BABU BANARASI DAS UNIVERSITY LUCKNOW

SCHOOL OF ENGINEERING

Syllabus for

Bachelor of Technology

in

Electrical Engineering

(Effective from the Academic Session 2012-13)

COURSE STRUCTURE- B.Tech -2nd Year

(Electrical Engineering)

2nd – YEAR											SEMESTER-III
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU-301/ BHU-302	Industrial Psychology / Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	BAS-302	Numerical Techniques	2	1	0	15	10	25	50	75	3
3.	BEE-301	Networks &Systems	3	1	0	30	20	50	100	150	4
4	BEE-302	Electronic Devices & Circuits	3	1	0	30	20	50	100	150	4
5	BEE-303	Electrical Measurement & Measuring Instruments	3	1	0	30	20	50	100	150	4
6	BCS-305	Programming in 'C'	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7	BEE-351	Networks Lab	0	0	2	10	10	20	30	50	1
8	BEE-352	Electronic Devices & Circuits Lab	0	0	2	10	10	20	50	50	1
9	BEE-353	Electrical Measurements & Measuring Instruments Lab				10	10	20	50	50	1
10	BCS-355	'C' Programming Lab	0	0	2	10	10	20	30	50	1
11	GP-301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**16**	**5**	**8**	-	-	-	-	**1000**	**26**

2nd – YEAR											SEMESTER-IV
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU-402/ BHU-401	Industrial Sociology/ Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	BAS-401	Mathematics-III	3	1	0	30	20	50	100	150	4
3.	BEE-401	Electrical Machines & Energy Conversion-I	3	1	0	30	20	50	100	150	4
4	BEE-402	Fundamentals of Digital Electronics	3	1	0	30	20	50	100	150	4
5.	BEE-403	Microprocessors	3	1	0	30	20	50	100	150	4
6	BEE-404	Electrical & Electronics Engineering Materials	2	1	0	15	10	25	50	75	3
Practical / Training / Project											
7	BEE-451	Electromechanical Energy Conversion-I Lab	0	0	3	10	10	20	30	50	1
8	BEE-452	Digital Electronics Lab	0	0	2	10	10	20	30	50	1
9	BEE-453	Microprocessor Lab	0	0	3	10	10	20	30	50	1
10	BEE-454	Electrical Simulation Lab	0	0	2	10	10	20	30	50	1
11	GP-401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**16**	**5**	**8**	-	-	-	-	**1000**	**26**

BEE- 301: NETWORKS AND SYSTEMS

UNIT-1 Network Theorems (Applications to AC networks): Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.

UNIT-2 Analysis of coupled circuits: Introduction, Self Inductance, Mutual Inductance, Coefficient of coupling, Series connection of coupled coils, Dot convention in coupled circuits, AC networks based on coupled circuits, Review of Laplace Transform & its applications to electrical networks.

UNIT-3 Transient analysis: DC Transient response of R-L, R-C, R-L-C circuits (Series and parallel combination) for DC excitation- Initial conditions- solution method using differential equation and Laplace transforms.

AC Transient response of RL, RC, RLC circuits (Series and parallel combination) for Sinusoidal excitations- Initial conditions- solution method using differential equation and Laplace transforms.

UNIT-4 Two Port Networks: Two port network parameters- Z, Y, ABCD, hybrid parameters and their relations, Reciprocity and Symmetry, Inter-connections of two port networks, Ladder and Lattice networks. T & Π Transformation, Driving point and Transfer Functions.

UNIT-5 Network Synthesis: Positive Real Functions, Definition and properties, Synthesis of LC, RL & RC circuits using Cauer and Fosters first and second form.

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.

Text Books:

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A. Chakrabarti, "Circuit Theory" Dhanpat Rai & Co.
3. C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007.
4. D.Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.
5. Donald E. Scott: "An Introduction to Circuit analysis: A System Approach" McGraw Hill

Reference Books:

6. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis",Wiley Eastern Ltd.
7. N.C. Jagan and C. Lakshminarayana, "Network Analysis" B.S. Publications, 2008.
8. K.S. Suresh Kumar, "Electric Circuits and Networks" Pearson Education, 2009.
9. A Ramakalyan, "Linear Circuits: Analysis and Synthesis" Oxford University Press, 2005.

BEE-302: ELECTRONIC DEVICES & CIRCUITS

UNIT-1 Semiconductors: Intrinsic and extrinsic semiconductors, P-type and N-Type semiconductors, Theory of P-N junction diode, formation of space charge region, Forward and reverse biasing of diodes, energy band diagram of a diode, V-I Characteristics of diodes, equivalent circuit of diode, junction capacitances of diode.

UNIT-2 Rectifiers: Half wave and full wave bridge rectifier circuits, C filter, L filter, LC filter, CLC/II filter, various parameters of power supply, Zener diode and regulated power supply using Zener diodes.

UNIT-3 Transistors: PNP and NPN transistors, construction and current components, transistor as an amplifier, CE, CB and CC amplifier circuit, input and output characteristics of transistor circuits, various parameters of transistor, DC load line, Biasing of transistor amplifier, biasing stability, transistor as a switch.

UNIT-4 Field Effect Transistor: Construction, principle of working and V-I characteristics. MOSFET: Construction, principle of working and V-I characteristics, Depletion and enhancement type MOSFET, CMOS, FET biasing, parameters of a FET.

UNIT-5 Feedback amplifiers and oscillators: General feedback theory, current and voltage feedback, Effect of negative feedback, condition for oscillation, RC phase oscillator, Hartley and Colpitt's oscillator, Crystal oscillator, Tunnel Diode Oscillator.

Text Books:

1. Millman and Halkias, "Integrated Electronics", TMH Pbs.
2. Boylestad & Nashelsky, "Electronic devices and circuits", Pearson Pbs.
3. "Semiconductor Devices and circuits", Alok Dutta, Oxford University Press.

Reference Books:

4. Sedra Smith, "Microelectronic Circuits", Oxford Pbs.
5. Donald, "Electronic circuit analysis and design", TMH Pbs.
6. Nagrath "Electronics analog and digital", PHI Pbs.

BEE-303: ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

UNIT-1 Philosophy of Measurement: Classification of instrument system, characteristics of instruments & measurement system, errors in measurement and its analysis.
Measuring Instruments- Principle of operation, constructional details of moving coil, moving iron, electrodynamics, electrostatic and induction type of instruments; ammeters, voltmeters, wattmeter, energy meters: vibration galvanometer.

UNIT-2 Measurement of Parameters: Different methods of measuring low, medium and high resistance, Price's Guard wire method, Loss of charge method; measurement of inductance & capacitance with the help of AC bridges (Hay's bridge, Anderson bridge, Schering bridge, De Sauty bridge and wein's bridge). Sources of errors in bridge measurements and their minimization.
Poly phase metering: Blondel's theorem for n- phase, p-wire system, measurement of power, reactive KVA in 3 phase, balanced and unbalanced circuits.

UNIT-3 Instrument Transformers: Their application in the extension of instrument range, theory and construction of current and potential transformer, ratio and phase angle errors, effect of variation of power factor, secondary burden and frequency, Application of instrument transformers-measurement & protection, class of accuracy.

UNIT-4 Ac Potentiometer: Polar type & Coordinate type AC potentiometer, Application of AC potentiometers in electrical measurement.
Magnetic Measurement: Ballistic Galvanometer, Grassot fluxmeter, determination of hysteresis loop, measuremet of iron losses.

UNIT-5 Digital Measurement of Electrical Quantities: Concept of digital measurement, block diagram study of digital voltmeter, frequency meter, Electronic multimeter.
Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Principle & working of CRO, Application of CRO to different measurements.

Text Books:

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 .

Reference Books:

3. Forest K. Harries,"Electrical Measurement",Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,"Basic Electrical Measurement" Prentice hall of India,India.
5. W.D.Cooper, "Electronic Instrument & Measurement Technique" PHI.
6. Rajendra Prashad ,"Electrical Measurement &Measuring Instrument" Khanna Publisher.
7. J.B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria & Sons.

BEE-351: NETWORKS LAB

Note: Minimum 8 experiments are to be performed from the following list.

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.
3. Verification of Tellegen'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. Write Demo for the following in Ms-Power point.
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.

BEE-352: ELECTRONIC DEVICES & CIRCUITS LAB

Note : Minimum 8 experiments are to be performed from the following list :

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 study transistor as a switch and determine load voltage and load current when the transistor is ON.
8. 9. To study application of Operational Amplifier as summer integrator and voltage comparator
9. To study operation of Op-Amp based astable and monostable multivibrators.
10. To study operation IC 555 based astable and monostable multibrators.
11. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.

BEE-353: ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Study of CRO.
2. Calibration of ac voltmeter and ac ammeter
3. 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
4. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.
5. 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
6. Measurement of low resistance by Kelvin's double bridge
7. Measurement of voltage, current and resistance using dc potentiometer
8. Measurement of inductance by Maxwell's bridge
9. Measurement of inductance by Hay's bridge
10. Measurement of inductance by Anderson's bridge
11. Measurement of capacitance by Owen's bridge
12. Measurement of capacitance by De Sauty bridge
13. Measurement of capacitance by Schering bridge
14. Study of Frequency and differential time counter
15. Measurement of energy and error determination of single phase energy meter.
16. Three phase power measurement using 2- wattmeter method.

BEE-401: ELECTRICAL MACHINES & ENERGY CONVERSION-I

UNIT-1 Principles of Electro-mechanical Energy Conversion: Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems (defining energy & Co-energy) , Singly Excited Systems, determination of mechanical force, mechanical energy, torque equation , Doubly excited Systems, Energy stored in magnetic field, electromagnetic torque , Generated emf in machines, torque in machines with cylindrical air gap.

UNIT-2 Basic concepts of Rotating Electrical Machines: Constructional details of various rotating machines, Introduction to Lap and wave windings, EMF generation, Effect of chording and distribution of winding on EMF, Harmonics in generated emf, MMF of distributed winding

DC Machines: Construction, Action of commutator, E.M.F. generated in armature, Torque in DC machines, Methods of excitation, armature reaction, MMF and flux density wave from the DC Machines, Commutation process, interpoles and compensating windings. Basic performance equations of DC machine. Magnetization and operating characteristics of DC generators and DC motors.

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

UNIT-4 Transformers: Construction, Theory and operation, EMF equation.

Single Phase Transformer: Phasor diagram, Equivalent circuit, Efficiency and Voltage regulation, All day efficiency

Testing of Transformers: O.C. and S.C. tests, Sumpner's test, Polarity test.

Auto Transformer: Single phase and three phase auto transformers, volt-amp relation, efficiency, merits & demerits and applications.

UNIT-5 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 and load sharing of single phase and three phase transformers, excitation phenomenon and harmonics in transformers, three winding transformers.

Text Books:

1. Electrical Machinery by P.S. Bhimbra.
2. Electric Machinery by Fitzerald, Kingsley and Umans.
3. I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill

Reference Books:

4. Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
5. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
6. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press, 2001.

BEE-402: FUNDAMENTALS OF DIGITAL ELECTRONICS

UNIT- 1 Number Systems: Binary, Octal, Decimal, Hexadecimal, Number base conversions, complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted, BCD, 2421, Gray code-Excess 3, code-A conversion from one code to another and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Boolean function, Minimization of Boolean expressions, Sum of Products (SOP),Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, Don't care conditions.

UNIT- 2 Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Implementations of Logic Functions using gates, NAND-NOR implementations, Multi level gate implementations, Multi output gate implementations.

Combinational Circuits- Design procedure, Adders/Subtractors, Serial adder/Subtractor, Parallel adder/Subtractor, Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/ Demultiplexer, encoder/decoder, paritychecker, code converters. Implementation of combinational logic using MUX.

UNIT- 3 Sequential Circuit: Latches, Flip flops SR, JK, T, D and Master slave, Characteristic excitation table and equation, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops.

UNIT- 4 Sequential Circuit Design: Classification of sequential circuits , Asynchronous / Ripple counters, Synchronous counters, Modulo-n counter, Synchronous counters, state diagram, State table, State minimization, State assignment, Register, shift registers, Universal shift register, Ring counters, Sequential circuit designing, Asynchronous/Ripple counters, Synchronous counter.

UNIT- 5 OP-AMP applications: Astable, Monostable and Bistable multivibrators, Schmitt trigger, IC-555 Timer, A/D and D/A converters.

Memory Devices- Classification of memories, RAM organization , Memory decoding, memory expansion, Static RAM Cell, Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM cell, ROM organization , PROM, EPROM, EEPROM, EAPROM, Programmable Logic Devices, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Taub & Schilling "Digital Electronics"- Tata Mc Graw Hill
2. M. Morris Mano, Digital Design, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003
3. John .M Yarbrough, Digital Logic Applications and Design, Thomson- Vikas publishing house, New Delhi, 2002.

Reference Books:

4. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 2nd ed., Vikas Publishing House Pvt. Ltd, New Delhi, 2004
5. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
6. R.P.Jain, Modern Digital Electronics, 3 ed., Tata McGraw–Hill publishing company limited, New Delhi, 2003.

BEE-403: MICROPROCESSORS

UNIT-1 Introduction to microprocessors: microprocessor general architecture and its basic operations, microcomputer system: memory and input-output devices, code conversion, BCD arithmetic and 16 bit data operations, BCD to binary and binary to BCD conversion, Binary to ASCII and ASCII to binary conversion.

UNIT-2 8085 Microprocessor: Pin diagram, architecture, Instruction set and timing diagrams, Instruction format and addressing modes, Assembly language programs, debugging of programs, Interrupts and memory interfacing.

UNIT-3 Programming techniques: Looping, counting, indexing, counters and time delays, Illustrative programs, stacks and subroutines.

UNIT-4 Programmable peripheral interfaces-8255 A, programmable interval timer-8253, programmable interrupt controller 8259, Direct-memory access (DMA) and 8257 DMA controller, Microprocessor applications.

UNIT-5 Introduction to Pentium and its higher generations: architecture, memory management. Assembler, debugger, Introduction to bit Slice processor , Signal processing processor and transputers , Introduction to development tools , MDS , logic analyzer , in-circuit emulator.

Text Books:

1. Ramesh S.Gaonkar, “Microprocessor Architecture, Programming and application with 8085/8080 A”, Wiley Eastern.
2. Aditya P.Mathur, “Introduction to microprocessors”, Tata McGraw Hill.

Reference Books:

3. Barry B. Brey, “The Intel Microprocessors: Architecture, Programming & Interfacing” PHI, 6th Edition, 2003.
4. D. V. Hall, “Microprocessor and Interfacing Programming & Hardware” TMH, 2nd Edition

BEE-404: ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

UNIT- 1 Crystal Structure of Materials:
A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth.
B. Energy bands in solids, classification of materials using energy band.

UNIT-2 Conductivity of Metals:
A. Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials.
B. Semi-Conductors: General concepts, types of semiconductors, Fermi Dirac distribution, intrinsic Semi-conductors, extrinsic Semi-conductors, hall effect, drift, mobility, diffusion in Semiconductors, Semi-conductors and their applications

UNIT- 3 Dielectric Materials: Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectric materials and spontaneous polarization, piezo- electricity. Frequency dependence of electronics, ionic and orientational polarization, complex dielectric constant and dielectric losses

UNIT- 4 Magnetic Properties of Material: Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Text Books :

1. A.J. Dekker,"Electrical Engineering Materials" Prentice Hall of India
2. R.K. Rajput," Electrical Engg. Materials," Laxmi Publications.
3. C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, published by S.Chand & Co, 2008.

Reference Books :

4. Solymar, "Electrical Properties of Materials" Oxford University Press.
5. Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford
6. University Press.
7. G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers.
8. T. K. Basak, "Electrical Engineering Materials" New age International.

BEE-451: ELECTROMECHANICAL ENERGY CONVERSION- I LAB

Note : Minimum 8 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 O.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.

BEE-452: DIGITAL ELECTRONICS LAB

Note : Minimum 8 experiments are to be performed from the following list :

1. To form basic logical OR gate having two or three inputs with two or three diodes.
2. To form basic logical OR, AND, NOR & NAND gates using transistor.
3. Verification of Boolean expansion.
4. To design a 4-bit parity generator /detector circuits.
5. To design a half adder circuit.
6. To design a full adder circuit.
7. To design a half subtractor circuit.
8. To design a full subtractor circuit.
9. To converters decimal to binary using 4-input NAND gates (Encoder)
10. To demonstrate the operation and application of 16:1 digital multiplexer using IC's.
11. To Design a R-S flip flop.
12. To Design a D flip flop.
13. To Design a J-K flip flop.
14. To design an up/down synchronous counter.
15. To study an 8-bit adder/sub tractor circuit.

BEE-453: MICROPROCESSORS LAB

Note : Minimum 10 experiments are to be performed from the following list :

A. Study based Experiments

1. Study of 8085 Microprocessor Trainer kit.
2. To study Pentium Processor.

B. Programming based Experiments (any five)

1. Write a program using 8085 for
   (a) 8 bit two numbers addition.
   (b) 16 bit two numbers addition.
3. Write a program for multiplication of two 8 bit numbers using 8085.
4. Write a program for division of two 8 bit numbers division using 8085.
5. Write a program for sorting a list of numbers in ascending & descending order.
6. Code conversion-Binding to Gray & Gray to binary .
7. Write a program for finding square of a number using look up table & verify
8. Write a program for temp control using 8085 & 8255 PPI.
9. Write a program for water level control using 8085 & 8255 PPI.

C. Interfacing based Experiments (any four)

1. To obtain interfacing of RAM chip to 8085/8086 based system.
2. To obtain interfacing of keyboard controller.
3. To obtain interfacing of DMA controller.
4. To obtain interfacing of PPI.
5. To obtain interfacing of UART/USART.
6. To perform microprocessor based stepper motor operation through 8085 kit.
7. To perform microprocessor based traffic light control.
8. To perform microprocessor based temperature control of hot water.

BEE-454: ELECTRICAL SIMULATION LAB

List of Experiments (PSPICE / MATLAB based minimum of two experiments)

Note : Minimum 8 experiments are to be performed from the following list :

1. Study of various commands of PSPICE.
2. To determine node voltages and branch currents in a resistive network.
3. To obtain Thevenin's equivalent circuit of a resistive network.
4. To obtain transient response of a series R-L-C circuit for step voltage input.
5. To obtain transient response of a parallel R-L-C circuit for step current input.
6. To obtain transient response of a series R-L-C circuit for alternating square voltage waveform.
7. To obtain frequency response of a series R-L-C circuit for sinusoidal voltage input.
8. To determine line and load currents in a three phase delta circuit connected to a 3-phase balanced ac supply.
9. To plot magnitude, phase and step response of a network function.
10. To determine z,y,g,h and transmission parameters of a two part network.
11. To obtain transient response of output voltage in a single phase half wave rectifier circuit using capacitance filter.
12. To obtain output characteristics of CE NPN transistor.
13. To obtain frequency response of a R-C coupled CE amplifier.
14. To obtain frequency response of an op-Amp integrator circuit.
15. To verify truth tables of NOT, ANDor OR gates implemented by NAND gates by plotting their digital input and output signals.

Reference Books:

1. Irvine, Calif, "PSPICE Manual" Microsim Corporation, 1992.
2. Paul W. Tuinenga, "SPICE : A guide to circuit Simulation and Analysis Using PSPICE", Prentice Hall, 1992.
3. M.H. Rashid, "SPICE for Circuits and Electronics Using PSPICE" Prentice Hall of India, 2000.

BABU BANARASI DAS UNIVERSITY
LUCKNOW

SCHOOL OF ENGINEERING

Syllabus for

B.Tech Third & Final Year

in

Electrical Engineering

(Effective from the Academic Session 2013-14)

COURSE STRUCTURE- B.Tech -2nd Year

(Electrical Engineering)

2nd – YEAR											SEMESTER-III
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU-301/ BHU-302	Industrial Psychology / Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	BAS-302	Numerical Techniques	2	1	0	15	10	25	50	75	3
3.	BEE-301	Networks &Systems	3	1	0	30	20	50	100	150	4
4	BEE-302	Electronic Devices & Circuits	3	1	0	30	20	50	100	150	4
5	BEE-303	Electrical Measurement & Measuring Instruments	3	1	0	30	20	50	100	150	4
6	BCS-305	Programming in 'C'	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7	BEE-351	Networks Lab	0	0	2	10	10	20	30	50	1
8	BEE-352	Electronic Devices & Circuits Lab	0	0	2	10	10	20	50	50	1
9	BEE-353	Electrical Measurements & Measuring Instruments Lab				10	10	20	50	50	1
10	BCS-355	'C' Programming Lab	0	0	2	10	10	20	30	50	1
11	GP-301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**16**	**5**	**8**	-	-	-	-	**1000**	**26**

2nd – YEAR											SEMESTER-IV
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
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1.	BHU-402/ BHU-401	Industrial Sociology/ Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	BAS-401	Mathematics-III	3	1	0	30	20	50	100	150	4
3.	BEE-401	Electrical Machines & Energy Conversion-I	3	1	0	30	20	50	100	150	4
4	BEE-402	Fundamentals of Digital Electronics	3	1	0	30	20	50	100	150	4
5.	BEE-403	Microprocessors	3	1	0	30	20	50	100	150	4
6	BEE-404	Electrical & Electronics Engineering Materials	2	1	0	15	10	25	50	75	3
Practical / Training / Project											
7	BEE-451	Electromechanical Energy Conversion-I Lab	0	0	3	10	10	20	30	50	1
8	BEE-452	Digital Electronics Lab	0	0	2	10	10	20	30	50	1
9	BEE-453	Microprocessor Lab	0	0	3	10	10	20	30	50	1
10	BEE-454	Electrical Simulation Lab	0	0	2	10	10	20	30	50	1
11	GP-401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**16**	**5**	**8**	-	-	-	-	**1000**	**26**

BBD UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Electrical Engineering

YEAR III, SEMESTER-V

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credits
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	BHU-501	Engineering & Managerial Economics	3	0	0	30	20	50	100	150	3
2.	BEE-501	Electro Mechanical Energy Conversion-II	3	1	0	30	20	50	100	150	4
3.	BEE-502	Control Systems	3	1	0	30	20	50	100	150	4
4.	BEE-503	Power System- I	3	1	0	30	20	50	100	150	4
5.	BEE-504	Signals & Systems	2	1	0	15	10	25	50	75	3
6	BEC-506	Communication Engineering	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
9	BEE-551	Electro Mechanical Energy Conversion-II Lab	0	0	3	10	10	20	30	50	2
7.	BEE-552	Control Systems Lab	0	0	2	10	10	20	30	50	1
8	BEC-556	Communication Engineering Lab	0	0	2	5	5	10	15	25	1
10.	GP-501	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**18**	**5**	**7**	**-**	**-**	**-**	**-**	**1000**	**27**

BBD UNIVERSITY, LUCKNOW

STUDY & EVALUATION SCHEME

B. Tech. Electrical Engineering

YEAR III, SEMESTER-VI

Sl. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credits
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	BHU-601	Industrial Management	3	0	0	30	20	50	100	150	3
2.	BEE-601	Power Electronics	3	1	0	30	20	50	100	150	4
3.	BEE-602	Electro Magnetic Field Theory	3	1	0	30	20	50	100	150	4
4.	BEE-603	Power Systems- II	3	1	0	15	10	25	100	150	4
5.		Professional Elective-I	3	1	0	30	20	50	100	150	4
6	BEC-606	Fundamentals of Digital Signal Processing	2	1	0	15	10	25	50	75	3
PRACTICAL/TRAINING/PROJECT											
7.	BEE-651	Power Electronics Lab	0	0	3	10	10	20	30	50	2
8	BEE-656	Advance Simulation Lab	0	0	2	5	5	10	15	25	1
9.	BEE-658	Seminar	0	0	2	-	-	50	-	50	1
10.	GP-601	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**18**	**5**	**7**	**-**	**-**	**-**	**-**	**1000**	**27**

4 to 6 weeks of Industrial Training after 6th semester to be evaluated in the 7th Semester

Professional Elective –I		
1	BEE-011	Electrical Instrumentation & Process Control
2	BEE-012	Special Machines and Linear Machines
3	BEE-014	Power Station Practices
4	BCS-016	Principles in Soft Computing
5	BCS-017	Concepts in Data Base Management System

STUDY & EVALUATION SCHEME

B. Tech. Electrical Engineering

YEAR IV, SEMESTER-VII

Sl. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credits
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	OE-01-06	Open Elective-I*	3	0	0	30	20	50	100	150	3
2.	BEE-701	Electric Drives	3	1	0	30	20	50	100	150	4
3.	BEE-702	Power System Protection	3	1	0	30	20	50	100	150	4
4.		Professional Elective-II	3	1	0	30	20	50	100	150	4
5.		Professional Elective-III	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
7.	BEE-751	Electric Drives Lab	0	0	2	10	10	20	30	50	1
8.	BEE-752	Power System Protection Lab	0	0	3	10	10	20	30	50	2
9	BEE-757	Industrial Training Evaluation	0	0	2	-	-	-	50	50	1
10	BEE-759	Mini Project	0	0	3	-	-	50	-	50	2
10.	GP-701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**15**	**5**	**9**	-	-	-	-	**1000**	**26**

*** Students are to opt for the courses floated by the other departments.**

Professional Elective –II		
1	BEE-021	Power System Transients
2	MEE-004	Deregulation of Power System
3	MEE-005	High Voltage Direct Current Transmission
4	MEE-016	Power System Reliability
5	MEE-017	Signal Conditioning & Data Acquisition

Professional Elective –III		
1	BEC-021	Satellite Communication
2	BEC-036	Embedded Systems
3	BEC-038	VLSI Design & Technology
4	BEC-036	Embedded Systems
5	BCS-036	Computer Networks
6	BCS-037	Object Oriented System &C++

STUDY & EVALUATION SCHEME

B. Tech. Electrical Engineering

YEAR IV, SEMESTER-VIII

Sl. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credits
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	OE-21-OE-25	Open Elective-II*	3	0	0	30	20	50	100	150	3
2.	BEE-801	Utilization of Electrical Energy and Traction	4	0	0	30	20	50	100	150	4
3.		Professional Elective-IV	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
9	BEE-858	Seminar	0	0	2	-	-	50	-	50	1
10	BEE-859	Project	0	0	12			150	300	450	12
10.	GP-801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**10**	**1**	**14**	**-**	**-**	**-**	**-**	**1000**	**25**

*** Students are to opt for the courses floated by the other departments.**

Professional Elective –IV		
1	BEE-041	SCADA & Energy Management System
2	MEE-009	Flexible AC Transmission System (FACTS) Controllers
3	MEE-011	Power Quality
4	MEE-014	Robust & Adaptive Control
5	MEE-015	Intelligent Instrumentation

List of Open Electives

Open Elective –I			Department
1	OE-01	Entrepreneurship Development Program	Humanities
2	OE-02	Graph Theory	Mathematics
3	OE-03	Operations Research	Mathematics
4	OE-04	E-Commerce	Computer Science
5	OE-05	Energy Management	Electrical Engineering
6	OE-06	Quality Management	Mechanical Engineering

Open Elective –II			Department
1	OE-21	Disaster Management, Guidelines & Control	Civil Engineering
2	OE-22	Human Computer Interaction	Computer Science
3	OE-23	Nano Technology	Electronics & Communication
4	OE-24	Non-Conventional Energy Resources	Electrical Engineering
5	OE-25	Product Development	Mechanical Engineering

BEE-501 ELECTRO MECHANICAL ENERGY CONVERSION - II

UNIT-I

Synchronous Machine- I

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

UNIT-II

Synchronous Machine II:

Two reaction theory - modified phasor diagram - analysis by two reaction theory - sudden short circuit - current waveforms - transient and sub transient reactance - slip test, Power angle characteristics of cylindrical rotor and salient pole machines - reactance power - active and reactive power control

DC excitation - static excitation - brush less excitation and self excitation - locus of generated voltage for constant real power and variable excitation - automatic voltage regulators

Synchronous Motor -

principle of operation - equivalent circuit - effect of load changes on synchronous motor - mechanical load diagram - armature current as function of power developed and excitation - V curves - inverted V curves – O curves - transition of a machine from generator mode to motor mode - phasor diagram - torque and power relations - minimum excitation for given power - hunting - periodicity of hunting - suppression – different starting methods.

UNIT-III:

Three phase Induction Machine – I

Three phase induction motors - construction - principle of operation - rotor MMF and production of torque – slip and frequency of rotor current - phasor diagram - equivalent circuit - mechanical power developed – maximum torque - torque slip characteristics - losses and power flow - single phasing - no-load and blocked rotor tests - circle diagram - effect of deep bar and double cage rotors - effects of air gap flux harmonics - cogging and crawling -Induction generator & its applications.

UNIT-IV

Three phase Induction Machine- II

Starting methods of three phase induction motors - direct on line starting - auto transformer starting - star delta starting - rotor resistance starting - starters and contactors - basic methods for speed control of three phase induction motors - voltage control - frequency control - rotor resistance control - pole changing - static frequency conversion and slip power recovery scheme

UNIT-V

Single phase Induction Motor:

Double revolving field theory, Equivalent circuit, No load and blocked rotor tests,

Starting methods, repulsion motor

AC Commutator Motors:

Universal motor, Single phase a.c. series compensated motor, stepper motors

Text / Reference books:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publisher, 7th Edition, 2011

2. Ashfaq Hussain"Electric Machines" Dhanpat Rai & Company, 2nd Edition, 2010

3. Fitzgerald A.E. & Kingsley: Electrical Machinery, Tata McGraw Hill., 6th edition, 2003.

4. D.P.Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw Hill, 2004

5. Langsdorf A.S., Theory of AC Machinery, McGraw Hill., 2nd edition, 2002.

BEE-502 CONTROL SYSTEM

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.

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, Conversion of state variable model to transfer function model andvice-versa, diagonalization, Controllability and observability and their testing.

Text / Reference books:

1. Nagrath & Gopal, “Control System Engineering”, 4th Edition, New age International.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall of India., 5th Edition, 2010
3. B.C. Kuo & Farid Golnaraghi, “Automatic Control System” Wiley India Ltd, 2008.
4. B.S Manke, “ Linear Control System with MATLAB Application”, Khanna Publishers, 2012
5. Norman S. Nise, Control System Engineering 4th edition, Wiley Publishing Co., 2004

6. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
7. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press, 2002

BEE-503 POWER SYSTEMS-I

Unit -1

Introduction to Power system- Structure of Power System,

Generation-Conventional sources of electrical energy - thermal, hydroelectric, diesel and nuclear power plants – renewable energy sources - power plant economics - operating costs - load factor - demand factor - diversity factor – plant factor - tariffs-distributed generation-microgrid - smartgrid.

Transmission-Overhead transmission systems - arrangement of conductors – - types of conductors - copper, aluminium and ACSR conductors - Volume of conductor required for various systems of transmission- Choice of transmission voltage, conductor size - Kelvin's law.

Unit2

Resistance, inductance and capacitance of three phase transmission lines - symmetrical and unsymmetrical spacing - double circuit lines - bundled conductors - effect of earth on transmission line capacitance - performance of transmission lines.

Representation of lines - short and medium lines - equivalent Pi and T networks. Long lines - equivalent circuit of a long line.

Unit-3

Corona - disruptive critical voltage - visual critical voltage -power loss due to corona -Factors affecting corona interference on communication lines.

Insulators - Different types - Voltage distribution, grading and string efficiency of suspension insulators. Comparison of EHVAC & HVDC transmission.

Unit-4

Mechanical Design of transmission line:

Mechanical features of transmission lines – sag - sag template, Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration Dampers

Cables -types of cables - insulation resistance - voltage stress - grading of cables - capacitance of single core and 3 - core cables - current rating.

Unit 5

Distribution systems - classification and arrangement of distribution systems - distribution substation layout and arrangement - economic loading of distribution transformers - considerations in primary and secondary distribution system design - current distribution and voltage drop calculation-design of feeders and distributors

Text / Reference Books:

1. I.J.Nagarath & D.P. Kothari, "Power System Engineering", TMH Publication, 1994.
2. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill., 2011
3. B.R. Gupta: "Power system Analysis and Design", Wheeler publishers, 1993.
4. Grainger J.J, Stevenson W.D, "Power system Analysis", McGraw Hill, 1994.
5. C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition
6. Asfaq Hussain, "'Power System", CBS Publishers and Distributors, 2012
7. A.T. Starr, "Generation, Transmission & Utilization of Electric Power", Sir Issac Pitman and Sons, 4th Edition, 1973.
8. Turan, Goren, "Electric Power Transmission System Engineering", John Wiley, 1988
9. S.L. Uppal, "Electric Power", Khanna Publishers, 1992.
10. Weedy B M, Cory B J, "Electric Power Systems", John Wiley Publication, 5th Edition, 2012

BEE-504 SIGNALS & SYSTEMS

UNIT-I

Introduction to signals and systems:

Classification of Signal and representation: Continuous time and discrete time, even/odd, periodic/aperiodic, random/deterministic, energy/power, one/multidimensional, some standard signals, Basic Operations on Signals for CT/DT signal, transformation of independent & dependent variables

Definition of System and their classifications: CT/DT, linear/non-linear,variant/non-variant,causal/non-causal system, static/dynamic system, interconnection of systems

UNIT-II

Fourier Transform Analysis

Fourier symmetry, Fourier Integral and Fourier Transform. Transform of common functions and periodic wave forms: Properties of Fourier Transform, Relation between Laplace and Fourier Transform.

UNIT-III

Fourier Transform Representation for Discrete-Time Signals, Sampling, Reconstruction of Continuous-Time Signals from Samples, Fourier Series Representations for Finite-duration Non-periodic Signals. Filtering and Signal Distortion: Time Response, Frequency Response,
Linear Distortion and Equalization, Ideal Low-Pass Filters, Band-Pass Transmission, Phase Delay and Group Delay, Nonlinear Distortion.

UNIT- IV

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

Text / Reference books

1. David K.Cheng; "Analysis of Linear System", Narosa Publishing Co.
2. Simon Haykins," Signals and Systems", John Wiley, 2002
3. Alan V. Oppenheim, Alan S. Willsky, "Signals & Systems", PHI Publication, 2nd Edition.
4. B.P. Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
5. P. Ramakrishna Rao, "Signals and System", Tata Mc. Graw Hill, 20011.
6. I.J. Nagrath, S.N. Saran, R. Ranjan and S.Kumar, "Singnals and Systems, "Tata Mc. Graw Hill, 2001.
7. Taan S. Elali & Mohd. A. Karim, "Continuous Signals and Systems with MATLAB" 2nd Edition, CRC Press.

BEE-551 ELECTRO-MECHANICAL ENERGY CONVERSION – II LABORATORY

Note: The minimum 8 experiments are to be performed from the following, 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 arrive equivalent circuit.
2. To perform load test on a three phase induction motor and draw:a). Torque -speed characteristics b) Power factor-line current characteristics
5. To perform no load and blocked rotor tests on a single phase induction motor and arrive equivalent circuit.

6. To study speed control of three phase induction motor by keeping V/f ratio constant

7. To study speed control of three phase induction motor by varying supply voltage.

8. 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.

9. To determine V-curves and inverted V-curves of a three phase synchronous motor.

10. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.

11. 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 other commercial software)

12. 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.

13. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.

14. 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.

15. 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.

17. To determine steady state performance of a three phase induction motor using equivalent circuit.

BEE-552 CONTROL SYSTEM LABORATORY

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 V/S 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 behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.

10. To study PID Controller for simulation proves like transportation lag.

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

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 transfer functions and examine the stability of the closed loop system.

BEE-601 POWER ELECTRONICS

Unit-1

Power Semiconductor Switches

Power diodes - Basic structure and V-I characteristics - various types - **DIACs** – Basic structure and V-I characteristics – **TRIACs** - Basic structure and V-I characteristics -

IGBTs - Basic structure and V-I characteristics.

MOSFETs - Basic structure and V-I characteristics

Thyristors - basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT –

Unit 2:

Rectifiers

Thyristors- series and parallel operation, methods of turning off - commutation circuits.

Line frequency phase controlled rectifiers using SCR

Single Phase – Half wave rectifier with R and RL loads – Full wave half controlled and fully controlled converters with continuous and constant currents - Input side harmonics and power factor - Effect of source inductance

Three Phase - Half wave rectifier with R and RL loads - Full wave fully controlled converters with continuous and constant currents

Unit 3: Inverters & Cycloconverters (10 Hrs)

Inverters – Single phase inverters – series, parallel and bridge inverters. Single Phase Pulse Width Modulated

(PWM) inverters – Basic circuit and operation.

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

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. 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

Unit V: DC – DC Converters

Choppers - principle of operation - step-up and step-down choppers.

Switching regulators - Buck regulators - Boost regulators - Buck-boost regulators - Switched mode power supply - principle of operation and analysis

Text/Reference Books:

1. Ned Mohan, Power Electronics., John Wiley and Sons, 2nd edition, 1995.
2. Rashid, Power Electronics, Circuits Devices and Applications, Pearson Education, 3rd edition, 2004.
3. G.K.Dubey, Thyristorised Power Controllers, Wiley Eastern Ltd, 1993.
4. Dewan & Straughen, Power Semiconductor Circuits, John Wiley & Sons, 1975.
5. Cyril W Lander, Power Electronics, Mc Graw Hill, 3rd edition, 1993.
6. M.D. Singh and K.B.Khanchandani, "Power Electronics"Tata MC Graw Hill, 2005
7. P.C Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2nd Edition.
8. P.S Bhimbhra , " Power Electronics", Khanna Publishers, 2012

BEE-602 ELECTRO MAGNETIC FIELD THEORY

Unit -1

Coordinate systems and transformation: Cartesian coordinates, cylindrical coordinates, and spherical coordinates system, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and curl of a vector with their physical Explanation. Divergence theorem and Stoke's theorem, Laplacian of a scalar.

Unit-2

Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to continuous charge distributions, Electric flux density, Gauss's Law – Maxwell's equation, Application of Gauss's Law, Electric Potential-Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation. Electrostatic boundary condition, Poission's and Laplace's equations, general procedures for solving Poission's or Laplace's equations, resistance and capacitance

Unit-3

Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields. Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.

Unit-4

Electromagnetic Waves Maxwell's equation in Time varying Field, Faraday's Law, displacement current,. Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence and oblique incidence

Unit-5

Transmission line Transmission line parameters, Transmission line equations, input impedance, characteristic impedance, lossless Transmission line open circuit and short circuit Transmission line Reflection in Transmission Line, standing wave ratio and power,applications of transmission lines.

Text / Reference books

1. M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press.
2. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH.
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. Principle and applications of Electromagnetic fields by Ptonsey R and Collin R.P.
6. Jean G Van Bladel "Electromagnetic Fields", 2nd edition, Wily and sons,inc, publication
7. Bakshi & Bakshi "Electromagnetic Field Theory",Fifth edition,2009, Technical Publication

8. Shadowitz A "The Electromagnetic Field" Mc. Graw Hill Publication

BEE-603 POWER SYSTEMS- II

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

Load Flow

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 - III

Short circuit studies - faults on power systems - short circuit capacity of a bus and circuit breaker ratings-current limiting reactor

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

Unit-IV

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 Zbus using singular transformation and algorithm, computer method for short circuit calculations

Unit-V

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

Text/ Reference books

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill, 1975
2. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill., 2011
3. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press, 2007.
4. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International, 4th Edition, 2006
5. Hadi Sadat; "Power System Analysis", Tata McGraw Hill, 2002
6. M.A Pai, " Computer Techniques in Powe System Analysis", Tata Mc Graw Hill, 2005
7. J.D. Glover, M.S. Sharma & T.J.Overbye, "Power System Analysis and Design" Thomson, 2008.
8. P.S.R. Murthy "Power System Analysis" B.S. Publications, 2007.
9. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill, 1968

BEE-651 POWER ELECTRONICS LABORATORY

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

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without free wheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with 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 out put voltage and load current.

BEE-656 ADVANCE SIMULATION LAB

Note: The minimum of 10 experiments is to be performed

1. Verification of sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specification

PROFESSIONAL ELECTIVES -I

BEE-011 ELECTRICAL INSTRUMENTATION AND PROCESS CONTROL

Unit-I:

Transducer – I:

Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT,RVDT

Unit-II

Transducer – II:

Capacitive, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquilevel.

Unit-III:

Telemetry :

General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter.

Data Acquisition System:

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

Unit-IV:

Display Devices and Recorders:

Display devices, storage oscilloscope, spectrum analyzer, strip chart & x-y recorders, magnetic tape & digital tape recorders.

Recent Developments:

Computer aided measurements, fiber optic transducers, microsensors, smart sensors, smart transmitters.

Unit-V:

Process Control :

Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

Text / Reference 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
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
6. Rajendra Prasad,"Electronic Measurement and Instrumentation Khanna Publisher
7. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHI Learning.

BEE-012 SPECIAL MACHINES AND LINEAR MACHINES

Unit I

Servo Motors

Servo motors -Requirement of a good servomotor, Types of servomotors: D. C. servomotor: Basic working principle and its classification, Field controlled and Armature controlled DC servomotor, Application: servostabilizer and position control system. AC servo motor: construction, operating principle and Application. Symmetrical components applied to two - phase servo motors -equivalent circuit and performance based on symmetrical components - servo motor torque - speed curves.

Unit 2:

Stepper Motors

Stepper motors - construction features - method of operation - drive - amplifiers and transistor logic -Drive Circuits - half stepping and the required switching sequence - the reluctance type stepper motor – ratings. Characteristics of Stepper Motor- Stepper motor application.

Unit 3:

Reluctance motors - General types of synchronous motors - Reluctance motors - definitions - construction - polyphase and split phase reluctance motors - capacitor type reluctance motors

Hysteresis motors - Construction - polyphase - capacitor type and shaded pole hysteresis motors –Methods of reversing direction of rotation in shaded pole motor. Advantage over reluctance motors, Torque develop and slip

Unit 4:

Universal motors – Applications - torque characteristics - essential parts of universal motors - EMF due to main filed and cross field - Transformer and rotational emf - circuit model and Phasor Diagram.

Unit 5: Linear Machines

Linear machines - basic difference between LEMS and rotating - machine – classification of LEMS, linear motors and levitation machines –

Linear induction motors - linear synchronous motors - DC linear motors – linear levitation machines, Edge Effect, MMF wave and its velocity, air gap flux density

Text/Reference Books

1. Toro.V.D, "Electric machines and power systems", Prentice Hall of India, 1985.
2. Nasar.S.A,Boldeal, "Linear Motion Electric machine", John Wiley,1976
3. V.U.Bakshi U.A.Bakshi, "Electrical Circuits and Machines", Technical Publication, Pune, 2008.
4. V V Athani, "Stepper Motors: Fundamentals Applications and Design" , New Age International 2007.
5. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electric machinery", Tata McGraw-Hill 2002

BEE-014 POWER STATION PRACTICE

UNIT-I

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

Thermal Power Plant:

Site selection, general layout and operation of plant, detailed description and use of different parts.

Hydro Electric Plants:

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

UNIT-II

Nuclear Power Plant:

Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding.

Gas Turbine Plant:

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

Diesel Plants:

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

UNIT-III

Sub-stations Layout:

Types of substations, bus-bar arrangements, typical layout of substation.

Power Plant Economics and Tariffs:

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

UNIT-IV

Economic Operation of Power Systems:

Characteristics of steam and hydro-plants,

Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss.

Hydrothermal Scheduling

UNIT-V

Non Conventional Energy Sources:

Power Crisis, future energy demand, role of Private sectors in energy management,

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 / Reference Books:

1. B.R. Gupta,"Generation of Electrical Energy", S. Chand Publication, 2009

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, 2007

4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill, 1975

BEE- 701 ELECTRIC DRIVES

UNIT- I

Fundamentals of Electric Drive: Electric Drives and its parts, advantages of electric drives, classification of electric drives, speed-torque conventions and multi-quadrant operations, constant torque and constant power operation, types of load, Load torque: components, nature and classification

Unit-II:

Dynamics of Electric Drive: Dynamics of motor-load combination, Steady state stability of Electric Drive, Transient stability of electric drive

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

Unit-III:

Electric Braking: Purpose and types of electric braking, Braking of dc, three phase induction and synchronous motors.

Dynamics during Starting and Braking: Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, Methods of reducing energy loss during starting, Energy relations during braking, Dynamics during braking

Unit-IV:

Power Electronic Control of DC Drives: Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), Dual converter fed separately excited dc motor drive, Rectifier control of dc series motor, Supply harmonics, Power factor and ripples in motor current Chopper control of separately excited dc motor and dc series motor.

Unit-V:

Power Electronic Control of AC Drives: Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI, CSI, and Cycloconverter 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 /Reference books:

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S.K.Pillai, "A First Course on Electric Drives", New Age International.
3. 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

BEE-702 POWER SYSTEM PROTECTION

UNIT- I

Introduction to Protection System: Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology, definitions, codes, standards.

UNIT-2

Protective Relays: : Functions, constructional and operating principles of Electromagnetic induction and thermal relays, Gas actuated relay, Earth fault relays, Directional relays, Differential relays, Distance relays, Basic principles of static relaying, Phase and amplitude comparator.
Recent Trends in Relays: Numerical Relays, Microprocessor based relays

UNIT-3

Switchgear principles: Circuit breakers-principles of operation, Theory of arc formation and its extinction (AC and DC), re-striking and recovery voltage, RRRV, Current chopping, Duties of switchgear, Constructional features and Selection of LT breakers (MCB/MCCB/ELCB) and HT Breakers (ABCB - OCB – SF6CB– VCB-HVDCCB), Circuit breaker ratings, Testing of circuit breakers.

UNIT- 4

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.

Over voltages, Surges , Lightning strokes, Protection against lightning, Earth wires, Lightning diverters, Surge absorbers, Arcing ground, Neutral earthing, Basic concepts of insulation levels and their selection, BIL, Co-ordination of insulation.

UNIT-5

Protection of Transmission Line: Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus bar, auto re-closing.

Apparatus Protection: Protection of Transformer, generator and motor.

NEC and importance of relevant IS/IEC specifications related to switchgear and protection.

Text / Reference Books:

1. S. S. Rao, "Switchgear and Protection", Khanna Publishers,1986
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd, 1977
1. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill., 2011
2. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill, 1995
3. Y. G. Paithankar and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India, 2004
4. T.S.M Rao,"Power System Protection: Static Relays with Microprocessor Applications" Tata Macgraw Hill", 1989
5. A.R. Van C. Warringtaon , " Protective Relays- Their Theory and Practice, Vol. I & II" Jhon Willey & Sons.

BEE-751 ELECTRIC DRIVES LAB

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

(A) Hardware Based Experiments:

1. To study speed control of separately excited dc motor by varying armature voltage using 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 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.

BEE-752 POWER SYSTEM PROTECTION LAB

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

(A) Hardware Based:

1. To determine direct axis reactance (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

PROFESSIONAL ELECTIVES -II

BEE-021 POWER SYSTEM TRANSIENTS

UNIT 1

Origin and nature of transients and surges: Surge parameters of plant. Equivalent circuit representations. Lumped and distributed circuit transients.

UNIT 2

Line energization and de-energization transients: Earth and earth wire effects. Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients.

UNIT 3

Lightning Phenomenon: Influence of tower footing resistance and earth resistance. Traveling waves in distributed parameter multi-conductor lines, parameters as a function of frequency. Influence of pole opening and pole re-closing.

UNIT 4

Insulation Co-ordination: Over voltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arcs, and metallic contacts.

UNIT 5

Simulation of surge diverters in transient analysis.

Text Books/References

1. Transients in Power System By V. A. Vanikov, Mir Publications, Moscow.

2. Traveling Waves on Transmission Lines Bewley; L.V., Dover Publications Inc., New York.

3. High Voltage Insulation Engineering By Ravindera Arora, Wolfgang Mosch, New Age International Publishers Limited.

4. Electrical Transients in Power Systems By Greenwood:A., John Wiley & Sons,

MEE-016 POWER SYSTEM RELIABILITY

Probability and Reliability: Review of probability concepts, probability distributions, applications of binomial distribution to engineering problems, probability distribution in reliability evaluation, reliability indices, network modeling and evaluation of simple and complex networks, system reliability evaluation using probability distributions, frequency and load duration techniques, key indices of power system reliability and their calculation.

Maintainability and Availability: Introduction, maintainability, availability, system down time, reliability and maintainability trade off, instantaneous repair rate, MTTR, reliability and availability functions.

Generation system Reliability Evaluation: Concept of loss of load probability (LOLP), Energy demand, E(DNS), Evaluation of these indices for isolated systems, generation system, reliability analysis using the frequency and duration techniques.

Transmission System Reliability Evaluation:

Evaluation of LOLP and E(DNS), indices for an isolated transmission system, interconnected system reliability, bulk power system reliability.

Distribution System Reliability Evaluation: Reliability analysis of radial systems with perfect and imperfect switching.

Text Books/References:

1. Billinton R., “Power System Reliability calculation”, MIT Press, USA.
2. Endreyni, “Reliability Modeling in Electric Power System”, John Wiley, New York.
3. Billinton R & Alan R. N., “Reliability evaluation of Power Systems,” Second Edition, Plenum Press, 1996.
4. Reliability Engineering by L. S. Srinath, Affiliated East West Press Ltd.
5. Reliability Engineering by K. K. Aggarwal, Kluwer, Academic Publication.

6. Reliability Engineering by A. K. Govil.

MEE-017 SIGNAL CONDITIONING & DATA ACQUISITION SYSTEM

Signal Conditioning: Introduction, amplification, instrumentation amplifies, Optical amplifiers, A.C.& D.C. amplifiers, Operational amplifier specifications, operational amplifier circuits in instrumentation, Adder, inverter, subtractor, integrator, differentiator, logarithmic converter, Differential amplifier, Modulator-Demodulators, filters, types of filters, low pass, band pass, bridges, current sensitive bridge circuit, Voltage sensitive bridge. Clipping and clamping circuits.

A/D & D/A Conversion Techniques: Resolution and Quantization, Aperture time, Sampling D/A Converters, A/D conversion techniques- successive approximation, resistor method, voltage to time A/D converter, Voltage to frequency converter techniques. Dual flow integration technique, Sample and hold circuit.

Introduction to Data Acquisition System: Instrumentation systems, types of instrumentation systems, components of an Analog-Data-acquisition system, uses of data acquisition system, use of recorders in digital system, Digital recording systems, input conditioning equipment. Digitizer, Multiplexer (TDM, FDM). Land line telemetry, R F telemetry. Transmission channels. Modulation methods.

Harmonic Analysis of Periodic Signals: Fundamentals of Fourier analysis, Practical harmonic analysis using a wattmeter.

Text Books/References

1. Measurement systems- Application and design by E.O. Doebelin

2. Electronic measurement and instrumentation by Oliver & Cage.

3. Microprocessors & Interfacing by Douglas V.Hall TATA Mc Graw Hill.

4. Operational amplifier circuits by R.F. Coughlin & Driscoll.

5. Microprocessors with Applications in process Control by S.I. Ahson, Tata McGraw Hill New Delhi.

6. Electrical Measurements: Fundamentals, Concepts, Applications by Martin U Reissland, New Age International Publishers.

BEE-801 UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

UNIT-1

Electric Heating:

Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating Dielectric heating

UNIT-2

Electric Welding: Electric Arc Welding, Electric Resistance welding, Electronic welding control

Electrolyte Process: Principles of electro deposition, Laws of electrolysis, applications of electrolysis

UNIT-3

Illumination: Various definitions, Laws of illumination, requirements of good lighting, Design of indoor lighting and outdoor lighting systems

Refrigeration and Air Conditioning: Refrigeration systems, domestic refrigerator, water cooler, Types of air conditioning, Window air conditioner

UNIT-4

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-5

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 Publication

PROFESSIONAL ELECTIVES-IV

BEE-041 SCADA & ENERGY MANAGEMENT SYSTEM

UNIT 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.

UNIT 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.

UNIT 3:

MAN- Machine Communication: Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.

UNIT 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.

UNIT 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, 1986

2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India, 1986

3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons, 1996

4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th Edition.

OPEN ELECTIVES

OE-05 ENERGY MANAGEMENT

UNIT 1:

Introduction: Energy sources, energy demand and supply, Energy crisis, future scenario; 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 2:

Electrical Load and Lighting Management: General principles; Illumination and human comfort; Lighting systems; Equipments; Electrical systems; Electrical load analysis; Peak load controls;

Heating and Cooling Management: General principles of energy managements in HVAC systems; Human comforts and health requirements; HVAC systems; Boiler and heat sources; Chillers, fans, pumps, cooling towers; Modeling of heating and cooling loads in buildings; Energy management opportunities.

UNIT 3:

Process Energy Management: Principles; Process heat, Combustion, Automatic fuel controls; Steam generation and distribution, Hot water and pumping, Furnaces and ovens; Process electricity; Compressed air; Manufacturing process; Energy storage for process industries; Process control.

UNIT 4:

Integrated Building systems: General principles; Environment conformation; Passive design considerations; Building envelope design consideration, Integration of building system, Energy storage-cold storage techniques, Economic analysis.

UNIT 5:

Economic Aspects of Energy Management: General considerations; Economic analysis methods; Life-cycle costing, Break even analysis, benefit cost analysis, payback period analysis, present worth analysis, equivalent annual cost analysis, Use of computers; Management of energy with environment aspects.

Text books/References:

1. S Kaushik, T Verma, "Rural Energy Management", Deep and Deep Publishers.

2. W R Murphy, G Mckay, " Energy Management", B.S. Publications.

3. S. C. Patra, B.C Kurse, R. Kataki, "Renewable Energy and Energy Management", International Book Co.

4. J Piper, "Operations and Maintenance Manual for Energy Management", Standard Publishers

OE- 24 NON-CONVENTIONAL ENERGY RESOUCES

UNIT-1

Indian and global energy sources, Energy exploited, Energy planning, Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy.

Solar radiations: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, Zenith angle, solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length.

UNIT-2

Solar energy: Solar thermal power and its conversion, Solar collectors, Flat plat, Concentric collectors, Cylindrical collectors, Thermal analysis of solar collectors. Solar energy storage, Different systems, solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants.

UNIT-3

Biogas: Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Energy plantation, Fuel properties.

Wind energy:

Properties of wind, Availability of wind energy in India, wind Velocity, win machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Economic issues, Recent development.

UNIT-4

Electrochemical effects and fuel cells: Revisable cells, Ideal fuel cells, other types of fuel cells, Efficiency of cells, Thermions systems.

Tidal power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems.

Hydrogen Energy: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel.

UNIT-5

Thermoelectric systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators.

Geothermal energy: Hot springs, Steam ejection, Principal of working, types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts Problems associated with geothermal conversion.

Ocean energy: Principal of ocean thermal energy conversion, Power plants based on ocean energy, problems associated with ocean thermal energy conversion systems.

Text Books:

1. Bansal Keemann, Meliss," Renewable energy soucesa and conversion technology", Tata Mc Graw Hill.

2. Rai G.D,"Non-Conventional energy Sources", Khanna Publishers.

3. Ashok V. Desai,"Nonconventional Energy", New Age Internantional Publishers Ltd

BEE-505 ELECTRICAL MACHINES

Unit: 1

Single Phase Transformer: Phasor diagram, efficiency and voltage regulation, all day efficiency, 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.

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.

Unit: 2

D.C. Machines: - Construction of DC Machines, Armature winding, Emf and torque equation ,Armature Reaction ,Commutation , Interpoles and Compensating Windings, Performance Characteristics of D.C. generators, 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 Leonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburne's Test)

Unit: 3

Three phase Induction Machine:- Constructional features, Rotating magnetic field, Principle of operation Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator & its applications.

Unit: 4

Alternator: - Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method.

Synchronous Motor: Starting, effect of excitation on line current (V-curves), synchronous condenser.

Servo Motor: Two phase a.c. servo motor & its application.

Text / Reference books:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publisher, 7th Edition, 2011
2. Ashfaq Hussain"Electric Machines" Dhanpat Rai & Company, 2nd Edition, 2010
3. Fitzgerald A.E. & Kingsley: Electrical Machinery, Tata McGraw Hill., 6th edition, 2003.
4. D.P.Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw Hill, 2004
5. Langsdorf A.S., Theory of AC Machinery, McGraw Hill., 2nd edition, 2002.

BEE-555 ELECTRICAL MACHINES & AUTOMATIC CONTROL LAB

Note: To perform at least 7 experiments of Electrical Machines and 3 experiments of Automatic Control System

A. Electrical Machines

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by direct loading.

2. To obtain efficiency of a dc shunt machine by no load test.

3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) field control.

4. To determine polarity and voltage ratio of single phase and three phase transformers.

5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on a single phase transformer at full load and 0.8 p.f loading.

6. To obtain 3-phase to 2-phase conversion using Scott connection.

7. To perform load test on a 3-phase induction motor and determine

(a) speed- torque characteristics (ii) power factor v/s line current characteristics.

8. To study speed control of a 3-phase induction motor using (a) Voltage Control

(b) Constant (Voltage/ frequency) control.

9. To perform open circuit and short circuit test on a 3-phase synchronous machine and determine voltage regulation at full load and unity, 0.8 lagging and 0.8 leading power factor using synchronous impedance method.

10. To determine V-curve of a 3-phase synchronous motor at no load, half load and full load.

B. Automatic Control System:

1. To determine transient response of a second order system 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 determine speed – torque characteristics of an a.c. 2-phase servo motor.

4. To study and calibrate temperature using Resistance Temperature Detector (RTD)

5. To study dc servo position control system within P and PI configurations.

6. To study synchro transmitter and receiver system and determine output V/s input characteristics.

7. To study open loop and closed loop control of a dc separately excited motor.