STUDY AND EVALUATION SCHEME											
B-Tech. Electrical Engg./Electrical & Electronics Engineering											
								YEAR: 2nd SEMESTER-III			
Sl. No.	COURSE NO	SUBJECT	PERIOD			EVALUATION SCHEME			EXAM ESE	SUBJECT TOTAL	CREDIT
						SESSIONAL EVALUATION					
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	NAS-301/-NOE 031-039	Mathematics III/Science Based Open Elective	3	1	0	30	20	50	100	150	4
2	NME-309	Thermal & Hydraulic Machines	3	1	0	30	20	50	100	150	4
3	NEE-301	Electro-Mechanical Energy Conversion–I	3	1	0	30	20	50	100	150	4
4	NEE-302	Electrical Measurement & Measuring Instruments	3	1	0	30	20	50	100	150	4
5	NEE-303	Basic System Analysis	2	1	0	15	10	25	50	75	3
6	NHU301/ NHU302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
7	AUC-001/ AUC-002	*Human Values & Professional Ethics/ Cyber Security*	2	0	0	15	10	25	50	75*	
PRACTICAL / DESIGN / DRAWING											
8	NME-359	Thermal & Hydraulic Machines Lab	0	0	3	10	10	20	30	50	1
9	NEE-351	Electromechanical Energy Conversion- I Lab	0	0	3	10	10	20	30	50	1
10	NEE-352	Electrical Measurement Lab	0	0	2	10	10	20	30	50	1
11	NEE-353	Numerical Technique Lab	0	0	2	10	10	20	30	50	1
12	NGP-301	General Proficiency Lab	-	-	-	-	-	50	-	50	
		Total	**17**	**5**	**7**					**1000**	**25**

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

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

Note: Numbers of departmental subjects/labs in any semester may vary as per requirement keeping subject total and credit total unchanged.

STUDY AND EVALUATION SCHEME											
B-Tech. Electrical Engg./Electrical & Electronics Engineering											
								YEAR: 2nd SEMESTER-IV			
Sl. No.	**COURSE NO**	**SUBJECT**	**PERIOD**			**EVALUATION SCHEME**				**SUBJECT TOTAL**	**CREDIT**
						SESSIONAL EVALUATION			**EXAM ESE**		
			L	**T**	**P**	**CT**	**TA**	**TOTAL**			
THEORY SUBJECTS											
1	NOE 041-049/ NAS-401	Science Based Open Elective/ Mathematics III	3	1	0	30	20	50	100	150	4
2	NEC-409	Analog & Digital Electronics	3	1	0	30	20	50	100	150	4
3	NEE-401	Electro-Mechanical Energy Conversion–II	3	1	0	30	20	50	100	150	4
4	NEE-402	Network Analysis and Synthesis	3	1	0	30	20	50	100	150	4
5	NEE-403	Instrumentation & Process Control	2	1	0	15	10	25	50	75	3
6	NHU401/ NHU402	Industrial Psychology /Industrial Sociology	2	0	0	15	10	25	50	75	2
7	AUC-002/ AUC-001	*Cyber Security/ Human Values & Professional Ethics*	2	0	0	15	10	25	50	75*	-
PRACTICAL / DESIGN / DRAWING											
8	NEC-459	Electronics Lab	0	0	3	10	10	20	30	50	1
9	NEE-451	Electro-Mechanical Energy Conversion – II Laboratory	0	0	3	10	10	20	30	50	1
10	NEE-452	Network Lab	0	0	2	10	10	20	30	50	1
11	NEE-453	Electrical Instrumentation Lab	0	0	2	10	10	20	30	50	1
12	NGP-401	General Proficiency	-	-	-			50	-	50	
		Total	**16**	**5**	**10**					**1000**	**25**

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

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

NME-309 :THERMAL AND HYDRAULIC MACHINES L : T : P::3 : 1 : 0

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.

NEE – 301: ELECTRO-MECHANICAL ENERGY CONVERSION –I

L T P 3 1 0

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. (7)

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. (9)

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). (8)

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. (8)

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.(9)

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

4. A.E. Fitggerald, C.Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

5 Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India. 6 M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.

7 P.S. Bimbhra, " Generalized Theory of Electrical Machines", Khanna Publishers

NEE-302: ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

L T P 3 1 0

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. (4)

(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. (5)

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. (8)

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. (9)

UNIT IV

(1) AC Potentiometers- Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement. (4)

(2) Magnetic Measurement- Ballistic galvanometer, Flux meter**,** Determination of hysteresis loop, measurement of iron losses**.** (4)

UNIT V

(1) Digital Measurement of Electrical Quantities- Concept of digital measurement, Block diagram, Study of digital voltmeter, Frequency meter, *Spectrum analyzer,* Electronic multimeter. (3)

(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. (3)

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
6. W. D. Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
7. J. B. Gupta, "Electrical Measurement & Measuring Instrument", S. K. Kataria & Sons

NEE-303- BASIC SYSTEM ANALYSIS

L T P 3 1 0

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. (9)

UNIT II

Fourier Transform Analysis- Exponential form and *compact* trigonometric form of Fourier series, Fourier symmetry, Fourier Transform: Properties, Applications to network analysis. (8)

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. (8)

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. (8)

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. (7)

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.
8. I. J. Nagrath, S.N. Saran, R. Ranjan and S. Kumar, “Singnals and Systems”, Tata Mc. Graw Hill, 2001.
9. Taan S. Elali & Mohd. A. Karim, “Continuous Signals and Systems with MATLAB” 2nd Edition, CRC Press.

NEC-409 : ANALOG AND DIGITAL ELECTRONICS

L T P
3 1 0

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.
3. Millman, J. and Grabel A, “Microelectronics” Mc Graw Hill
4. Anand Kumar, “Switching Theory and Logic Design” Prentice Hall of India, 2008.
5. Aloke. K. Dutta, “Semiconductor Devices and circuits”, Oxford University Press, 2008.

NEE-401: ELECTRO-MECHANICAL ENERGY CONVERSION - II

L T P 3 1 0

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. (9)

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, V-curves, Hunting & damping, Synchronous condenser. (8)

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. (9)

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). (8)

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. (8)

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

NEE- 402 NETWORK ANALYSIS AND SYNTHESIS

L T P 3 1 0

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. (7)

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. (8)

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. (7)

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.* (3)

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, Inter-connections of two port networks, Ladder and Lattice networks: T & Π representation. (8)

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. (5)

(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. (4)

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
5. Joseph A. Edminister, " Theory & Problems of Electric Circuits", McGraw Hill

NEE – 403: ELECTRICAL INSTRUMENTATION AND PROCESS CONTROL
L T P 2 1 0

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 (7)

Unit-II

Transducer – II

Capacitive, Piezoelectric, Hall effect and Opto electronic transducers. Measurement of motion, force, pressure, temperature, flow and liquid level. (6)

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. (8)

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. (7)

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
7. M.M.S. Anand, “Electronic Instruments and Instrumentation Technology” PHI Learning.

NEE-351: ELECTROMECHANICAL ENERGY CONVERSION- I LAB

L T P 0 0 3

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.

College may add any two S/W based experiments in the above list.

NEE-352: ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS LAB

L T P 0 0 3

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.

College may add any two experiments in the above list.

NEE-353: NUMERICAL TECHNIQUE LAB

L T P 0 0 2

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.

College may add any three experiments in the above list.

NME-359 : Thermal & Hydraulic M/c Lab **L : T : P::0 : 0 : 3**

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.

NEE- 451: ELECTRO-MECHANICAL ENERGY CONVERSION – II LABORATORY

L T P 0 0 3

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.

NEE-452: NETWORK LABORATORY

L T P 0 0 2

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.

College may add any three S/W based experiments in the above list.

NEE – 453: ELECTRICAL INSTRUMENTATION LAB.

L T P 0 0 2

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

College may add any three S/W based experiments in the above list.

NEC-459 ELECTRONICS LAB

L T P 0 0 2

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

EVELUATION SCHEME OF ELECTRICAL ENGINEERING

Third Year

ELECTRICAL ENGG- Semester-V

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NEE-501	Elements Of Power System	3	1	0	30	20	50	100	150	4
2	NEE 502	Power Electronics	3	1	0	30	20	50	100	150	4
3	NEE-503	Control System	3	1	0	30	20	50	100	150	4
4	NEE-504	Microprocessor & Its Applications	3	1	0	30	20	50	100	150	4
5	NEC-508	Fundamentals of E.M. Theory	2	1	0	15	10	25	50	75	3
6	NHU-501	Engineering Economics	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NEE-551	Power Electronics Lab	0	0	3	10	10	20	30	50	1
8	NEE 552	Control System Lab	0	0	3	10	10	20	30	50	1
9	NEE-553	Microprocessor Lab	0	0	2	10	10	20	30	50	1
10	NEE 554	Simulation Based Minor Project	0	0	2	10	10	20	30	50	1
11	NGP 501	GP						50		50	1
		TOTAL	16	5	10					1000	26

ELECTRICAL ENGG. -Semester-VI

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NEE-601	Power System Analysis	3	1	0	30	20	50	100	150	4
2	NEE 602	Switchgear & Protection	3	1	0	30	20	50	100	150	4
3	NEE-603	Special Electric Machine	3	1	0	30	20	50	100	150	4
4	NEE-011 / NEE-014	Departmental Elective-I	3	1	0	30	20	50	100	150	4
5	NEE-021 / NEE-024	Departmental Elective-II	2	1	0	15	10	25	50	75	3
6	NHU-601	Industrial Management	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NEE-651	Power System Lab	0	0	2	10	10	20	30	50	1
8	NEE-652	Electrical CAD Lab	0	0	3	10	10	20	30	50	1
9	NEE-653	Minor Project	0	0	2	10	10	20	30	50	1
10	NEE 654	Seminar	0	0	3		50	50		50	1
11	NGP 601	GP						50		50	1
		TOTAL	16	5	10					1000	26

Elective-I

NEE – 011: Digital Control System
NEE - 012: Fundamentals of Digital Signal Processing
NEE - 013: Neural Networks and Fuzzy System
NEE - 014: Power Theft and Energy Management

Elective-II

NEE – 021: High Voltage Engineering
NEE -022: Intelligent Instrumentation
NEE -023: Conventional & CAD of Electrical Machines
NEE -024: Smart Energy Delivery Systems

NEE-501: ELEMENTS OF POWER SYSTEM

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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

NEE-502:POWER ELECTRONICS

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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

NEE-503: CONTROL SYSTEM

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Unit-I

The Control System:

Open loop & closed control; servomechanism, Physical examples. Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit-II

Time Response analysis:

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants

Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices

Unit-III

Control System Components:

Constructional and working concept of ac servomotor, synchros and stepper motor

Stability and Algebraic Criteria concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.

Root Locus Technique:

The root locus concepts, construction of root loci

Unit-IV

Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots

Stability in Frequency Domain:

Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles

Unit-V

Introduction to Design:

The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain.

Review of state variable technique:

Review of state variable technique, conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley India Ltd.
4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

5. Norman S. Mise, Control System Engineering , Wiley Publishing Co.
6. Ajit K Mandal, "Introduction to Control Engineering" New Age International.
7. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
8. Samarjit Ghosh, " Control Systems theory and Applications", Pearson Education

NEE-504: MICROPROCESSORS

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UNIT-I:

Introduction to Digital Computer and Microprocessor:

Digital Computers: General architecture and brief description of elements, instruction execution, instruction format, and instruction set, addressing modes, programming system, higher lever languages.

Buses and CPU Timings: Bus size and signals, machine cycle timing diagram, instruction timing, processor timing.

Microprocessor and Microprocessor Development Systems: Evolution of Microprocessor, Microprocessor architecture and its operations, memory, inputs-outputs (I/Os), data transfer schemes interfacing devices, architecture advancements of microprocessors, typical microprocessor development system.

UNIT-II:

8-bit Microprocessors.

8085 microprocessor: pin configuration, internal architecture. Timing & Signals: control and status, interrupt: ALU, machine cycles,

Instruction Set of 8085:

Addressing Modes: Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing.

Instruction format, op-codes, mnemonics, no. of bytes, RTL, variants, no. of machine cycles and T states, addressing modes.

Instruction Classification: Data transfer, arithmetic operations, logical operations, branching operation, machine control; Writing assembly Language programs, Assember directives.

UNIT-III:

16-bit Microprocessors: Architecture:

Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation,

Operating Modes

Instruction Set of 8086

Addressing Modes**:** Instruction format:

Discussion on instruction Set: Groups: data transfer, arithmetic , logic string, branch control transfer, processor control.

Interrupts: Hardware and software interrupts, responses and types.

UNIT-IV

Fundamental of Programming: development of algorithms, flowcharts in terms of structures,(series, parallel, if-then-else etc.)

Assembler Level Programming: memory space allocation (mother board and user program) Assembler level programs (ASMs)

UNIT-V

Peripheral Interfacing:

I/O programming: Programmed I/O, Interrupt Driven I/O, DMA I/O interface: serial and parallel communication, memory I/O mapped I/Os. Peripheral Devices: 8237 DMA controller, 8255-Programmable peripheral interface, 8253/8254 Programmable timer/counter.

8259 programmable Interrupt Controller.

Text Books:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing" Tata Mc. Graw Hill.

4. Krishna Kant, “Microprocessors and Microcontrollers” PHI Learning.

Reference Books:

5. Brey, Barry B. “INTEL Microprocessors” Prentice Hall (India)
6. ADitya P Mathur, “Introduction to Microprocessor” Tata Mc Graw Hill
7. M. Rafiquzzaman, “Microprocessors- Theory and applications” PHI
8. B. Ram, “Advanced Microprocessor & Interfacing” Tata McGraw Hill
9. Renu Singh & B.P.Singh, “Microprocessor and Interfacing and applications” New Age International
10. N. Senthil Kumar, “Microprocessors and Microcontroller”, Oxford University Press.
11. Liu and Gibson G.A., “Microcomputer Systems: The 8086/8088 Family” Prentice Hall (India)

NEC-508: FUNDAMENTALS OF E.M.THEORY

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Unit I
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

NEE-551: POWER ELECTRONICS LABORATORY

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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 resistive 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,

NEE– 552: CONTROL SYSTEM LABORATORY

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Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output vs input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.

Software based experiments (Use MATLAB, LABVIEW software etc.)

10. To simulate PID controller for transportation lag.
11. To determine time domain response of a second order system for step input and obtain performance parameters.
12. To convert transfer function of a system into state space form and vice-versa.
13. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' fir stability.
14. To plot a Bode diagram of an open loop transfer function.
15. To draw a Nyquist plot of an open loop transfers functions and examine the stability of the closed loop system.

Reference Books:

1. K.Ogata,"Modern Control Engineering" Prentice Hall of India.
2. Norman S.Nise, "Control System Engineering", John Wiley & Sons.
3. M.Gopal, "Control Systems: Principles & Design" Tata Mc Graw Hill.

NEE-553: MICROPROCESSOR LABORATORY

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A. Study Experiments

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor

B. Programming based Experiments (any four)

4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from ^{0}F to ^{0}C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and division)

C. Interfacing based Experiments (any four)

10. To obtain interfacing of RAM chip to 8085/8086 based system
11. To obtain interfacing of keyboard controller
12. To obtain interfacing of DMA controller
13. To obtain interfacing of PPI
14. To obtain interfacing of UART/USART
15. To perform microprocessor based stepper motor operation through 8085 kit
16. To perform microprocessor based traffic light control
17. To perform microprocessor based temperature control of hot water.

EEE-601: POWER SYSTEM ANALYSIS

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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.
7. D.Das, " Electrical Power Systems" New Age International.
8. J.D. Glover, M.S. Sharma & T.J.Overbye, "Power System Analysis and Design" Thomson.
9. P.S.R. Murthy " Power System Analysis" B.S. Publications.
10. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill
11. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.

NEE – 602: SWITCHGEAR AND PROTECTION

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3 1 0

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.
5. T.S.M Rao,“Power System Protection: Static Relays with Microprocessor Applications” Tata Macgraw Hill”.
6. A.R. Van C. Warringtaon , “ Protective Relays- Their Theory and Practice, Vol. I & II” Jhon Willey & Sons.

NEE-603: SPECIAL ELECTRICAL MACHINES

L T P
3 1 0

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 .

DEPARTMENTAL ELECTIVES

ELECTIVE – I

NEE – 011: Digital Control System

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3 1 0

UNIT-I

Signal Processing in Digital Control:

Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample- hold circuit., pulse transfer function, solution of difference equation by z-Transform method.

UNIT-II

Design of Digital Control Algorithms:

Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

UNIT-III

State Space Analysis and Design:

State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.

UNIT-IV

Stability of Discrete System:

Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane.

Lyapunov's Stability in the sense of Lyapunov, stability theorems for continuous and discrete systems, stability analysis using Lyapunov's method.

UNIT-V

Optimal digital control :

Discrete Euler Lagrange equation, max. min. principle, optimality & Dynamic programming, Different types of problem and their solutions.

Text Books:

1. B.C.Kuo, "Digital Control System",Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

Reference Books:

3. J.R.Leigh, "Applied Digital Control", Prentice Hall, International
4. C.H. Houpis and G.B.Lamont, "Digital Control Systems:Theory, hardware, Software",Mc Graw Hill.

NEE - 012: FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

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3 1 0

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.
4. Rabiner, L.R. and Gold B., “Theory and applications of DSP”, Prentice Hall of India.
5. Oppenheim, Alan V. & Willsky, Alan S. , “Signals and Systems” , Prentice Hall of India, 2nd Edition
6. Johnson, J.R. , “Introduction to Digital Signal Processing”, Prentice Hall of India.

NEE - 013: NEURAL NETWORKS AND FUZZY SYSTEM

L T P
3 1 0

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 propogation networks)

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation 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

Fuzzy Neural Networks:

L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propogation (BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

1. Kumar Satish, “Neural Networks” Tata Mc Graw Hill
2. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

Reference Books:

3. Siman Haykin, “Neural Netowrks” Prentice Hall of India
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.

NEE - 014: POWER THEFT AND ENERGY MANAGEMENT

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3 1 0

UNIT-I

Introduction: Energy sources, Energy demand and supply, Energy crisis, Future scenario,

Menace of power theft, reasons for power pilferage, electricity loss and theft-National and Global scenario, Security seals and tampering, harmonics and power theft, Control Over power theft.

UNIT-II

Power Theft in Electro-mechanical Meters: Power theft in Voltage circuit, by-passing meters, drilling holes on Electro-mechanical Meters, Insertion of film into meter, partial earth fault tampering, Missing Neutral Method.

Power Theft in Electronic Meters:

Power theft by means of Electrostatic Discharge, by tampering printed circuit board, by tampering the frequency circuit, tampering on display circuits of energy meter, Introducing limit switch.

UNIT-III

Energy system efficiency, Energy conservation aspects, Instrumentation and measurements.

Principles of Energy Management and Energy Audit: General principles, Planning and program, Introduction to energy audit, General methodology, Site surveys, Energy systems survey, Energy audit, Instrumentation, Analysis of data and results.

UNIT-IV

Electrical Load and Lighting Management: General principles, Illumination and human comfort, Lighting systems, Equipment's, Electrical systems, Electrical load analysis, Peak load controls.

Demand Side Management: Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy ,Planning, Implementation and its application. Customer Acceptance & its implementation issues. National and International Experiences with DSM

Text Books:

1. G.Sreenivasan, "Power Theft", PHI Learning Private Limited
2. Amlan Chakrabarti, "Energy Engineering and Management ", PHI Learning Private Limited
3. W R Murphy, G Mckay, 'Energy Management' B.S. Publications.

DEPARTMENTAL ELECTIVES
ELECTIVE – II

NEE – 021: HIGH VOLTAGE ENGINEERING

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UNIT-I

Break Down In Gases:

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, breakdown in vacuum.

Break Down In Liquid Dielectrics:

Classification of liquid dielectric, characteristic of liquid dielectric, breakdown in pure liquid and commercial liquid.

Break Down In Solid Dielectrics:

Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

UNIT-II

Generation of High Voltages and Currents:

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III

Measurement of High Voltages and Currents:

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT-IV

Non-Destructive Testing:

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing:

Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Book:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, McGraw Hill Education (India) Private Limited.

Reference Books:

2. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
3. R. S. Jha, "High Voltage Engineering", Dhanpat Rai & sons
4. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
5. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
6. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

NEE -022: INTELLIGENT INSTRUMENTATION

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2 1 0

Unit – 1& 2

1. **Introduction: Introduction to Intelligent Instrumentation:**
   Historical Perspective, current status, software based instruments.
2. **Virtual Instrumentation:**
   Introduction to graphical programming, data flow & graphical programming techniques, advantage of VI techniques, VIs and sub-VIs loops and charts , arrays, clusters and graphs, case and sequence structures, formula nodes, string and file I/O, Code Interface Nodes and DLL links.

Unit-3

3. Data Acquisition Methods: Analog and Digital IO, Counters, Timers, basic ADC designs, interfacing methods of DAQ hardware, software structure, use of simple and intermediate VIs. Use of Data Sockets for Networked Communication and Controls.

Unit-4

4. PC Hardware Review & Instrumentation Buses: Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, PCMCIA buses. IEEE488.1 & 488.2 Serial Interfacing - RS232C, RS422, RS423, RS485; USB, VXI, SCXI, PXI.

References:

1. G.C. Barney / Intelligent Instrumentation / Prentice Hall.
2. A.S. Moris / Principles of Measurement & Instrumentation / Prentice Hall.
3. H. S. kalsi, “Electronic Instrumentation”, McGraw Hill Education (India) Private Limited.
4. S. Gupta , J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED./ Instrument Society of America, 1994.
5. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill.

NEE -023: CONVENTIONAL & CAD OF ELECTRICAL MACHINES

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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.

NEE -024: SMART ENERGY DELIVERY SYSTEMS

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UNIT I

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

UNIT II

Smart Grid Technologies: Part 1: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

UNIT III

Smart Grid Technologies: Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

UNIT IV

Microgrids and Distributed Energy Resources: Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai “Integration of Green and Renewable Energy in Electric Power Systems”, Wiley
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, “Smart Grids”, Wiley Blackwell 19
5. Stuart Borlase, “Smart Grids (Power Engineering)”, CRC Press

Reference Books:

1. Andres Carvallo, John Cooper, “The Advanced Smart Grid: Edge Power Driving Sustainability: ”, Artech House Publishers July 2011
2. James Northcote, Green, Robert G. Wilson “Control and Automation of Electric Power Distribution Systems (Power Engineering)”, CRC Press
3. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert “Substation Automation (Power Electronics and Power Systems)”, Springer
4. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication

NEE – 651: POWER SYSTEM LAB

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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 (x_d) and quadrature axis reactance (x_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (x_d) and sub transient quadrature axis reactance (x_q) 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.

NEE=652: ELECTRICAL CAD LAB

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1. Design of Single phase transformer.
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.

U.P.TECHNICAL UNIVERSITY, LUCKNOW

STUDY AND EVALUATION SCHEME

B-Tech. Electrical Engineering

(EFFECTIVE FROM SESSION : 2010-11) **YEAR: 4th SEMESTER-VII**

Sl.No.	COURSE NO	SUBJECT	PERIOD			EVALUATION SCHEME				SUBJECT TOTAL	CREDIT
						SESSIONAL EVALUATION			EXAM ESE		
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	EOE-071-EOE-074	Open Elective-I	3	1	0	30	20	50	100	150	4
2	EEE-031-EEE-034	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3	EEE-041-EEE-044	Departmental Elective-IV	3	1	0	30	20	50	100	150	4
4	EEE-701	Switch Gear & Protection	3	1	0	30	20	50	100	150	4
5	EEE-702	Electric Drives	3	1	0	30	20	50	100	150	4
6	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL / DESIGN / DRAWING											
7	EEE-751	Power System Lab	0	0	3	10	10	20	30	50	1
8	EEE-752	Electric Drives Lab	0	0	3	10	10	20	30	50	1
9	EEE-753	Project	0	0	3	-	50	50	-	50	2
10	EEE-754	Industrial Training Viva voice	0	0	2	-	-	50	-	50	1
11	GP-701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**17**	**7**	**11**	**170**	**170**	**440**	**560**	**1000**	**26**

U.P.TECHNICAL UNIVERSITY, LUCKNOW

STUDY AND EVALUATION SCHEME

B-Tech. Electrical Engineering

(EFFECTIVE FROM SESSION : 2010-11) **YEAR: 4th SEMESTER-VIII**

Sl.No.	COURSE NO	SUBJECT	PERIOD			EVALUATION SCHEME				SUBJECT TOTAL	CREDIT
						SESSIONAL EVALUATION			EXAM ESE		
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	EEE-081-EOE-084	Open Elective-II	3	1	0	30	20	50	100	150	4
2	EEE-051-EEE-054	Departmental Elective-V	3	1	0	30	20	50	100	150	4
3	EEE-061-EEE-064	Departmental Elective-VI	3	1	0	30	20	50	100	150	4
4	EEE-801	Utilization of Electrical Energy & Traction	3	0	0	30	20	50	100	150	3
5	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL / DESIGN / DRAWING											
6	EEE-851	Project	0	0	12	-	100	100	250	350	8
7	GP-801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**14**	**5**	**12**	**120**	**180**	**350**	**650**	**1000**	**24**

DEPARTMENTAL ELECTIVES

ELECTIVE – I

Course No.	Sl. No	Subject
ECS-019	1	Database Management System, Data Mining And Warehousing
EEE-011	2	Digital Control System
EEN-011	3	Fundamentals of Digital Signal Processing
EEE-012	4	Special Electrical Machines

ELECTIVE – II

Course No.	Sl. No	Subject
EEE-021	1	High Voltage Engineering
EEE-022	2	Intelligent Instrumentation
EEE-023	3	Conventional And CAD of Electrical Machines
ECS-029	4	Cryptography & Network Security

ELECTIVE – III

Course No.	Sl. No	Subject
ECS-039	1	Object Oriented Systems and C^{++}
EEE-031	2	Power System Operation and Control
EEE-032	3	Advanced microprocessors and micro controllers
EEE-033	4	Neural Networks and fuzzy System

ELECTIVE – IV

Course No.	Sl. No	Subject
ECS-049	1	Computer Networks
EEE-041	2	EHV AC & DC Transmission
EEC-049	3	Digital Communication
EOE-042	4	Power Station Practice

ELECTIVE – V

Course No.	Sl. No	Subject
EEE-051	1	Bio Instrumentation
EEE-052	2	Advanced Control System
EEE-053	3	Reliability Engineering
EEE-054	4	Energy Efficiency & Conservation

ELECTIVE – VI

Course No.	Sl. No	Subject
EEE-061	1	Power Quality
EEE-062	2	SCADA & Energy Management System
EEC-069	3	Multimedia System
EEE-063	4	Power Converters Applications

SCIENCE BASED OPEN ELECTIVE

EOE-031 / EOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
EOE-032 / EOE-042	Nano Sciences
EOE-033 / EOE-043	Laser Systems and Applications
EOE-034 / EOE-044	Space Sciences
EOE-035 / EOE-045	Polymer Science & Technology
EOE-036 /EOE-046	Nuclear Science
EOE-037 / EOE-047	Material Science
EOE-038 / EOE-048	Discrete Mathematics
OPEN ELECTIVE-I	
EOE -071	Entrepreneurship Development
EOE-072	Quality Management
EOE-073	Operations Research
EOE-074	Introduction to Biotechnology
OPEN ELECTIVE-II	
EOE-081	Non Conventional Energy Resources
EOE-082	Nonlinear Dynamic Systems
EOE-083	Product Development
EOE-084	Automation & Robotics

YEAR- IV

EEE – 701: SWITCHGEAR AND PROTECTION

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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, iley 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.
5. T.S.M Rao,"Power System Protection: Static Relays with Microprocessor Applications" Tata Macgraw Hill".
6. A.R. Van C. Warringtaon , " Protective Relays- Their Theory and Practice, Vol. I & II" Jhon Willey & Sons.

EEE –702: ELECTRIC DRIVES

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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.

Reference Books:

3. M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.
6. V.Subrahmanyam, “Electric Drives: Concepts and Applications”, Tata McGraw Hill.

EEE – 751: POWER SYSTEM LAB

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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 (x_d) and quadrature axis reactance (x_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (x_d) and sub transient quadrature axis reactance (x_q) 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.

EEE – 752: ELECTRIC DRIVES LAB

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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 single-phase 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.

EEE -753: PROJECT

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Project shall be assigned to students at the start of VIIth semester. There should not usually be more than 3 students in batch. The project should be based on latest technology as far as possible and it may be hardware or/and software based. The assessment of performance of students should be made at least twice in the semester. Students should be encouraged to present their progress of project using overhead projector or LCD projector.

EEE – 754 PRACTICAL & INDUSTRIAL TRAINING PRESENTATION

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Students will go practical & Industrial training of four weeks in any industry or reputed organization after the VIth semester examination in summer. They will also prepare an exhaustive technical report of the training which will be duly signed by the officer under whom training was taken in the industry/organization. They will have to present about the training before a committee consisting of faculty members constituted by the concerned Head of the Department.

EEE – 801: UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

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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 in door 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 International Publications.

EEE – 851: PROJECT

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Students should devote themselves to expedite progress of the project as soon as VIIIth semester starts. They are supposed to finish project work latest by middle of April and submit project report by the end of the April month. The assessment of performance of students should be made at least twice in the semester. The students should present project using overheads project or power point presentation using in the end semester project examination

DEPARTMENTAL ELECTIVES
ELECTIVE - I
ECS-019 : DATABASE MANAGEMENT SYSTEM AND DATA MINING AND WAREHOUSING

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Unit-I:

Introduction:

An overview of database management system, database system v/s file system, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, data definitions language, DML, overall database structure.

Data modeling using the Entity Relationship Model:

ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables extended ER model, relationships of higher degree.

Unit-II:

Relational data Model and Language:

Relational data model concepts, integrity constraints: entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple and domain calculus.

Introduction to SQL:

Characteristics of SQL-Advantage of SQL data types and literals, types of SQL commands, SQL operators and their procedure tables, views and indexes, queries and sub queries, aggregate functions, insert, update and delete operations. Joins, Unions, Intersection, minus, cursors in SQL.

Unit-III:

Data Base Design & Normalization:

Functional dependencies, normal forms, first, second and third normal forms,BCNF,inclusion dependences, loss less join decompositions, normalization using FD,MVD,and JDs, alternative approaches to database design.

Unit-IV:

Foundation. Introduction to DATA Warehousing. Client / Server Computing model & Data Warehousing. Parallel processors & System. Distributed DBMS implementations.
Client /Server RDBMS Solutions.

Unit-V:

DATA Warehousing. Data Warehousing Components. Building a Data Warehouse. Mapping the Data Warehouse to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, cleanup & Transformation Tools. Metadata.

Data Mining: Introduction to data mining

Text Books:

1. Korth, Silbertz, Sudarshan, “Database Concepts”, Mc Graw Hill
2. Date C.J., “An Introduction To Database System”,Addition Wesley
3. Alex Berson & Stephen J.Smith,“Data Warehousing,Data Mining & OLAP”,Tata Mc.Graw Hill.
4. Mallach, “Data Warehousing System”, Mc. Graw Hill

Reference Books :

1. Elmasri,Navathe, “Fundamentals of Database Systems”,Addition Wesley
2. Bipin C.Desai, “An Introduction to Database Systems, “Galgotia Publication
3. Majumdar & Bhattacharya, “Database Management System”, Tata Mc Graw Hill
4. Ramakrishnan, Gehrke, “Database Management System”, Mc Graw Hill.

EEE – 011: Digital Control System

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UNIT-I **Signal Processing in Digital Control:** Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit., pulse transfer function, solution of difference equation by z-Transform method.
UNIT-II **Design of Digital Control Algorithms:** Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.
UNIT-III **State Space Analysis and Design:** State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and observability, design of digital control system with state feedback.
UNIT-IV **Stability of Discrete System:** Stability on the z-plane and Jury stability criterion, bilinear transformation, Routh stability criterion on rth plane. Lyapunou's Stability in the sense of Lyapunou, stability theorems for continuous and discrete systems, stability analysis using Lyapunor's method.
UNIT-V **Optimal digital control :** Discrete Euler Lagrange equation, max. min. principle, otpimality & Dynamic programming, Different types of problem and their solutions.

Text Books:

1. B.C.Kuo, "Digital Control System",Saunders College Publishing.
2. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill.

Reference Books:

3. J.R.Leigh, "Applied Digital Control", Prentice Hall, International
4. C.H. Houpis and G.B.Lamont, "Digital Control Systems:Theory, hardware, Software",Mc
5. Graw Hill.

EEN - 011: FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

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

Reference Books:

2. Proakis, J.G. & Manolakis, D.G.," Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India.
3. Rabiner, L.R. and Gold B., "Theory and applications of DSP", Prentice Hall of India.
4. Oppenheim, Alan V. & Willsky, Alan S. , "Signals and Systems" , Prentice Hall of India, 2nd Edition
5. Johnson, J.R. , "Introduction to Digital Signal Processing", Prentice Hall of India.
6. De Fatta, D.J.Lucas, J.G. & Hodgkiss, W. S.," Digital Signal Processing", John Wiley& Sons

EEE-012: SPECIAL ELECTRICAL MACHINES

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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.

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

Elective II

EEE – 021: HIGH VOLTAGE ENGINEERING

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UNIT-I

Break Down In Gases:

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, breakdown in vacuum.

Break Down In Liquid Dielectrics:

Classification of liquid dielectric, characteristic of liquid dielectric, breakdown in pure liquid and commercial liquid.

Break Down In Solid Dielectrics:

Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric in practice, breakdown in composite dielectrics.

UNIT-II

Generation of High Voltages and Currents:

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III

Measurement of High Voltages and Currents:

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT-IV

Non-Destructive Testing:

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing:

Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Book:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.

Reference Books:

2. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
3. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers
4. R. S. Jha, "High Voltage Engineering", Dhanpat Rai & sons
5. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

EEE -022: INTELLIGENT INSTRUMENTATION

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Unit – 1& 2

1. **Introduction: Introduction to Intelligent Instrumentation:**
   Historical Perspective, current status, software based instruments.
2. **Virtual Instrumentation:**
   Introduction to graphical programming, data flow & graphical programming techniques, advantage of VI techniques, VIs and sub-VIs loops and charts , arrays, clusters and graphs, case and sequence structures, formula nodes, string and file I/O, Code Interface Nodes and DLL links.

Unit-3

3. Data Acquisition Methods: Analog and Digital IO, Counters, Timers, basic ADC designs, interfacing methods of DAQ hardware, software structure, use of simple and intermediate VIs. Use of Data Sockets for Networked Communication and Controls.

Unit-4

4. PC Hardware Review & Instrumentation Buses: Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, PCMCIA buses. IEEE488.1 & 488.2 Serial Interfacing - RS232C, RS422, RS423, RS485; USB, VXI, SCXI, PXI.

References:

1. G.C. Barney / Intelligent Instrumentation / Prentice Hall, 195.
2. A.S. Moris / Principles of Measurement & Instrumentation / Prentice Hall, 1993.
3. S. Gupta , J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED./ Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing II Ediction / McGraw Hil 1997.

EEE -023: CONVENTIONAL & CAD OF ELECTRICAL MACHINES

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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.

ECS-029 : CRYPTOGRAPHY AND NETWORK SECURITY

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UNIT-I

Introduction:

Introduction to Security attacks, services and mechanism, Introduction to cryptology.

Conventional Encryption: Conventional Encryption model, classical encryption techniques – substitution ciphers & transposition ciphers, cryptanalysis, stereography, stream & block ciphers.

Model Block Ciphers : Block Ciphers principles, Shannon's theory of Confusion and diffusion, fiestal structure, Data Encryption Standards (DES), Strength of DES, Differential & Linear Cryptanalysis of DES, Block Cipher modes of operation, Triple DES, IDEA encryption & decryption, Strength of IDEA, Confidentiality using Conventional Encryption, traffic confidentiality, key distribution, random number generation.

UNIT -II

Introduction to graph, ring and field, Prime and relative prime numbers, modular arithmetic, Fermat's & Euler's Theorem, Primality testing, Euclid's Algorithm, Chines reminder theorem, Discrete logarithms. Principles of public key cryptosystems, RSA algorithm, security of RSA, key management, Diffle- Hellman key Exchange algorithm, Introductory idea of Elliptic curve cryptography, Elganal Encryption.

UNIT -III

Message Authentication & Hash Functions: Authentication recruitments, Authentication functions, Message Authentication codes, Hash functions, Birthday attacks, security of Hash function & MACS, MD5 message digest algorithm, secure Hash Algorithm (SHA).

Digital Signature : Digital Signature, Authentication protocol, Digital Signature Standard (DSS), proof of digital signature algorithm.

UNIT IV

IP Security : Authentication Header, Encapsulating security payloads, Combining security associations, Key management.

Web Security : Secure Socket Layer & Transport Layer Security, secure Electronic Transaction (SET).

System Security: Intruders, Viruses and related threads, Firewall design principles, trusted systems.

Text Books:

1. William Stallings, "Cryptography and Network Security : Principles and Practice", Prentice Hall.
2. Johanners A. Buchmann, " Introduction to cryptography", Springer –Verlag.
3. Bruce Schiener, "Applied Cryptography".

ELECTIVE-III

ECS -039 OBJECT ORIENTED SYSTEMS AND C++

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Unit-I
Object & classes, Links and Associations, Generalization and Inheritance, Aggregation, Abstract classes, Generalization, Multiple Inheritance, Meta data.

Unit-II
Events and States, Operations and Methods, Nested state diagrams, Concurrency, Relation of Object and Dynamic Models.

Unit-III
Functional Models, Data flow diagrams, Specifying Operations, Constraints, OMT Methodologies, examples and case studies to demonstrate methodology

Unit-IV
Principles of object oriented programming, Tokens, Expressions, classes, Functions, Constructors, Destructors,Functions overloading, Operator Overloading, I/O Operations.
Real life applications, Inheritance Extended Classes, Pointer. Virtual functions, Polymorphisms, Working with files, Class templates, Function templates,Exception handling, String manipulation.
Translating object oriented design into implementations.

Unit-V:
Introduction to Unix/Linux operating systems. Concept of file system, handling ordinary files,concept of shell, vi editor, Basic ile attributes, concept of process, Basic system administration.

Text Books:

1. Rambaugh James etal, "Object Oriented Design and Modeling",PHI-1997
2. Balagurusamy E," Object Oriented Programming with C++", TMH,2001 '
3. Sumitabha Das “Unix concepts & application” TMH

Reference Books:

4. Dillon and Lee, "Object Oriented Conceptual Modeling", New Delhi PHI-1993
5. Lipman, Stanley B, Jonsce Lajoie, *C++* Primer Reading", AWL, 1999
6. Stephen R. Shah, "Introduction to Object Oriented Analysis and Design", TMH
7. Berzin Joseph, "Data Abstraction: the object oriented approach using *C++",* McGraw Hill
8 Budd, Timothy, "An Introduction to Object Oriented Programming", Pearson 2000

EEE –031: POWER SYSTEM OPERATION AND CONTROL

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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 control-control 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. J. Wood & B.F. Wollenburg, " Power Generation, Operation and Control " John Wiley & Sons.

Reference Books:

5. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. P. Kundur, " Power System Stability and Control Mc Graw Hill.
7. M.H. Rashid, "Power Electronics: Circuits, devices and Applications" Prentice Hall of India,3rd Edition.
8. T. K. Nagsarkar & M.S.Sukhiza,' Power System Analysis' Oxford University Press.

EEE-032 : ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

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Unit-I

Mode of operation of higher order processors: Real mode and protected mode

Real mode and protected mode memory addressing, access right byte, Memory paging, System descriptors, Multi Tasking & TSS.

Unit-II

Instruction Set of higher order processors(8086 to Pentium):

Comparison with 8086 in real mode: Generalized instruction set format

Addressing Mode: DRAM & BRAM

Categorization of instruction set of INTEL processors.

Integer instructions: Data transfer instructions, arithmetic and logical operations, string instructions, branch control instructions, procedure call instruction and return instruction.

Unit-III

Processing of CALLS, INTERRUPTS & EXCEPTIONS: Privilege levels; ENTER and LEAVE Instructions, INT N. IRET. Interrupt processing sequence, Protected mode interrupts.

Unit-IV

Assembly Level Programming: ROM BIOS Routines, MS DOS BIOS Routines, Assembling a progam using Assembler, exe and. com programs.

Mixed Language Programming: using Assembly with C/C ++

Unit-V

Microcontrollers: Introduction, basic functions, applications of 8-bit and 16-bit microcontrollers.

8-bit microcontrollers INTEL 8051: Internal Architecture, signals, memory organization and interfacing, Timing and control, port operations, interrupts and I/O addressing. Instruction Set and programming.

16-bit microcontrollers INTEL 8096: Architectural description, memory Organization and interfacing, I/O addressing, Interrupts, instruction set and programming.

Text Books:

1. Ray, A.K. & Burchandi, K.m., "Advanced Microprocessors and Peripherals: Architeacture, Programming and Interfacing" Tata Mc.Graw Hill.
2. Renu Sing & B.P.Singh, "Advanced Microprocessors and Microcontrollers" New Age International.
3. Krishna Kant,"Microprocessors and Microcontrollers" PHI Learning.
4. Brey, Barry B. "The INTEL Microprocessors" Pearson Education.

Reference Books:

5. Ayala, "The 8051 Micro Controller", Centage Learning.
6. Mazidi M.A., Maizidi J.G. Mckinlay R.D., "The 8051 Microcontroller and Embedded Systems" Pearson Education.
7. Rajkamal, "The concept and feature of microcontrollers 68HC11, 8051 and 8096", S.Chand Publisher, New Delhi

Peatman John, "Design with microcontroller", Mc.-Graw Hill Publishing.

EEE-033: NEURAL NETWORKS AND FUZZY SYSTEM

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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 propogation networks)

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation 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

Fuzzy Neural Networks:

L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propogation(BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

1. Kumar Satish, “Neural Networks” Tata Mc Graw Hill
2. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India.

Reference Books:

3. Siman Haykin,”Neural Netowrks”Prentice Hall of India
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.

ELECTIVE-IV

ECS-049: COMPUTER NETWORKS

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UNIT-I

Introduction :

Goals and applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design- Delay Analysis, Back Bone Design, Local Access Network Design. Physical Layer Transmission Media, Switching methods , ISDN, Terminal Handling.

UNIT-II

Medium Access Control sub layer:

Medium Access sub layer- Channel Allocation, LAN protocols- ALOHA protocols- Overview of IEEE standards – FDDI, Data Link Layer – Elementary data Link Protocols, Sliding Window protocols, Error Handling.

UNIT –III

Network Layer:

Network Layer – Point – to Point Networks, routing, Congestion control, Internetworking – TCP /IP –IP packet, IP address, IP v6.

UNIT –IV

Transport Layer:

Transport Layer – Design issues, connection management, session Layer – Design issues, remote procedure call, Presentation Layer – Design issues, data compression techniques, cryptography – TCP Window Management.

UNIT –V

Application Layer:

Application Layer- File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application, Example Networks – Internet and Public Networks.

Text Books:

1. Behrouz A. Forouzan, “Data Communication and Networking”, Tata Mc Graw Hill.
2. A.S. Tanenbaum, “ Computer Networks”, 3rd Edition, Prentice Hall India .
3. S. Keshav, “An Engineering Approach on Computer Networking”, Addition Wesley.
4. W. Stallings, “Data and Computer Communication”, Macmillan Press.

EEE - 041: EHV AC & DC TRANSMISSION

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UNIT-I

Introduction :

Need of EHV transmission, standard transmission voltage, comparison of EHV ac & dc transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission

UNIT-II

EHV AC Transmission :

Corona loss formulas, corona current, audible noise – generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

UNIT-III

Extra High Voltage Testing:

Characteristics and generation of impulse voltage, generation of high Ac and Dc voltages, measurement of high voltage by spheregaps and potential dividers.

Consideration for Design of EHV Lines:

Design factors under steady state limits, EHV line insulation design based upon transient over voltages.

Effects of pollution on performance of EHV lines.

UNIT-IV

EHV DC Transmission – I:

Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters.

Principle of dc link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of dc link.

UNIT-V

EHV DC Transmission – II:

Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, ac and dc filters,

Multi Terminal DC systems (MTDC): Types, control, protection and applications.

Text Books :

1. R. D. Begamudre, “Extra High Voltage AC Transmission Engineering” Wiley Eastern.
2. K. R. Padiyar, “HVDC Power Transmission Systems: Technology and System Reactions” New Age International.
3. J. Arrillaga,“ High Voltage Direct current Transmission” IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
4. M. S. Naidu & V. Kamaraju, “High Voltage Engineering” Tata Mc Graw Hill.

Reference Books:

5. M. H. Rashid , “ Power Electronics : Circuits, Devices and Applications” Prentice Hall of India.
6. S. Rao, “EHV AC and HVDC Transmission Engineering and Practice” Khanna Publisher.
7. “EPRI, Transmission Line Reference Book, 345 KV and above” Electric Power Research Institute. Palo Alto, California, 1982.

EEC- 049 : DIGITAL COMMUNICATION

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UNIT-I

Elements of Digital Communication and Information Theory:

Model of a Digital Communication, System, Probability Theory and Random Variables , Logarithmic Measure of Information, Entropy and Information and InformationRate, Conditional Entropy and Redundancy, Source Coding, Fixed and Variables Length Code Words, Source Coding Theorem, Prefix Doing and Kraft Inequality, Shannon-Fano and Huffman Coding.

UNIT-II

Digital Base band Transmission:

PCM Coding, DM, DPCM, ADCM, Data Transfer Rate, Line Coding and its Properties and its Properties, NRZ &RZ &RZ Types, Signaling Format For Unipolar, Polar, Bipolar (AMI) & Manchester Coding and Their Power Spectra (No Derivation) Matched Filter Reciver, Derivation of Its Impulse Response and Peak Pulse Signal to Noise Ratio.

Correlation Detector Decision Threshold and Error Probability For Binary, Unipolar (ON-OFF) Signaling, ISI, Nyquist Criterion For Zero ISI & Raised Cosine Spectrum.

UNIT-III

Digital Modulation Techniques:

Gram-Schmidt Orthgonalization Procedure, Types of Digital Modulation, Wave forms for Amplitude, Frequency and Phase Shift Keying, Method of Generation and Detection of Coherent & & Non-Coherent Binary ASK, FSK & PSK Differential Phase Shift Keying, Quadrature Modulation Techniques QPSK, Probability of Error and Comparison of Various Digital Modulation Techniques.

UNIT-IV

Digital Multiplexing:

Fundamentals of Time Division Multiplexing, Electronic Commutator, Bit, Byte Interleaving T1 Carrier System, Synchronization and Signaling of T1, TDM, PCM Hierarchy, T1 toT4 PCM TDM System (DS1 to DS4 Signals)

UNIT-V

Error Control Coding:

Error Free Communication Over a Noize Channel, Hamming code, Relation Between Minimum Distance and Minimum Distance Error Correcting Capability, Linear Block Codes, Encoding and Syndrome Decoding, Cyclic Codes, Tree diagram state diagram and Trellis Diagram, Viterbi and Sequential Decoding Comparison of performance.

Text Book:

Haykin, simon / "Communication System" / John Wiley /4th Ed.

Reference Books:

1. Singh, R.P. & Sapre, S.D. /"Communication Systems: Analog &Digital" /Tata McGraw-Hill.
2. Lathi, B.P. / "Modern Digital &Analog Communication System" /Oxford University Press.
3. Simon Haykin/ "Prinicples of Communication Systems"/ Tata McGraw-Hill
4. Taub & Schilling/"Communication Systems"/Tata McGrw-Hill.
5. A.B. Carlson / "Digital Communication Systems"/Tata McGraw-Hill.
6. Prokis J.J/ "Digital Communications" /McGrawHill
7. Charkrabarti, P. / "Analaog & Digital Comminication" / Tata McGraw –Hill
8. Kennedy, Georg & Davis, Bernard/ "Electronic communication systems" / Tata McGraw-Hill.

EEE 042: POWER STATION PRACTICE

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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,

MHD generation: Working principle, open and closed cycles, MHD systems, advantages, parameters governing power output.

Solar power plant: Conversion of solar heat to electricity, Solar energy collectors, Photovoltaic cell, power generation, future prospects of solar energy use.

Wind Energy: Windmills, power output with combined operation of wind turbine generation and isolated generating system, technical choices& economic size.

Geothermal Energy: Earth energy, heat extraction, vapor turbine cycle, difficulties & disadvantages,

Tidal energy: Tidal phenomenon, tidal barrage, tidal power Schemes.

Ocean Thermal Energy: Introduction, energy conversion, problems.

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.

Reference Books:

4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
5. S. L. Uppal, "Electrical Power", Khanna Publishers.

ELECTIVE V

EEE – 051: BIO-INSTRUMENTATION

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UNIT-I

Basic physiological system of the body:

Problems encountered in measuring living systems, bioelectric potentials, biomaterials

Basic Transducer Principles:

Active and passive transducers,

Transducers for biomedical applications.

Generation, propagation and distribution of bioelectric potentials (ECG, EEG and EMG).

UNIT-II

Bio-potential electrodes:

Basic types (micro, skin surface and needle electrodes) biochemical transducers. (PH, blood, gas and specific ions electrodes).

The cardiovascular system and measurements:

Heart and cardiovascular system and circulation block diagram, blood pressure and measurement, characteristics of blood flow and heart sounds.

Electrocardiography, ECG lead configurations, ECG recording and their types

UNIT-III

The Nervous System

The anatomy of nervous system, Neuronal communication, EPSP & IPSP

Organization of the brain,

Measurements from the nervous system

Systemic Body & Skin Temperature Measurement

Temperature measurements

Brief idea about ultrasonic measurements

UNIT-IV

Patient care monitoring:

Elements of intensive care,

Organization of the Hospital for patient-care monitoring

Pace-makers-types, systems, modes and generators,

Defibrillators-types.

Bio telemetry & applications of telemetry in patient care

UNIT-V

Automation of chemical tests,

Instrumentation for diagnostic X Rays,

Interfacing computer with medical instrumentation and other equipments, biomedical computer applications.

Shock hazards from electrical equipments, methods of accident prevention

Text Book:

1. T. Cromwell, F.J. Weibell & F.A.Pfieffer, "Biomedical Instrumentation & Measurements" Prentice Hall International

Reference Books:

2. R.S. Khanpur, "Handbook of Biomedical Instrumentation" Tata Mc Graw Hill
3. H.E. Thomas, "Handbook of Biomedical Instrumentation and Measurement" Restone Publishing Company
4. J.G. Webester, "Medical Instrumentation", Houghton Mifflin.

EEE – 052: ADVANCED CONTROL SYSTEM

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Unit-I

State Space Analysis of Continuous System:

Review of state variable representation of continuous system, conversion of state variable models to transfer function and vice-versa, solution of state equations and state transition matrix, controllability and obsrvability, design of state observer and controller

Unit-II

Analysis of Discrete System:

Discrete system and discrete time signals, state variable model and transfer function model of discrete system, conversion of state variable model to transfer function model and vice-versa, modeling of sample-hold circuit, solution of state difference equations, steady state accuracy, stability on the z-plane and Jury stability criterion, bilinear transformation, Routh-Hurwitz criterion on rth planes

Unit-III

Stability:

Lyapunov's stability theorems for continuous and discrete systems, methods for generating Lyapunov function for continuous and discrete system, Popov's criterion.

Non linear System:

Types of non linearities, phenomena related to non - linear systems.

Analysis of non linear systems-Linearization method, second order non-linear system on the phase plane, types of phase portraits, singular points, system analysis by phase-plane method, describing function and its application to system analysis.

Unit-IV

Optimal Control:

Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization.Pontryagin's Minimum Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation, Riccati equation and its solution.

Unit-V

Adaptive Control:

Introduction, modal reference adaptive control systems, controller structure, self tuning regulators.

Introduction to neural network, fuzzy logic and genetic algorithms

Text Books:

1. M.Gopal, "Digital Control and State variable Methods", Tata Mc Graw Hill
2. Ajit K.Madal, "Introduction to Control Engineering: Modelling, Analysis and Design"
3. New Age International.
4. D.Landau, "Adaptive Control", Marcel Dekker Inc.
5. S.Rajasekaran & G.A.Vjayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic
6. Alogorithms: Synthesis and Applications" Prentice Hall of India.

Reference Book:

7. Donald E. Kiv, “Optimal Control Theory: An Introduction” Prentice Hall
8. B.C. Kuo, “Digital Control Systems” Sounders College Publishing
9. C.H.Houpis and G.B.Lamont,“Digital Control Systems:Theory,Hardware,Software”Mc Graw Hill.

EEE – 053: RELIABILITY ENGINEERING

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1. Introduction:

Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness.

2. Reliability Mathematics :

Definition of probability, laws of probability , conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis procedures, empirical reliability calculations.

3. Reliability:

Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie-set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method.

4. Reliability Improvements:

Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance.

5. Reliability Testing:

Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

Reference Books:

1. R.Billintan & R.N. Allan,"Reliability Evaluation of Engineering and Systems", Plenum Press.
2. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiely and Sons.
3. S.K. Sinha & B.K. Kale,"Life Testing and Reliability Estimation", Wiely Eastern Ltd.
4. M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGraw Hill.
5. G.H.Sandler,"System Reliability Engineering", Prentice Hall.

EEE-054: ENERGY EFFICIENCY AND CONSERVATION

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UNIT -I

Energy conservation:-

Principles of Energy Conservation, Energy conservation Planning, Energy conservation in small scale industries, Large scale industries and in electrical generation, transmission and distribution. Energy conservation Legislation. 4

Energy Audit:-

Aim of energy Audit, Strategy of Energy Audit, Energy management Team Considerations in implementing energy conservation Programme, Instruments for energy audit, Energy audit of Electrical System, HVAC, Buildings, Economic analysis. 4

UNIT -II

Demand Side Management:-

Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy ,Planning, Implementation and its application. Customer Acceptance & its implementation issues. National and International Experiences with DSM. 8

UNIT –III

Voltage and Reactive power in Distribution System:-

Voltage and reactive power calculations and control: Voltage classes and nomenclature, voltage drop calculations, Voltage control, VAR requirements and power factor, Capacitors unit and bank rating, Protection of capacitors and switching, Controls for switched capacitors and fields testing. 10

UNIT –IV & V

Efficiency in Motors and Lighting system:-

Load scheduling/shifting, Motor drives- motor efficiency testing, energy efficient motors, and motor speed control. Lighting- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows.UPS selection, Installation operation and maintenance.

Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003 14

Text / Reference Books

1. Tripathy S. C., "Electric Energy Utilization and conservation", Tata McGraw Hill.
2. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982.
3. "The Efficient Use of Energy", Edited by I.G.C.Dryden, Butterworths, London, 1982.
4. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York, 1982.
5. L.C.Witte, "P.S.Schmidt, D.R. Brown, Industrial Energy Management and Utilization", HemispherePubl, Washington, 1988
6. Power Capacitor Handbook, Butterworth & Co (Publishers) Ltd, 1984.
7. Electrical Systems Analysis and Design for Industrial Plants, McGraw-Hill Book Company.
8. IEEE Bronze Book, 'Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities, IEEE Press.

ELECTIVE-VI

EEE-061: POWER QUALITY

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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 transients- motor 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, multi-meter 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.

EEE-062: SCADA & ENERGY MANAGEMENT SYSTEM

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1. SCADA:

Purpose and necessity, general structure, data acquisition, transmission & monitoring. general power system hierarchical Structure.

Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites.

2. Supervisory and Control Functions:

Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc.

Regulatory functions: Set points and feed back loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.

3. MAN- Machine Communication:

Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.

4. Data basis- SCADA, EMS and network data basis.

SCADA system structure - local system, communication system and central system. Configuration-NON-redundant- single processor, redundant dual processor. multicontrol centers, system configuration.

Performance considerations: real time operation system requirements, modularization of software programming languages.

5. Energy Management Center:

Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management.

Text Books:

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th Edition.

EEC-069 : MULTIMEDIA SYSTEM

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3 1 0

Unit-I

Introduction

Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment products

Stages of Multimedia Projects

Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit-II

Multimedia Building Blocks

Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Unit-III

Data Compression

Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modelling. Finite Context Modelling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Unit-IV

Speech Compression & Synthesis

Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

Unit-V

Images

Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formatic animations Images standards, JPEG Compression, Zig Zag Coding, Multimedia Database.Content based retrieval for text and images,

Video: Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent development in Multimedia.

Text/Reference Books:

1. Tay Vaughan “Multimedia, Making IT Work” Osborne McGraw Hill.
2. Buford “Multimedia Systems” Addison Wesley.
3. Agrawal & Tiwari “Multimedia Systems” Excel.
4. Mark Nelson “Data Compression Book” BPB.
5. David Hillman “Multimedia technology and Applications” Galgotia Publications.
6. Rosch “Multimedia Bible” Sams Publishing.
7. Sleinreitz “Multimedia System” Addison Wesley.
8. James E Skuman “Multimedia in Action” Vikas.

EEE – 063: POWER CONVERTER APPLICATIONS

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UNIT-I

HVDC Transmission:

Schematic diagram, modes of operation, twelve pulse line commutated converters, effect of source

inductance, control of HVDC converters, converter faults and protection, harmonic filters.

UNIT-II

FACT Controllers :

Principle of power transmission, principles of shunt compensation and series compensation; Shunt compensators-TCR,TSC, SVC,STATCOM

Series compensators-TSSC,FCSC,TCSC,SSVC; Phase angle compensator, Unified power flow controller (UPFC),comparison of compensators.

UNIT-III

Power Supplies:

Desirable specifications of power supplies, drawbacks of linear power supply.

Switch-Mode Power supply (SMPS)-schematic diagram, flyback converter, forward converter, push-pull converter, half bridge and full bridge converters; Uninterruptible power supply (UPS)-configurations of off-line and on-line UPS, switch mode and resonant power supplies; air-craft power supply.

UNIT-IV

Industrial Applications:

High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electric welding control.

UNIT-V

Interconnection of Renewable Energy Sources to the Utility Grid :

Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage systems;

DC circuit breaker, single phase and three phase ac switches;

Excitation control of synchronous generators.

Text Books:

1. Ned Mohan, T.M.Undeland and William P.Robins, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons.
2. M.H. Rashid, “Power Electronics: Circuits, Devices and Applications” Prentice Hall of India.

Reference Books:

3. K.R.Padiyar, “HVDC Power Transmission: Technology and System Reactions” New Age International