac motors, brushless dc motors and their important features and applications, PCB motors.

Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators and applications

UNIT-V

Single Phase Commutator Motors:

Construction, principle of operation, characteristics of universal and repulsion motors ; Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Text Books:

1. P.S. Bimbhra “Generalized Theory of Electrical Machines” Khanna Publishers.
2. P.C. Sen “ Principles of Electrical Machines and Power Electronics” John willey & Sons, 2001
3. G.K.Dubey “Fundamentals of Electric Drives” Narosa Publishing House, 2001

Reference Books:

4. Cyril G. Veinott “Fractional and Sub-fractional horse power electric motors” McGraw Hill International, 1987
5. M.G. Say “ Alternating current Machines” Pitman & Sons .

FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

Unit-I

Discrete-Time Signals And Systems:

Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier Transform.

Discrete Fourier Transform:

Discrete Fourier transforms, properties, linear convolution using DFT, DCT

Unit-II

Sampling of Continuous Time Signals:

Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion

Unit-III

Transform Analysis of LTI Systems:

Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, and linear systems with generalized linear phase

Overview of finite precision numerical effects, effects of coefficient quantization,Effects of round-off noise in digital filters, zero-input limit cycles in fixed point realizations of IIR digital filters.

Unit-IV

Filter Design Techniques:

Design of D-T IIR filters from continuous – time filters, design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters, FIR equiripple approximation

Unit-V

Efficient computation of the DFT:

Goertzel algorithm, decimation in time and decimation in frequency, FFT algorithm, practical considerations, implementation of the DFT using convolution, effects of finite register length.

Fourier Analysis of Signals Using DFT :

DFT analysis of sinusoidal signals, time-dependent Fourier transforms: Block convolution, Fourier analysis of non – stationary and stationary random signals, spectrum analysis of random signals using estimates of the autocorrelation sequence

Text Books:

1. S. Salivahanan, “Digital Signal Processing”, McGraw Hill Education (India) Private Limited.

2. Oppenheim A.V., Schafer, Ronald W. & Buck, John R,”Discrete Time Signal processing”, Pearson Education .

Reference Books:

3. Proakis, J.G. & Manolakis, D.G.,” Digital Signal Processing: Principles Algorithms and Applications”, Prentice Hall of India.

CONVENTIONAL & CAD OF ELECTRICAL MACHINES

UNIT-I

Basic Considerations:

Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, Classification of insulating materials.

Calculation of total mmf and magnetizing current. Transformer Design:

Output equation design of core, yoke and windings, overall dimensions,

Computation of no load current to voltage regulation, efficiency and cooling system designs

UNIT-II

Design of rotating machines – I:

Output equations of rotating machines, specific electric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, selection of frame size. Core and armature design of dc and 3-phase ac machines

UNIT-III

Design of rotating machines – II:

Rotor design of three phase induction motors.

Design of field system of DC machine and synchronous machines. Estimation of performance from design data.

UNIT-IV

Computer Aided Design

Philosophy of computer aided design, advantages and limitations. Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization and its general procedure.

Flow charts and 'c' based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines.

Text Books:

1. K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Sons.
2. K.G. Upadhyay," Conventional and Computer Aided Design of Electrical Machines" Galgotia Publications.

Reference Books:

3. M.G. Say, "The Performance and Design of AC Machines" Pitman & Sons.
4. A.E. Clayton and N.N. Hancock, "The Performance and Design of D.C.Machines" Pitman & Sons.
5. S.K. Sen, "Principle of Electrical Machine Design with Computer Programming" Oxford and IBM Publications.

BTMB-61 : INDUSTRIAL MANAGEMENT

Unit-I Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Unit-II Management Function: Principle of Management – Time and motion study, work simplification – process charts and flow diagrams, Production Planning.

Unit-III Inventory Control: Inventory, Cost, Deterministic Models, Introduction to supply chain management.

Unit-IV Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

Laboratory

POWER SYSTEM LAB

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

(A) Hardware Based:

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study ferranty effect and voltage distribution in H.V. long transmission line using transmission line model.
10. To study operation of oil testing set.

Simulation Based Experiments (using MATLAB or any other software)

11. To determine transmission line performance.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To obtain formation of Y-bus and perform load flow analysis
14. To perform symmetrical fault analysis in a power system
15. To perform unsymmetrical fault analysis in a power system

Text Books:-

1. Hasdi Sadat, "Power System Analysis" Tata Mc.Graw Hill.
2. T. K. Nagsarskar & M.S. Sukhija,' Power System Analysis' Oxford Universitry Press.

ELECTRICAL CAD LAB

2. Design of Three phase transformer.
3. Design of Single phase Induction Motor.
4. Design of Three phases Induction Motor.
5. Design of DC motor.
6. Design of DC generator.
7. Design of Single phase alternator.
8. Design of three phase alternator.
9. Design of Synchronous Motor.
10. Design of lag, lead and lag-lead compensator.

Text Books:-

1. A.K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Sons.
2. M.G. Say, "The Performance and Design of AC Machines" Pitman & Sons.
3. D.P. Kothari & I J Nagrath, "Electric Machine", McGraw Hill Education (India) Private Limited, Sigma Series.
4. S.K. Bhattacharya, "Electrical Machine", McGraw Hill Education (India) Private Limited.
5. Bhag S, Guru and Huseyin R.Hiziroglu, " Electric machinery and Transformers", Oxford University Press.

SEMESTER - VII

[BTOE-71] QUALITY MANAGEMENT

UNIT-I Quality Concepts:
Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II Quality Management :
Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. 3 Human Factor in quality (11) Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

UNIT-III Control Charts:
Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. 5 Attributes of Control Chart Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT –IV
Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V
ISO-9000 and its concept of Quality Management
ISO 9000 series, Taguchi method, JIT in some details.

Text / Reference Books:
1. Lt. Gen. H. Lal, “Total Quality Management”, Eastern Limited, 1990.
2. Greg Bounds, “Beyond Total Quality Management”, McGraw Hill, 1994.
3. Menon, H.G, “TQM in New Product manufacturing”, McGraw Hill 1992.

Electric Drives

UNIT-I: Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives Classification of electric drives Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation
Types of load Load torque: components, nature and classification
UNIT-II: Dynamics of Electric Drive: Dynamics of motor-load combination Steady state stability of Electric Drive Transient stability of electric Drive

Selection of Motor Power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization

UNIT-III: Electric Braking: Purpose and types of electric braking, braking of DC, three phase induction and synchronous motors

Dynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting of DC shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking

UNIT-IV: Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited DC motor drives (continuous conduction only), dual converter fed separately excited DC motor drive, rectifier control of DC series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited DC motor and DC series motor.

UNIT-V: Power Electronic Control of AC Drives:

Three Phase induction Motor Drive:

Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes.

Three Phase Synchronous motor:

Self controlled scheme

Special Drives:

Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications

Text Books:

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S.K. Pillai, "A First Course on Electric Drives", New Age International.
3. B.N. Sarkar, "Fundamental of Industrial Drives", Prentice Hall of India Ltd.

Reference Books:

1 M. Chilkin, "Electric Drives",Mir Publishers, Moscow.
2 Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia, Pvt. Ltd.

POWER STATION PRACTICE

UNIT-I:Introduction: Electric energy demand and growth in India, electric energy sources.

Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts.

Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India

UNIT-II: Nuclear Power Plant: Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding.

Gas Turbine Plant: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications.

Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications

UNIT-III: Sub-stations Layout: Types of substations, bus-bar arrangements, typical layout of substation.

Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.

UNIT-IV: Economic Operation of Power Systems: Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering

transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling

UNIT-V:Non Conventional Energy Sources: Power Crisis, future energy demand, role of Private sectors in energy management, concepts & principals of MHD generation, Solar power plant, Wind Energy, Geothermal Energy, Tidal energy, Ocean Thermal Energy.

Text Books:

1. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad

Analog & Digital Communication

UNIT I:

Elements of communication system and its limitations Amplitude Modulation: Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, super hetrodyne receiver, IF amplifiers, AGC circuits Frequency Division multiplexing

UNIT II:

Angle Modulation: Basic definitions Narrow band and wideband frequency modulation, transmission bandwidth of FM signals Generation and detection of frequency modulation Noise: External noise, internal noise Noise calculations, signal to noise ratio Noise in AM and FM systems

UNIT III:

Pulse Modulation: Introduction, sampling process Analog Pulse Modulation Systems-Pulse Amplitude Modulation, Pulse width modulation and Pulse Position Modulation. Waveform coding Techniques: Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.

UNIT IV:

Digital Modulation Techniques: Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, methods of generation of coherent and noncoherent, ASK,FSK and PSK, comparison of above digital techniques.

UNIT V:

Time Division Multiplexing: Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannan Fano coding.

Text Books:

1.Simon Haykin," Communication Systems" John Wiley & Sons 4th Edition
2.G.Kennedy and B. Davis," Electronic Communication Systems" 4th Edition, Tata McGraw Hill
3. Simon Haykin, "Digital Communications" John Wiley & Sons
4. T.L. Singal, "Analog & Digital Communication", Tata Mc Graw Hill

Reference Books:

1. B.P. Lathi, "Modern Analog & Digital Communication Systems" Oxford University Press.
2. Taub & Schilling, "Communication System: Analog and Digital" Tata Mc Graw Hill
3. R.P. Singh & S.D. Sapre, "Communication Systems Analog and Digital" Tata McGraw Hill.

POWER SYSTEM OPERATION AND CONTROL

UNIT-I: Introduction: Structure of power systems, Power system control center and real time

computer control, SCADA system Level decomposition in power system Power system security Various operational stages of power system Power system voltage stability

UNIT-II: Economic Operation: Concept and problems of unit commitment Input-output characteristics of thermal and hydro-plants System constraints Optimal operation of thermal units without and with transmission losses, Penalty factor, incremental transmission loss, transmission loss formula (without derivation) Hydrothermal scheduling long and short terms Concept of optimal power flow

UNIT-III: Load Frequency Control:

Concept of load frequency control, Load frequency control of single area system:
Turbine speed governing system and modeling, block diagram representation of single area system, steady state analysis, dynamic response, control area concept, P-I control, load frequency control and economic dispatch control. Load frequency control of two area system: Tie line power modeling, block diagram representation of two area system, static and dynamic response

UNIT-IV: Automatic Voltage Control: Schematic diagram and block diagram representation, different types of Excitation systems & their controllers.

Voltage and Reactive Power control: Concept of voltage control, methods of voltage controlcontrol by tap changing transformer. Shunt Compensation, series compensation, phase angle compensation

UNIT-V

State Estimation:Detection and identification, Linear and non-linear models.

Flexible AC Transmission Systems:

Concept and objectives FACTs controllers: Structures & Characteristics of following FACTs Controllers. TCR,FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR, UPFC

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murty, "Operation and control in Power Systems" B.S. Publications.
3. N. G. Hingorani & L. Gyugyi, " Understanding FACTs" Concepts and Technology of Flexible AC Transmission Systems"
4. A. J. Wood & B.F. Wollenburg, " Power Generation, Operation and Control " John Wiley & Sons.

Reference Books:

1. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill

ELECTRIC DRIVES LAB

Note: - Minimum 10 experiments are to be performed from the following out of which at least three should be simulation based.

(A) Hardware Based Experiments:

1. To study speed control of separately excited dc motor by varying armature voltage using singlephase fully controlled bridge converter.
2. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.
3. To study speed control of separately excited dc motor using single phase dual converter (Static Ward-Leonard Control)
4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper
5. To study closed loop control of separately excited dc motor
6. To study speed control of single phase induction motor using single phase ac voltage controller.
7. To study speed control of three phase induction motor using three phase ac voltage controller
8. To study speed control of three phase induction motor using three phase current source inverter
9. To study speed control of three phase induction motor using three phase voltage source inverter
10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper
11. To study speed control of three phase slip ring induction motor using static scherbius slip power

recovery control scheme

Simulation Based Experiments (using MATLAB or any other software)

12. To study starting transient response of separately excited dc motor
13. To study speed control of separately excited dc motor using single phase fully / half controlled bridge converter in discontinuous and continuous current modes.
14. To study speed control of separately excited dc motor using chopper control in motoring and braking modes.
15. To study starting transient response of three phase induction motor
16. To study speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.

ANALOG AND DIGITAL COMMUNICATION LAB

Note: The minimum 10 experiments are to be performed from the following:

1. To study amplitude modulation using a transistor and determine depth of modulation.
2. To study generation of DSB-SC signal using balanced modulator.
3. To study generation of SSB signal
4. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
5. To study super heterodyne AM receiver and measurement of sensitivity, selectivity and fidelity.
6. To study frequency modulation using voltage controlled oscillator.
7. To detect FM signal using Phase Locked Loop.
8. To measure noise figure using a noise generator.
9. To study PAM, PWM and PPM.
10. To realize PCM signal using ADC and reconstruction using DAC and 4 bit/8bit system. Observe quantization noise in each case.
11. To study Delta Modulation and Adaptive Delta Modulation. 12. To study PSK-modulation system.
13. To study FSK-modulation system.
14. To study sampling through a Sample-Hold circuit and reconstruction of the sampled signal and observe the effect of sampling rate & the width of the sampling pulses.
15. To study functioning of colour television
16. Fabricate and test a PRBS generator
17. Realization of data in different forms, such as MRZ-L,NRZ - M&N,NRZ-S.
18. Manchester coding & decoding (Biphase L) of NRZ-L data.

SEMESTER - VIII

ELECTRICAL & ELECTRONICS ENGINEERING MATERIALS

UNIT – I

Crystal Structure of Materials:
A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth
B. Energy bands in solids, classification of materials using energy band.
UNIT – II
Conductivity of Metals:
Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals
UNIT – III
Mechanism of Conduction in semiconductor materials:
Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials.
UNIT – IV
Magnetic Properties of Material:
Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.
Text Books :
1 A.J. Dekker, "Electrical Engineering Materials" Prentice Hall of India
2 R.K. Rajput," Electrical Engg. Materials," Laxmi Publications.
3 C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S. Chand & Co.
References :
1 Solymar, "Electrical Properties of Materials" Oxford University Press.
2 Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.
3 G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers.
4 T. K. Basak, "Electrical Engineering Materials" New age International.

UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

Unit-I:
Electric Heating:
Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating
Unit-II:
Electric Welding:
Electric Arc Welding Electric Resistance welding Electronic welding control
Electrolyte Process:
Principles of electro deposition, Laws of electrolysis, applications of electrolysis
Unit-III
Illumination:
Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems
Refrigeration and Air Conditioning:
Refrigeration systems, domestic refrigerator, water cooler Types of air conditioning, Window air conditioner
Unit-IV:
Electric Traction - I

Types of electric traction, systems of track electrification Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

Unit-V:

Electric Traction – II

Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energy saving Power Electronic control of dc and ac traction drives Diesel electric traction.

Text Books:

1. H. Partab, "Art and Science of Electrical Energy" Dhanpat Rai & Sons.
2. G.K. Dubey, "Fundamentals of Electric Drives" Narosa Publishing House

Reference Books:

3. H. Partab, " Modern Electric Traction" Dhanpat Rai & Sons.
4. C.L. Wadhwa, " Generation, Distribution and Utilization of Electrical Energy" New Age InternationalPublications

POWER QUALITY

Unit-I

Introduction to Power Quality:

Terms and definitions of transients, Long Duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions**;** Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching D C offset; waveform distortion; voltage fluctuation; power frequency variations**.**

Unit-II

Voltage Sag: Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, Active Series Compensator.

Unit-III

Electrical Transients: Sources of Transient Over voltages- Atmospheric and switching transientsmotor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.

Unit-IV

Harmonics: Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc. harmonic mitigation techniques.

Unit-V

Measurement and Solving of Power Quality Problems: Power quality measurement devices- Harmonic Analyzer , Transient Disturbance Analyzer, wiring and grounding tester, Flicker Meter, Oscilloscope, multimeter etc.

Introduction to Custom Power Devices-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC)

Text Books:

1. Roger C Dugan, McGrahan, Santoso & Beaty, "Electrical Power System Quality" McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices" Kluwer Academic Publishers
3. C. Sankaran, " Power Quality" CRC Press.

[BTOE-81]NON-CONVENTIONAL ENERGY RESOURCES

UNIT-I Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.
Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.
Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations.
Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.
Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics, Performance and limitations of energy conversion systems.

UNIT-V Bio-mass: Availability of bio-mass and its conversion theory.
Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations.
Wave and Tidal Wave: Principle of working, performance and limitations, Waste Recycling Plants.

Text/References Books:
1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.
5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.