Shaheed Bhagat Singh State Technical Campus,

Moga Road,Ferozepur-152004(Punjab)

StudyScheme for 4 Year B.Tech (Electrical Engineering)

Semester 3rd

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	TM	Credits
1	BTAM-301A	C	Engineering Mathematics-III	Theory	3	1	0	40	60	100	4
2	BTEE-301A	C	Circuit Theory	Theory	3	1	0	40	60	100	4
3	BTEE-302A	C	Transformer & Direct Current Machines	Theory	3	1	0	40	60	100	4
4	BTEE-303A	C	Electrical Measurements	Theory	3	0	0	40	60	100	3
5	BTEE-304A	C	Electronic Devices & Circuits	Theory	3	0	0	40	60	100	3
6	BTHU-301A	L	Professional Skills-I	Practical	0	0	2	30	20	50	1
7	BTEE-305A	L	Lab-I Circuit Theory & Electronic Devices	Practical	0	0	2	30	20	50	1
8	BTEE-306A	L	Lab-II Transformer & Direct Current Machines Lab	Practical	0	0	2	30	20	50	1
9	BTEE-307A	T-I	Training –I (Four Week Training in-house)	Practical	0	0	4	60	40	100	2
Total											23

Semester 4th

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	TM	Credits
1	BTEE-401A	C	Electrical Engineering Materials	Theory	3	1	0	40	60	100	4
2	BTEE-402A	C	Linear Control System	Theory	3	1	0	40	60	100	4
3	BTEE-403A	C	Electromagnetic Field Theory	Theory	3	1	0	40	60	100	4
4	BTEE-404A	C	Microprocessor	Theory	3	1	0	40	60	100	4
5	BTEE-405A	C	Digital Electronics	Theory	3	1	0	40	60	100	4
6	BTEE-406A	L	Lab-III Linear Control System Lab	Practical	0	0	2	30	20	50	1
7	BTEE-407A	L	Lab-IV Digital Electronics	Practical	0	0	2	30	20	50	1
8	BTEE-408A	L	Lab V Electrical Measurements & Instrumentation Lab	Practical	0	0	2	30	20	50	1
9	BTHU-401A	L	Professional Skills-II	Practical	0	0	2	30	20	50	1
										Total Credits	24

Semester 5th

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	T M	Credits
1	BTEE-501A	C	Asynchronous Machines	Theory	3	1	0	40	60	100	4
2	BTEE-502A	C	Power Electronics & Drives	Theory	3	1	0	40	60	100	4
3	BTEE-503A	C	Generation and Economics of Electric Power	Theory	3	1	0	40	60	100	4
4	BTDE1-51XA	E	Elective-I	Theory	3	0	0	40	60	100	3
5	BTOE1-9XXA	O	Open Elective I	Theory	3	0	0	40	60	100	3
6	BTEE-504A	L	Lab VI Power Electronics Laboratory	Practical	0	0	2	30	20	50	1
7	BTEE-505A	L	Lab VII Electrical: Estimation & Costing Laboratory	Practical	0	0	2	30	20	50	1
8	BTHU-501A	L	Professional Skills-III	Practical	0	0	2	30	20	50	1
9	BTEE-506A	T-II	6 Weeks Institutional / Industrial Training	Practical	0	0	6	60	40	100	3
			Total								24

Semester 6th

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	TM	Credits
1	BTEE-601A	C	Synchronous Machines	Theory	3	1	0	40	60	100	4
2	BTEE-602A	C	Power System-I (Transmission and Distribution)	Theory	3	1	0	40	60	100	4
3	BTDE2-61XA	E	Elective-II	Theory	3	0	0	40	60	100	3
4	BTDE3-61XA	E	Elective-III	Theory	3	0	0	40	60	100	3
5	BTOE2-9XXA	O	Open Elective II	Theory	3	0	0	40	60	100	3
6	BTEE-603A	L	Lab-VIII Electrical Machines-II Laboratory	Practical	0	0	2	30	20	50	1
7	BTEE-604A	L	LAB IX Programming in MATLAB	Practical	0	0	2	30	20	50	1
8	BTHU-601A	L	Professional Skills IV	Practical	0	0	2	30	20	50	1
Total											20

Semester 7th

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	T M	Credits
1	BTEE-701A	C	Non-linear and Digital Control System	Theory	3	0	0	40	60	100	3
2	BTEE-702A	C	Power System-II (Switchgear and Protection)	Theory	3	0	0	40	60	100	3
3	BTDE4-71XA	E	Elective-IV	Theory	3	0	0	40	60	100	3
4	BTOE3-9XXA	O	Open Elective III	Theory	3	0	0	40	60	100	3
5	BTEE-703A	PR	Project-1	Practical	0	0	6	40	60	100	4
6	BTEE-704A	L	Lab X Software Laboratory	Practical	0	0	2	30	20	50	1
7	BTEE-705A	L	Lab XI Power System-II Lab	Practical	0	0	2	30	20	50	1
8	BTEE-706A	T-III	Industrial Training (after 6th Sem)	Practical	0	0	0	120	80	200	4
Total											22

Semester 8th

Sr. No.	Subject Code	Type	Subject Name	Type	L	T	P	I	E	T M	Credits
1	BTEE-801A	C	Power System Analysis and Design	Theory	3	1	0	40	60	100	4
2	BTEE-802A	C	High Voltage Engg.	Theory	3	0	0	40	60	100	3
3	BTDE5-81XA	E	Elective-V	Theory	3	0	0	40	60	100	3
4	BTEE-803A	PR	Project II	Practical	0	0	6	120	80	200	6
5	BTEE-804A	L	Lab XII Power System Analysis Laboratory	Practical	0	0	2	30	20	50	1
				Total							17

List of Elective Subjects

Elective	Sem	Subject Code	Subject Name
Elective - I	5	BTEE-511A	Power Plant Engineering
		BTEE-512A	Special Electrical Machines
		BTEE-513A	Microcontroller
		BTEE-514A	Instrumentation Engineering
Elective - II	6	BTEE-611A	Electrical Power Utilization
		BTEE-612A	Energy Auditing & Management
		BTEE-613A	Substation Equipment & Design
		BTEE-614A	Digital Control System
Elective - III	6	BTEE-615A	Energy Efficient Machines
		BTEE-616A	Virtual Instrumentation
		BTEE-617A	Flexible AC Transmission System Devices
		BTEE-618A	Non-conventional Energy Sources
Elective - IV	7	BTEE-711A	System Engineering and Reliability
		BTEE-712A	Digital Signal Processing
		BTEE-713A	EHVAC Transmission
Elective - V	8	BTEE-811A	Electrical Machine Design
		BTEE-812A	HVDC Transmission
		BTEE-813A	Fuzzy Logics &Systems
		BTEE-814A	Neural Networks

List of Open Elective Subjects of B.Tech Programme offered by Electrical Engineering Department to the other departments		
Open Elective-I **BTOE1-9XXA**	**Subject Code**	**Subject Name**
	BTEE-901A	Power Plant Engineering
	BTEE-902A	Instrumentation Engineering
	BTEE-903A	Substation Equipment & Design
Open Elective-II **BTOE2-9XXA**	**Subject Code**	**Subject Name**
	BTEE-904A	Non-conventional Energy Sources
	BTEE-905A	Transformers
	BTEE-906A	Energy Efficient Machines
Open Elective-III **BTOE3-9XXA**	**Subject Code**	**Subject Name**
	BTEE-907A	Energy Auditing & Management
	BTEE-908A	Special Electrical Machines
	BTEE-909A	Microcontroller

Semester -3rd

(BTEE-301A) Circuit Theory

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course Outcomes:

Students will be able to

- To acquaint students with the basic concepts and functions of network theorems.
- To analyze the problems on time and frequency domain analysis.
- The capability to synthesize the electrical network using foster and cauer forms.
- The ability to understand and analyze the basic filter circuits.

UNIT 1: CIRCUITS CONCEPTS

Independent and dependent sources, Signals and wave forms: Periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer and Reciprocity.

UNITII: TIME AND FREQUENCY DOMAIN ANALYSIS

Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, Time domain behaviours from poles and zeros, Convolution Theorem.

UNIT III: NETWORK SYNTHESIS

Network functions, Impedance and admittance function, Transfer functions, Relationship between transfer and impulse response, poles & zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros, Realiability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

UNIT IV: FILTERS SYNTHESIS

Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, Pass bands and stop bands, Design of constant-K, m-derived filters, Composite filters.

REFERENCE BOOKS:

1. Bird John, Electrical Circuit Theory and Technology, 2nd Ed., Newnes, 2003
2. Chakraborty, Abhijit, Circuit Theory, 2nd Edition, DhanpatRai, 2001
3. Chaudhury D. Roy, Networks & Synthesis, New Age International.
4. Edminister J.A., Electric Circuits, 4th Edition, Tata McGraw Hill, 2002
5. Iyer T.S.K.V., Circuit Theory, Tata McGraw Hill, 2006
6. Mohan, Sudhakar Sham, Circuits & Networks Analysis and Synthesis, 2nd Edition, Tata McGraw Hill, 2005
7. Van Valkenberg, M.E., Network Analysis & Synthesis, PHI learning, 2009
8. Van Valkenberg, M.E., Network Analysis & Synthesis, 3rd Edition, Pearson Education, 2006

(BTEE-302A) Transformers & Direct Current Machines

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course Outcomes:

Students will be able to:

- Understand and memorize the concept of transformer, auto transformer & DC machine.
- Apply the Knowledge acquired while solving numerical problems related to transformer and DC machine.
- Analyze the concepts & problems related to transformers and dc machines.
- Draw the operating characteristics of different types of Dc machine, equivalent circuit and phasor diagram of transformer.

UNIT-1:Single Phase Transformer

Working principle, construction of single phase transformer, EMF equation, phasor diagrams on no-load and on loaded conditions, open circuit and short circuit tests, equivalent circuit parameters estimation, voltage regulation and efficiency, back to back test. Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers

Auto-Transformers : Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.

UNIT-2:Three Phase Transformer

Different types of winding connections, Voltage and current ratios, Parallel operation of three phase transformers. Three winding transformer's equivalent circuit, off-load and on-load tap changing transformer, Scott connections. Testing of transformers.

UNIT-3 :DC GENERATOR

Working principle , construction of DC Machines, Armature windings, single and double layer winding diagrams, E.M.F. and torque equations, armature reaction, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of d.c. generators and their characteristics.

UNIT-4: D.C. MOTOR

Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency.

REFERENCE BOOKS:

1. Electrical Machinery by P.S. Bhimbra, Khanna Publishers, Delhi,7th Edition,2004
2. Electric Machinery by A.E.Fitzerald, C.Kingsley and S.D.Umans, Tata McGraw Hill,6th Edition, 2002
3. Theory of AC Machinery by A.S.Langsdorf, Tata McGraw Hill,2nd Edition,1955
4. Electrical Machines by Ashfaq Hussian, Dhanpat Rai & Company,2nd Edition,2002.
5. Electrical Machinery Fundamentals by S. J. Chapman, McGraw Hill,New York,2nd Edition,1991

(BTEE-303A) Electrical Measurement

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course Outcomes:

Students will be able to

- Understand the basic units, dimensions and dimensional formulas.
- Memorize the basic concept of potentiometers, bridges and instrument transformers and magnetic measurement.
- Be familiar with the working principles of various measuring instruments.
- Apply the acquired knowledge while solving the problems related with potentiometers, bridges, instrument T/F and magnetic measurements.

UNIT I : UNITS, DIMENSIONS AND STANDARDS

Introduction to MKS & Rationalised MKSA System, SI Units, Standards of EMF, Resistance, Capacitance and Inductance, Systematic errors.

UNIT II: GENERAL THEORY OF ANALOG MEASURING INSTRUMENTS

Operating torque, damping & controlling torque, T/W ratio, Pointers & Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. PMMC, dynamometer, induction, thermal, etc. for dc & ac measurement of voltage, current, power, frequency, phase & power factor etc., energy meter: their sources of error & compensation, shunts & multipliers, multi-meter.

UNIT III:POTENTIOMETERS

Basic D.C. potentiometer circuit, Modern form of D.C. potentiometer, measurement of voltage, current, Resistance and calibration of voltmeter & ammeter using D.C. potentiometer, volt ratio box, Self balancing potentiometer, A.C. potentiometers and their applications

UNIT IV:BRIDGES

Sources and Detectors, General equation for bridge balance, Wheatstone bridge and its sensitivity analysis, Kelvin double bridge, AC bridges: applications and conditions for balance, Maxwell's bridge, Hay's bridge, Schering bridge, Wien bridge, DeSauty's bridge, Insulation testing, Sources of errors in bridge circuits, Shielding of bridge elements, Wagner Earthling Device.

UNIT V: INSTRUMENT TRANSFORMERS

Theory and construction of current and potential transformers, ratio and phase angle errors and their minimization, Characteristics of current transformers (CT).and potential transformers (PT) and their Testing.

REFERENCE BOOKS:

1. Modern electronic instrumentation and measurement techniques By Cooper Halfrick, PHI, 1990.
2. Electronic Instrumentation & Measurement ByA.K.Sawhney, DhanpatRai& Sons, 19th Ed., 2011.
3. Electronic Instruments and Measurement By Jones & Chin 2nd Ed., 2010.
4. Theory of Errors by J.Toppin, Wessely Publishing., 4th Ed., 2000

(BTEE-304A) Electronic Devices & Circuits

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to:

- Know about with the basic concepts and properties of Electronic circuits and devices.
- Understand basic Engg. Abstractions on which analysis and design of electronic circuits and systems are based, including lumped circuits, digital and operational amplifier abstractions.
- Understand of how complex devices such as semiconductors, diodes and field effect transistors are modelled and how the models are used in design and analysis of useful circuits.
- formulate and solve the problems related to basic electronic circuits using analytic methods.
- use previously learned abstractions to analyze and design simple electronic circuits.

UNIT I :BASIC SEMICONDUCTOR AND DIODES

Intrinsic and extrinsic semiconductors, diffusion and drift currents, p-n junction under open-circuit, reverse bias and forward-bias conditions, p-n junction in the breakdown region, Ideal diode, terminal characteristics of junction diode, Load-line analysis of diode circuits, half wave rectifier and full wave rectifiers, Clippers and Clampers, capacitive filters, RC and LC filter, voltage multipliers. Principles, construction, characteristics and applications of Zener diodes, Light Emitting Diodes, Schottky Diode, Varactors

UNIT II :BIPOLAR AND UNIPOLAR TRANSISTORS

Bipolar junction transistor (BJT)- physical structure and modes of operation, Transistor characteristic and parameters, Common Base, Common Emitter and Common Collector Configurations, Transistor biasing, Transistor as a switch, Basics characteristics of an amplifier, Simple transistor model (re model), Common Emitter, Common Collector and Common base amplifiers, hybrid equivalent circuit, H-parameters, circuit analysis using h-parameters. Junction field effect transistor (JFET): Characteristics, parameters and biasing. Metal oxide field effect transistor (MOSFET): Characteristics, parameters and biasing. Class a power amplifier, Class B, Class AB Push-pull and Class C- amplifiers.

UNIT III :INTEGRATED CIRCUIT AND OPERATIONAL-AMPLIFIERS

Introduction to IC's, Op-Amps, Op- Amp Characteristics, Feedback, Different feedback configurations, Current– to–voltage converter and voltage-to-current converters, voltage and current amplifiers, mathematical operations using Op-Amp, summing, differential, integrating amplifiers, Comparators and Schmitt trigger

UNIT IV: OSCILLATORS AND ACTIVE FILTERS

Oscillations, Feedback oscillator Principles,RC phase shift oscillator, Wein bridge oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillators, frequency stability, negative resistance in oscillators. Active Filters (1st order) with low pass, high pass, band pass, band stop and all pass. Pin configuration of 555 timer, 555 timer as Oscillator: monostable, bistable and astable multivibrator.

REFERENCES BOOKS:

1. Electronic Devices & Circuits by Boylstad&Nashelsky.,Prentice Hall Pub.9th Ed.,2010.
2. Integrated Electronics by Millman&Halkias, Mc-Graw Hill Pub, 2nd Ed.,2001.
3. Electronic Principles by Malvino ,Mc-Graw Hill Pub, 7th Ed.,2007.
4. Principles of Electronics by V.K. Mehta. ,S Chand., 10th Ed. , 2006.
5. Electronic Circuits by Donald L. Shilling & Charles Belowl, TMH., 3rd Ed. ,2009.

(BTHU-301A) Professional Skills-I

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

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Course outcomes:

Students will be able to:

- Understand varied aspects of interpersonal -relations and develop ability for creating harmonious relations.
- Sharpen and demonstrate Numerical Ability and Reasoning Abilities.
- Apply stress management techniques after going through the knowledge of Stress and its coping strategies
- Develop and Demonstrate Speaking skills in various contexts such as Public speaking, Impromptu, Introducing Oneself and Telephonic conversation.

UNIT I : PERSONALITY DEVELOPMENT

General overview of personality, Understanding Self Concept and Self Esteem, Building Self Esteem, Self Confidence, Assertiveness (Activity based training) Understanding assessment of Personality.

UNIT II : MENTAL ABILITIES

Understanding Intelligence, emotional intelligence, successful intelligence, Development of emotional intelligence

UNIT III : SOCIAL ETIQUETTES AND PERSONAL GROOMING

Importance of social image, Dos and Don'ts in dressing up, Developing an Understanding of Social Etiquettes;

UNIT IV : COMMUNICATION SKILLS

Features of an effective communication, Verbal and Non-verbal communication, Understanding role of body language in effective communication

REFERENCE BOOKS:

1. Personality Development by Harold Wallace and L. Ann Masters, Cengage Learning.
2. Psychology by Baron, Prentice Hall India.
3. Educational Psychology by Anita Woolfolk, Pearson
4. Organisational behaviour by Stephen Robbins, Pearson Education.
5. Communication in organisations by Dalmer Fisher, Jaico Publishing House, New Delhi.

(BTEE-305A) Circuit Theory & Electronic Devices LAB

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to:

- After the completion of the course, the students could have skills about the basic Diode circuits, their operational characteristics and their applications.
- Ability to use the CRO.
- To understand the working of halfwave and Fullwave rectifier and Zener Diode.
- To study the output of BJT and FET.

LIST OF EXPERIMENTS

1. To draw V-I characteristics of PN junction diode (Ge, Si, switching and signal).
2. To design half wave rectifier.
3. To design full wave and bridge rectifiers.
4. To study transistor characteristics in common base and common emitter configurations.
5. To study the FET characteristics.
6. To design, study and compare various transistor biasing techniques.
7. To design regulated power supply using zener diode/ voltage regulator IC.
8. To study of an emitter follower circuit.
9. To verify Superposition theorem.
10. To verify Norton's theorem.
11. To verify Thevenin's theorem.
12. To verify maximum power transfer theorem.
13. To study the response of constant K-filters.
14. To study the response of m-derived filters
15. Diode clippers and clampers.

Note: Atleast ten experiments should be performed in semester

(BTEE-306A) Transformer & Direct Current Machines LAB

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to:

- Ability to perform experiments to draw the characteristics of DC machines.
- Ability to find out the losses and efficiency of transformer and DC Machines.
- Ability to perform various connection of transformer.
- To determine the Losses of DC Shunt Motor.

LIST OF EXPERIMENTS

1. To Load test on a single phase transformer.
2. To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit, voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of three phase transformer
6. To perform Scott connections on three phase transformer to get two phase supply
7. To study the constructional details of direct current (d.c.) machine and to draw sketches of different components
8. To measure armature and field resistance of direct current (d.c.) shunt generator and to obtain its open circuit characteristics.
9. To obtain load characteristics of direct current (d.c.) shunt/series /compound generator
10. To draw speed-torque characteristics of direct current (d.c.) shunt/series /compound generator.
11. To study direct current (d.c.) motor starters.
12. To perform Swinburne's test (no load test) to determine losses of direct current (d.c.) shunt motor.

Semester-4th

(BTEE-401A) Electrical Engineering Materials

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to:

- understand the Dielectric Properties of the Insulating Materials.
- have complete knowledge about the Properties and applications of insulating Material.
- analyze the Magnetic Properties and applications of magnetic materials**.**
- memorize about the Conducting Materials used in Electrical Engg.

UNIT I : Dielectric Properties of Insulating Materials

Static Field, Parameters of Dielectric material [Dielectric constant, Dipole moment, Polarization, Polarizability, Introduction to Polar and Non- Polar dielectric materials. Mechanisms of Polarizations-Electronic, Ionic and Orientation Polarization (Descriptive treatment only), Clausius Mossotti Equation, Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric Loss and loss tangent.

Optical Properties of Materials & Cells used for Power Generation: Photo-Conductivity, Photo-Electric Emission, Photo-Voltaic cells [Materials Used, Construction, Equivalent Circuit, Working and Application), materials used for Photo-Conductive cells, Photo-Emissive cells.

UNIT II : Insulating Materials, Properties & Application

Introduction, Characteristics of Good Insulating Material, Classification, Solid InsulatingMaterials-Paper, Press Board, Fibrous Materials, Ceramics, Mica & Asbestos, Resins, Polymers Ceramics, Enamels. Liquid Insulating Materials such as Transformer Oil, Varnish , Askarel,Insulating Gases like Air, SF6, Insulating Materials for Power & Distribution Transformers,Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears. Crystal defects. **Dielectric Breakdown:** Introduction, Concept of Primary and Secondary Ionization of Gases (Descriptive treatment only),Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Gaseous,Liquid and Solid Dielectric Materials

UNIT III: Magnetic Materials

Introduction, Parameters of Magnetic material Permeability, Magnetic Susceptibility, Magnetization, Classification of Magnetic Materials, Diamagnetism, Para magnetism, Ferromagnetism,Ferri-magnetism, Ferro-magnetic behaviour below Critical Temperature,Spontaneous Magnetization & Curie-Weiss law, Anti-ferromagnetism, Ferrites, Applications ofFerro-magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core ,Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Recording Materials, Compact Discs**.** Introduction to laser and magnetic strip technology

UNIT IV: Conducting Materials

General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and itsapplications, Materials of High & Low Resistivity-Constantan, Nickel-Chromium Alloy,Tungsten, Canthal, Silver & Silver alloys, Characteristics of Copper Alloys (Brass & Bronze),Materials used for Lamp Filaments, Transmission Lines, Electrical Carbon Materials, Material used for Solders, Metals & Alloys for different types of Fuses, Thermal Bimetal & Thermocouple. Introduction to Superconductivity and Super Conductors.

REFERENCE BOOKS:

1. A Course in Electrical Engineering Materials, by S. P. Seth, Dhanpat Rai and Sons publication, 2001
2. Electrical Engineering Materials, T.T.T.I, Madras, 1998
3. Electrical Engineering Materials, by K. B. Raina & S. K. Bhattacharya, S. K. Kataria & Sons,2004
4. Material Science for Electrical Engineering, by P.K. Palanisamy, Scitech Pub.(India) Pvt. Ltd., Chennai,2011

(BTEE-402A) Linear Control System

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to:

- understand the various concepts of linear and time variant systems modeling, state space analysis and block diagrams ,signal flow graphs ,open and closed loops and sampled data control systems .
- memorize the concepts of error detectors, potentiometers, servo motors and tacho generator .
- analyse the concepts of stability methods like Routh Hurwitz , Bode Plots , Root Locus and Nyquist Criterion techniques

UNIT-I : Introductory Concepts

Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, stability, linear and non-linear systems, time variant and invariant, pole-zero location, Block diagrams, some illustrative examples.

UNIT-II : Modeling

Force voltage analogy, force current analogy, Laplace transforms, Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Time Domain Analysis: Testing signals, Transient response of the first and second order systems, Time domain specifications, Steady state error and coefficients, PID controller, Absolute & relative stability, Routh-Hurwitz Criterion.

UNIT-III: Stability Analysis

Root locus technique, the extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot., Frequency domain analysis: Closed loop frequency response, Bode plots, stability and loop transfer function, Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

UNIT-IV: State Space Analysis

State space representations, transfer function, state transition matrix, controllability, observability.

Control Components: Error detectors – potentiometers and synchros, servo motors, A.C. and D.C. techno generators, Magnetic amplifiers.

REFERENCE BOOKS:

1. Dorf Richard C. and Bishop Robert H., Modern Control System, Addison –Wesley, Pearson New Delhi, 2009
2. Ogata K., Modern Control Engineering", Prentice Hall, 2011
3. Kuo B. C., Automatic Control System", Prentice Hall, 1999
4. Nagrath I.J. and Gopal M., Control System Engineering, Wiley Eastern Ltd, 1997
5. B. S. Manke, Linear Control Systems, 2002

(BTEE-403A) Electromagnetic Field Theory

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course Outcomes:

Students will be able to

- acquire knowledge of different coordinate system and Green theorem, Stokes theorem and concept of divergence, gradient and curl.
- acquaint students with Electrostatics and Magnetostatics concepts with laplace and poisson equations.
- acquire knowledge of Maxwell equations in steady field as well as in time varying field.
- understand Electromagnetic wave propagation in different mediums.

UNIT I : REVIEW OF VECTOR ANALYSIS

Vector analysis, Physical interpretation of gradient, divergence and curl; vector relations in other coordinate systems, integral theorems: divergence theorem, stoke's theorem, green's theorem and Helmholtz theorem.

UNIT II: ELECTROSTATICS

Introduction to fundamental relations of electrostatic field; Gauss's law and its applications; potential function; Field due to continuous distribution of charges; Equipotential surfaces; Divergence theorem; Poisson's equation and Laplace's equation, capacitance, electrostatic energy, Conditions at Boundary between dielectrics, Uniqueness theorem.

UNIT III: STEADY MAGNETIC FIELD

Magnetic induction and Faraday's laws; magnetic Flux Density; magnetic field strength and magnetomotive force; Ampere's work Law in the differential vector form; permeability; energy stored in a magnetic field ; ampere's force law; magnetic vector potential, Analogies between electric and magnetic fields.

UNIT IV: MAXWELL'S EQUATIONS AND POYNTING VECTOR

Equation of continuity for time varying fields, Inconsistency of ampere's law, Maxwell's equations in integral and differential form for static and time varying fields, conditions at a Boundary surface, Concept of Poynting vector, Poynting Theorem, Interpretation of ExH .

UNIT V: ELECTROMAGNETIC WAVES

Solutions for free-space conditions; Uniform plane Wave Propagation; Wave equations for a conducting medium; Sinusoidal time variations; Polarization; Conductors and Dielectrics; Direction Cosines; Reflection by Perfect Conductor -normal and oblique incidence, Perfect Dielectric normal incidence, Perfect Insulator –Oblique incidence; Brewster angle, Reflection at a surface of Conductive medium, Surface impedance.

REFERENCE BOOKS:

1. Electromagnetic Wave: Jordan and Balmain : PHI And Radiation System, 2010
2. Electromagnetics: Kraus : T.M.H.,2003
3. Problem and solutions in Electromagnetics, W H Hayt and J A buck, Tata McGraw Hill, 1999
4. Engineering Electromagnetic : W H Hayt, T.M.H, 2012.

(BTEE-404A) Microprocessors

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course Outcomes:

Students will be able to

- understand the basic concepts and functions of microprocessor.
- memorize the concepts of 8 bit and 16 bit microprocessors
- analyze the programming technique and develop assembly language programs of 8086 microprocessor.
- understand 8086 interrupts and its interfacing

UNIT I: INTRODUCTION TO MICROPROCESSOR

Types of computers, Microprocessor evolution and types, Central Processing Unit (CPU) operation and terminology, idea of 8- bit, 16-bit, 32-bit and 64- bit Microprocessors from Intel, Motorola and Zilog and their comparisons.

UNIT II: INTRODUCTION TO 8-BIT MICROPROCESSOR

8085 Microprocessor architecture, classification of instructions, Instruction format, and overview of the 8085 instruction set.

UNIT III: INTRODUCTION TO 16-BIT MICROPROCESSOR

8086 Internal Architecture, Addressing modes, program development steps, 8086 instruction set, Assembler directives, Assembly language, program development tools.

UNIT IV: PROGRAMMING OF 8086

Simple sequence programs, jumps, flags, conditional Jumps, IF-THEN, IF-THEN-ELSE, Multiple IF-THEN-ELSE, WHILE-DO, REPEAT-UNTIL, Instruction Timing and delay loops, strings, procedures, Macros.

UNIT V: 8086 SYSTEM CONNECTIONS, TIMING, TROUBLESHOOTING

Pin-diagram, maximum/minimum modes, timing diagrams, use of logic analyzer to observe Bus signals, troubleshooting a simple 8086 based system

UNIT VI: 8086 INTERRUPTS AND APPLICATIONS

8086 Interrupts, responses and applications, 8254 software programmable timer/counter, 8259 a priority Interrupt Controller

UNIT VII: INTERFACING OF 8086:

Programmable parallel ports and handshake, Interfacing a Microprocessor to Keyboards and alphanumeric displays, Digital to Analog (D/A) converter operation, interfacing and applications, Analog-to Digital (A/D) converter specifications and Interfacing.

REFERENCE BOOKS:

1. Gaonkar, Ramesh S. Microprocessor Architecture, Programming and Applications with the 8085, Penram International
2. Ram B, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai and Sons,
3. Hall, Douglas V. Microprocessors and interfacing: Programming and Hardware, Tata McGraw Hill
4. Brey, Barry B.Bray, The INTEL Microprocessors 8086/88, 80186, 286, 386, 486, Pentium Pro Processors, Architecture, Programming and Interfacing, 4 th Edition, Prentice Hall (India)
5. Ray A.K. and Bhurchandi K.M., Advanced Microprocessors and Peripherals, Tata McGraw Hill.

(BTEE-405A) Digital Electronics

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to

- Acquire knowledge about basics of digital electronics and problems related to Boolean algebra and also logic behind any digital system.
- Identify analyze and design combinational circuit.
- Analyze various synchronous and asynchronous sequential circuit.
- Acquire the knowledge of logic families.

UNIT I : Number System and Binary Code

Introduction, Binary, decimal, Octal, hexadecimal, BCD number system, Signed and unsigned number, binary operations - Addition, Subtraction. Multiplication and division.Subtractions using 1's and 2's compliment; ASCII code. Excess 3 codes and Gray code. Minimization of logic function:-OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorem of Boolean Algebra sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.

UNIT II: Combinational logic circuits

Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders (Half adder, full adder), substracters and code converters, parity checker, BCD display drive, magnitude comparators.

UNIT III: Sequential circuits

Flip Flop fundamentals, different flip flop configurations; SR, JK, D, T. Edge triggered and clocked flip flop, Registers; Types of Registers; series & parallel shift, circuit diagram, timing wave form and operations, counter, synchronous & asynchronous, Johnson counter.

UNIT IV: D/A and A/D Converters

Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A./D converter, A/D accuracy and resolution.

Logic Families: Introduction; RTL, DTL,&TTL.

REFERENCE BOOKS:

1.Modern Digital Electronics by RPJain,TMH, 4th Ed., 2011..
2. Digital Principals & Applications by Malvino& Leach, TMH , 4th Ed. , 1991.
3. An Engg. Approach to digital design by Fletcher, PHI, Indian Ed., 2011.
4. Digital Electronics by Sanjay Sharma, Kataria Sons, 1st Ed. , 2011.

(BTEE-406A) Linear Control System Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to:

- acquire skills to understand all types of control components
- analyse the stability of control systems
- study the characteristics of various devices.
- understand open loop and closed loop systems.

LIST OF EXPERIMENTS

1. To study the characteristics of potentiometers and to use 2- potentiometers as an error detector in a control system.
2. To study the synchro Transmitter-Receiver set and to use it as an error detector
3. To study the Speed – Torque characteristics of an AC Servo Motor and to explore its applications.
4. To study the Speed – Torque characteristics of an DC Servo Motor and explore its applications.
5. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
6. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
7. To study the characteristics of a thermocouple, a thermistor and a RTD
8. To study photo-conductive cell, semi-conductor photodiode and a silicon photo voltaic cell
9. To study a silicon phototransistor and obtain response of photo conductive cell
10. To study the variations of time lag by changing the time constant using control engineering trainer
11. To simulate a third order differential equations using an analog computer and calculate time response specifications.
12. To obtain the transfer function of a D.C. motor – D.C. Generator set using Transfer Function Trainer
13. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop systems
    (i)To study the operation of a position sensor and study the conversion of position in to corresponding voltage
    (ii) To study an PI control action and show its usefulness for minimizing steady state error of time response.
14. To measure Force / Displacement using Strain Gauge in a wheat stone bridge
15. To design a Lag compensator and test its performance characteristics.
16. To design a Lead-compensator and test its performance characteristics.
17. To design a Lead-Lag compensator and test its performance characteristics.

At-least ten experiments should be performed.

(BTEE-407A) Digital Electronics Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to:

- test and verify working and truth tables of combinational and sequential circuits
- study input output waveforms on digital storage oscilloscope
- Understand and commit to professional, ethics, responsibilities and norms of engineering practice.
- study converters.

LIST OF EXPERIMENTS

1. To study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and their Realization of OR, AND, NOT and XOR functions using universal gates.
2. To Realize of Half Adder using Logic gates.
3. To Realize of Full Adder using Logic gates.
4. To Realize Half Subtractor using Logic gates
5. To Realize of Full Subtractor using Logic gates
6. To Design 4-Bit Binary-to-Gray Code Converter.
7. To Design 4-Bit Gray-to-Binary Code Converter.
8. To study and design 4-Bit magnitude comparator using logic gates.
9. To study and design multiplexer Truth-table and their verification.
10. Realization of Half adder and Full adder using MUX.
11. To study and design Demultiplexer Truth table and their verification
12. Realization of Half subtractor and Full subtractor using DEMUX.
13. To study and verify Truth-table of RS, JK , D, JK Master Slave Flip Flops.
14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.
15. To Study different shift registers, viz. SIPO, SISO, PIPO, PISO.
16. To Study digital logic families.

At-least ten experiments should be performed.

(BTEE-408A) Electrical Measurement & Instrumentation Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

To make students familiar

- About the principal of operation and working characteristics of measuring instruments.
- With procedure of Measurement of Resistance, inductance, capacitance and frequency using appropriate bridges .
- Working of measuring instruments like RTD, transducer and thermocouple etc.

LIST OF EXPERIMENTS

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. To measure Insulation Resistance by Megger.
3. Measurement of resistance using Wheatstone Bridge
4. Measurement of resistance using Kelvin's Bridge.
5. Measurement of self inductance using Anderson's Bridge.
6. Measurement of frequency using Wein's Bridge
7. Measurement of capacitance using Schering Bridge
8. Measurement of displacement using LVDT.
9. To study the connections and use of Current and potential transformers and to find out ratio error.
10. To study the input-output characteristics of a potentiometer and to use a potentiometer as an error detector.
11. Measurement of unknown voltage using potentiometer.
12. Velocity measurement using air flow transducer.
13. RPM measurement using electromagnetic transducers
14. Study of the characteristics of a Piezoresistive Sensor for Pressure Measurement of a Liquid in a Tank
15. Study of the characteristics of Resistance Temperature Detector(RTD)
16. Temperature measurement using temperature sensor (RTD).
17. Study of the characteristics of a Thermocouple.

At-least ten experiments should be performed.

Semester-5th

(BTEE-501A) Asynchronous Machines

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to

- Understand and memorize the concept of poly phase induction motors, their starting and speed control methods,
- Apply the knowledge acquired for solving numerical problems on Induction machines and analyze the results.
- Appraise the performance of the Induction machines-single phase & three phase and select appropriate ac machines considering its significance.
- Understand working and applications of induction generator,special purpose motors and single phase motors.

UNIT I: Polyphase Induction Machines

Analogy between induction motor and transformer, production of rotating field in space distributed three-phase winding, constructional features, concept of slip and operation, rotor frequency, current and power, equivalent circuit, phasor diagram, torque-slip characteristics, effect of rotor circuit resistance, starting torque, crawling and cogging, cage motors(double cage and deep bar motor).

UNIT II : Starting Methods And Speed Control

Starting methods, speed control: (i) control of speed of rotating field, (ii) control of slip speed. Effect of voltage injection in rotor circuit of slip ring induction motor. Motor tests for estimation of equivalent circuit parameters.

UNIT III : Induction Generator

Isolated and Grid mode operation, method of excitation, performance characteristics of three-phase self-excited induction generator.

UNIT IV: Single –Phase Motors

Double revolving field theory, types of single phase motors, characteristics and equivalent circuit. Shaded pole motor: working principle and characteristics

UNIT V: Special Purpose Motors

Stepper Motors: construction, principle of operation and applications. Linear Induction Machines: construction, principle of operation and applications. Universal Motor: construction, principle of operation and applications.

REFERENCE BOOKS:

1. Fitzgerald A.E., Kingsley C. and Umans S.D., Electric Machinery, 6th Edition, McGraw Hill
2. Langsdorff E.H., Principles of A.C. Machines, McGraw Hill
3. Nagrath I.J. and Kothari D.P., Electrical Machines, 4th Edition, Tata McGraw Hill
4. Bimbhra P.S., Electrical Machinery, Khanna Publishers
5. Say M G, Alternating Current Machines, 5th edition, Sir Isaac pitman & Sons Ltd.

(BTEE-502A) Power Electronics and Drives

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will able to

- Understand the importance of power electronics and its application.
- Identify/mitigate the problems and find ways to solve them using power electronics.
- Understand the operation, function and interaction between various components and subsystems used in power electronics converter.

UNIT I: Thyrlstors and their characteristics

Introduction to Thyristor family, V-I characteristics of siliconcontrolled rectifier (SCR), gate turn-off thyristor (GTO), Bidirectional diode for alternating current (DIAC) and Bidirectional, Triode for Alternating Current (TRIAC). Principle of operation of silicon-controlled rectifier (SCR). Two transistor analogy. Turn on methods of a thyristor Switching characteristics of thyristors during tum-on and turn-off. Gate characteristics. Firing of thyristors. Gate triggering circuits. Series and parallel operation of silicon-controlled rectifiers (SCR) and their triggering circuits. Thyristor specifications; such as latching current and holding current, critical rate of rise of off-state voltage (dv/dt) and critical rate of rise of on-state current (di/dt) etc. Protection of SCR from over voltage and over current. Snubber circuits. Power dissipation.

UNIT II: Thyristor commutation techniques

Self commutation by resonating the load (Class A), Self commutation by LC circuit (class B), Complementary commutation (class C), Auxiliary commutation (class D), External pulse commutation (class E), AC Line commutation (class F).

UNIT III: Phase controlled techniques

Introduction to phase angle control. Single phase half wave controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. Three phase full controlled bridge rectifiers. Effect of resistive, inductive and resistive cum inductive loads. Basic circuit and principle of operation of Dual Converter, circulating current mode and non-circulating current mode of operation. Applications of rectifiers and dual converters to speed control of DC motor drives.

UNIT IV : Choppers

Introduction of chopper, Basic chopper classification, Basic chopper operations. Control strategies, Chopper configuration, voltage commutated chopper, Current commutated chopper, Load commutated chopper.

UNIT V : Cycloconverters

Basic principle of operation, Single phase to. single phase cycloconverter. Three phase half wave cycloconverter. Advantages disadvantages of cycloconverters.

UNIT VI : Inverters

Introduction & Classification of inverter. Operating principle, Single phase half bridge voltage source inverters, Single phase full bridge inverter. Modified McMurray half-bridge and full-bridge inverter. Three-phase bridge inverter. Voltage control (Pulse-width modulation (PWM) control etc.) and reduction of harmonics in the inverter output voltage. Series inverter.

UNIT VII: Symbols and V-I characteristics of Silicon Unilateral Switch (SUS), Silicon Controlled Switch (SCS), Silicon Bilateral Switch (SBS), Unijunction Transistor (UJT), Programmable Unijunction Transistor (PUT), Light-activated

silicon-controlled rectifier (LASCR), Reverseconducting Thyristors (RCT), Static Induction Thyristor (SITH), N- Metal Oxide Semiconduct or Controlled Thyristor (N-MCT), Field Controlled Thyristors (FCT).

REFERENCE BOOKS:

1. Bimbhra, P.S., Power Electronics, Khanna Publishers.
2. Singh M.D. and Khanchandani K.B., Power Electronics, Tata Mc Graw Hill Publishing company limited.
3. Rashid M.H., Power Electronics, Circuits Devices and Applications, Prentice Hall (India)
4. Sen, P.C., Power Electronics, Tata McGraw Hill Publishing Company limited.
5. Bhattacharya S.K. and Chatterji, S. Industrial Electronics and Control, by New Age international Publications(P) Ltd, New Delhi.

(BTEE-503A) Generation and Economics of Electric Power

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to

- Understand and memorize the basic concepts in electric power and energy system & identify sources of electricity generation and discuss their operations.
- Interpret load characteristics and demand & load modeling and recognize the roles of electricity management and regulatory entities.
- Analyze system integration challenges including structure, function and operations & Review energy economic functions &terminology and discuss the elements associated with determining revenues, costs and rates.
- Understand the concept of cogeneration and its advantages.

UNIT I : Introduction

Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations. Classification of power plants in base load and peak load plants

UNIT II: Loads and Load curves

Types of load (fixed voltage loads, resistive loads, Inductive motor loads, Mechanical load), effect of load on supply voltage, Maximum demand, Group diversity factor, Peak diversity factor, Types of load, chronological load curves, load-duration Curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

UNIT III : Power Plant Economics

Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation.

UNIT IV: Tariffs and power factor improvement

Objectives of tariff making, different types of tariff (domestic, commercial, agricultural and industrial loads). Need for power factor (p.f.) improvement, power factor improvement using capacitors, determination of economic power factor.

UNIT V: Selection of plant

Plant location, plant size, number and size of units in plants, economic comparison of alternatives based on annual cost, rate of return, present worth and capitalized cost methods.

UNIT VI:Economic operation of steam plants:

Methods of loading turbo-generators, input- output curve, heat rate, incremental cost, method of Lagrangian multiplier, effect of transmission losses, coordination equations, and iterative procedure to solve co-ordination equations.

UNIT VII: Hydro-thermal co-ordination

Advantages of combined working of Run-off River plant and steam plant, reservoir hydro plants and thermal plants, long-term operational aspects, scheduling methods.

UNIT VIII: Pollution and environmental problems:

Energy & environment, Air pollution, Aquatic impacts, nuclear plants and hydro plant impacts

UNIT VIII: Cogeneration

Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

REFERENCE BOOKS:

1. Deshpande M.V., Power Plant Engineering, Tata McGraw Hill (2004).
2. EI-Wakit M.M., Power Plant Engineering, McGraw Hill, USA
3. Rajput R.K., Power Plant Engineering, Luxmi Publications
4. Sharma P.C., Power Plant Engineering, Kataria and Sons
5. Skrotzki B.G.A. and Vapot W.A., Power Station Engineering and Economy, Tata McGraw-Hill
6. Arora S.C. and Dom Kundwar S., A course in Power Plant Engineering, Dhanpat Rai.

(BTEE-511A) Power Plant Engineering

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- Memorize the basic concept related to pollution and working of steam, hydro, diesel, nuclear and gas power plant and their accessories.
- Construct the layout of different type of power plants.
- Understand the combined operation of different power plants and comparison between various types of plants.
- Evaluate the numerical problems related to different types of power plants.

UNIT I : Steam Generators, Condensers and Turbines

Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.

UNIT II : Steam Power Plant

Classification, Operation, Description of Rankin cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

UNIT III: Hydro-Electric Power Plants

Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classification of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydro-station, layout of hydro power plant.

UNIT IV: Nuclear Power Plants

Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Site selections, safety measures, plant layout, Fusion reaction, Future of nuclear power.

UNIT V: Gas Turbine

Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations

UNIT VI: Diesel Power Plants

Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

UNIT VII: Combined Operation of Different Power Plants

Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

UNIT VIII: **Pollution Control**

Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

REFERENCE BOOKS:

1. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., A Textbook on Power System Engineering, Dhanpat Rai & Co.
2. EI-Wakit M.M., Power Plant Engineering, McGraw Hill, USA
3. Rajput R.K., Power Plant Engineering, Luxmi Publications
4. Sharma P.C., Power Plant Engineering, Kataria & Sons
5. Skrotzki B.G.A. and Vapot W.A., Power Station Engineering and Economy, Tata McGraw-Hill

(BTEE-512A) Special Electrical Machines

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Polyphase Synchronous Machines

Mathematical: Basic Synchronus machine parameters, Voltage, Flux linkage and inductance relations, Park's transformation – its physical concept, equations of performance

UNIT II :Balanced Steady State Analysis

Phasor equations and phasor diagrams, Power-angle characteristics, Cylindrical rotor and Salient pole machines, Short circuit ratio.

UNIT III : Transient Analysis

Three phase short-circuits, Armature and field transients, Transient torque, Sudden reactive loading and Unloading. Transient Analysis - a qualitative approach, Reactances and Time – Constants from equivalent circuits, Measurement of Reactances, Transient Power – angle characteristics.

UNIT IV : Synchronous – Machine Dynamics

The basic electromechanical equation, Linearized Analysis, Large Angular/oscillation, Non-linear analysis.

UNIT V : Transformers

Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformers, Determination of parameters.

UNIT VI : Excitation Phenomena In Transformers

Hamonics in Single – phase transformers, Harmonics in three-phase transformers, Disadvantages of harmonics, Suppression of harmonics

UNIT VII : Transformer Transients

In-rush curent phenomena, Qualitative approach, Analytical approach, In-rush current in 3-phase transformers.

UNIT VIII: Unbalanced Operation Of Three-Phase Transformers

Single-phase load on three-phase transformers, Single – Phasing in 3-phase transformers, Effect of using tertiary winding.

REFERENCE BOOKS:

1. Edikins B. ,Generalized theory of electrical Machines,
2. Concordia, Synchronous machines.
3. E.W. Kimbark , Power System Stability, Vol. III., Wiley
4. Fitzgerald A.E., Kingsley C. and Umans S.D., Electric Machinery, 6th Edition, McGraw Hill
5. Bimbra, P.S.,Generalized theory of electrical Machines, Khanna Publications
6. Draper A, Electrical Machines, Longman London, 1972
7. MIT Staff , Magnetic Circuits and Transformer.. 8. Daniels A. R., Introduction to Electrical Machines" MacMillan, London 1976.

(BTEE-513A) Microcontroller

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Introduction

Microprocessor, Micro-controllers and their comparison. The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts

UNIT II: 8051 Assembly Language Programming

The mechanics of programming, assembly language programming process, programming tools and techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions)

UNIT III: 8051 Microcontroller Design

Micro-controller specification, external memory and memory space decoding, reset and clock circuits, expanding input and output (I/O), memory mapped I/O, memory address decoding, memory access times, testing the design, timing subroutines, lookup tables for the 8051, serial data transmission

UNIT IV: Microcontroller Applications

Interfacing keyboards, displays, Digital-to-Analog (D/A) and Analog-to-Digital (A/D), multiple interrupts, serial data communications, introduction to the use of assemblers and simulators Embedded Systems: Introduction to PLDs and FPGA- architecture, technology and design issues, implementation of 8051 core.

REFERENCE BOOKS:

1. Kenneth J Ayola, The 8051 Micro Controller- Architecture, Programming and Application, Penram International Publication
2. John B Peatman, Design with Micro Controller, Tata McGraw Hill
3. Ray A. K. and Bhurchandi K. M., Advanced Microprocessors and Peripherals; Architecture, Programming and Interfacing, Tata McGraw Hill
4. Mazidi M. A. and Mazidi J. G., The 8051 Micro-controller and Embedded System, Pearson Education.
5. Udayashankara V. and Mallikarjunaswamy M.S., 8051 Microcontroller Hardware, Software and Applications, TataMcGraw Hill Education Pvt. Ltd., (2010)
6. Surekha Bhanot, Process Control, Oxford Higher Education.
7. Otter, Job Dan, Programmable Logic Controller, P.H. International, Inc, USA

(BTEE-514A) Instrumentation Engineering

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Electronic Instruments

Electronic voltmeter and current probes, tuned type and sampling type voltmeter, current probes for D.C. and A.C. measurements, electronic multimeter - construction, measurement of D.C. and A.C. voltage and current, measurement of resistance.

UNIT II: CRO

Construction, synchronisation, measurement of voltage,current, phase and frequency. Digital Instruments -Comparison of analog and digital instruments, digital voltmeter, multimeter and frequency meter.

UNIT III:Transducers

Terminology and definition, classification, transducing principles and elements, ultrasonic, optical and infrared sensors, inductive, capacitive and resistive transducers for measurements of length, thickness, displacement, velocity, torque, level, pressure, temperature, flow, humidity, moisture, and pH. Block diagram representation of instrumentation system

UNIT IV:End Devices

Recorders: x-y recorders, strip-chart recorder, magnetic and potentiometric recorder. Digital displays- LED & LCD Introduction to Data Acquisition system.

REFERENCE BOOKS:

1. A course in Electrical & Electronic Instrumentation A.K. Sawhney
2. Handbook of Transducer for Electronic Measuring system H.N. Norton
3. Instrumentation Devices & Systems Rangon, Mani & Sharma

(BTEE-521A) Human Resource Management

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT-I :Introduction

Introduction to Human Resource Management and its definition, functions of Human Resource Management & its relation to other managerial functions. Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization.

UNIT-II: Procurement and Placement

Need for Human Resource Planning; Process of Human Resource Planning; Methods of Recruitment; Psychological tests and interviewing; Meaning and Importance of Placement and Induction, Employment Exchanges (Compulsory Notification of vacancies) Act 1959, The Contract Labour (Regulation & Abolition) Act 1970.

UNIT-III: Training & Development

Difference between training and Development; Principles of Training; Employee Development; Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.

UNIT-IV: Job analysis & Design

Job Analysis: Job Description & Job Description, Job Specification.

UNIT-V : Job Satisfaction

Job satisfaction and its importance; Motivation, Factors affecting motivation, introduction to Motivation Theory; Workers ' Participation, Quality of work life.

UNIT-VI: The Compensation Function

Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961

UNIT-VII: Integration

Human Relations and Industrial Relations; Difference between Human Relations and Industrial Relations, Factors required for good Human Relation Policy in Industry; Employee Employer relationship Causes and Effects of Industrial disputes; Employees Grievances & their Redressal, Administration of Discipline, Communication in organization, Absenteeism, Labour Turnover, Changing face of the Indian work force and their environment, Importance of collective Bargaining; Role of trader unions in maintaining cordial Industrial Relations.

UNIT-VIII: Maintenance

Fringe & retirement terminal benefits, administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Safety Previsions under the Factories Act 1948; Welfare of Employees and its Importance, Social security, Family Pension Scheme, ESI act 1948, Workmen's Gratuity Act 1972, Future challenges for Human Resource Management.

REFERENCE BOOKS:

1. Lowin B. Flippo - Principles of personnel Management (Mc Graw-Hill)
2. R.C. Saxena - Labour Problems and social welfare (K.Math & Co.)
3. A Minappa and M. S. Saiyada - Personnel Management (Tata Mc. Graw-Hill)
4. C.B. Mamoria - Personnel Management (Himalaya Publishing House, Bombay)
5. T.N. Bhagotiwal - Economics of Labour and Industrial Relations (Sahitya Bhawan Agra)

(BTEE-522A) Total Quality Management

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Quality and Total Quality Management:
Excellence in manufacturing/service, factors of excellence, relevance of TQM.
UNIT II: Concept and definition of quality
total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.
UNIT III:Just-in-time (JIT):
Definition:Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.
UNIT IV : Customer
Satisfaction, data collection and complaint, redressal mechanism.
UNIT V: Planning Process:
Policy development and implementation; plan formulation and implementation.
UNIT VI : Process Management
Factors affecting process management, Quality function development (QFD), and quality assurance system.
UNIT VII: Total Employees Involvement (TEI)
Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.
UNIT-VIII : Problems solving
Defining problem;Problem identification and solving process; QC tools. Benchmarking definition, concept, process and types of benchmarking.
UNIT-IX: Quality Systems
Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.
UNIT-X : Advanced techniques of TQM
Design of experiments: Failure mode effect analysis: Taguchi methods

REFERENCE BOOKS:
1. Total Quality Management by sunder Raju, Tata Mcgraw Hill
2. TQM for engineers by M.Zairi, Aditya Books
3. Total Quality Management Handbook by J.L. Hradeskym MCGraw Hill
4. ISO 9000 quality System by Dalela and Saurabh, standard Publishers

(BTEE-523A) Operating Systems

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Course Contents

Introduction to Operating system, computer system structure , operating system structure, process management, CPU scheduling , process synchronization, deadlocks.
Memory management paging and segmentation virtual memories[20%]
I./O system and secondary storage structure [10%]
Protection and security [10%]
Introduction to multiprocessor and distributed operating systems. [20%]
Case Studies: LINUX , UNIX Operating System with SOLARIS and SCO-UNIX [15%]

REFERENCE BOOKS:

1. A Silberschatz and Peter B. Calvin, " Operating System Concepts" Addison Wesley Publishing Company
2. Dhamdhere, " Systems Programming & Operating Systems" Tata McGraw Hill

(BTEE-524A) Biomedical Engineering

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I :Transducers

Strain gauge for respiratory flow transducer, piezo resistive transducer for intracardiac catheter, thermistor as temperature sensing elements - its characteristics and compensation for non-linearity.

UNIT II: Piezoelectric transducer

Its equivalent circuits and impedance frequency characteristics. Its applications as intra cardiac microphone, heart assist device and ultrasonic instruments. Variable inductance transducer, different configuration and application for measurement of muscular tremor. linear variable differential transformer (LVDT) and its signal processing circuitry. Magnetostrictive and variable capacitance transducers, stretched diaphragm transducer and its

UNIT III: Measurement and recording of bioelectric signals

electrocardiogram (ECG), electromyogram (EMG), electroencephalogram (EEG) and instruments for picking up and reproducing bioelectric signals, specific design characteristics, sources of noise and its removal.

UNIT IV: Measurement and recording of non-electric signal

Measurement and recording of pressure, temperature, respiration rate, pulse rate and blood flow. Electromagnetic blood flow meter, thermography, pH measurements, gas analysis, ESR (erythrocyte sedimentation rate) measurement, plethysmograph, X-Ray, tonometer and dialysis. Ultrasonics and echoencephalography radiography imaging isotopes and nuclear medicine.

UNIT V: Equipment for effecting the human body

Stimulator, defibrillator, pacemaker, diathermy.

UNIT VI: Prosthetics

Upper and lower extremity prostheses, harness control, EMG-controlled externally powered prosthesis, basic concept of monofunctional and multifunctional devices.

UNIT VII: Biotelemetry

Radio-telemetry of biological signal, signal source, antenna and frequency design considerations, example of single channel FM units

REFERENCE BOOKS:

1. Walter Welkowitz and Sid Deutch, Biomedical Instruments, theory and design, Academic press 1976.
2. Guha S.K., An Introduction to Medical Electronics, Bharti Publishers, Patna.
3. Harry E. Thomas, Handbook of Biomedical Instrumentation and Measurement, Reston Publishing Company, 1974. 4. Marvin D. Weisis, Biomedical Instrumentation, Chilton Book Company, 1973.
4. Geddes L.A., Barker L.E., Principles of Applied Medical Instrumentation, John Willey and Sons, 1968.

(BTEE-504A) Power Electronics Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to

- Study working of various power electronics devices.
- verify characteristics of SCR and UJT
- plot the waveform of rectifier, inverter and converters

LIST OF EXPERIMENTS

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. Study of Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter
12. To check the performance of a McMurray half-bridge inverter

At-least ten experiments should be performed.

(BTEE-505A) Electrical: Estimation & Costing Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to:

- Understand basic electricity rules and to draw wiring diagrams.
- Estimate the cost of domestic installation and industrial installation etc.
- Estimate the cost of distribution systems of overhead and underground.
- Make wiring diagrams of motor control circuits for starting of motors.

LIST OF EXPERIMENTS

1. To study Indian electricity rules
2. To carryout wiring diagram of residential building, Educational institute and Industry.Giving selection of appropriate wiring,list materials and accessories for given project.
3. To study the design consideration of Panel Boards.
4. To study the design consideration of various electrical systems:
   a. 3 phase four wire distribution systems
   b. Earthing
5. To estimate the cost of a domestic installation (Residential building, laboratory room or Drawing hall etc) with concept of illumination design. TERI (The Energy Research Institute) recommendations on lighting schemes
6. To estimate the cost of industrial installation (Work shop, agriculture, flour mill etc).
7. To estimate the cost of overhead service connection (Single phase and three phase).
8. To estimate the cost of underground service connection (single phase and three phase).
9. To estimate the cost of overhead, 440 V, 3-phase, 4 wire or 3 wire distribution line.
10. To estimate the cost of underground, distribution line.
11. To estimate the cost of any one electrical appliance.
12. To estimate the cost of repairs and maintenance of any one domestic appliance.
13. To study various types of light sources and lighting schemes.
14. To make wiring diagrams of motor control circuits for starting of (a) 3 phase induction motor (b) Wound Motor (c)Synchronous motor

Semester-6th

(BTEE-601A) Synchronous Machines

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

Students will be able to

- Understand about the general aspects and winding terminology used in 3-ϕ synchronous machines and 1-ϕ synchronous motors.
- Analyse the various methods of voltage regulations and EMF equations of alternators.
- Memorize power-angle characteristics of synchronous machines and the working and characteristics of synchronous motors.
- Understand the concepts about parallel operation and transient conditions of alternators .

UNIT I: GENERAL ASPECTS

Construction and working principle of synchronous machines, Excitation systems, production of sinusoidal electromotive force (EMF), flux and magnetomotive force (MMF) phasors in syn. machines; cylindrical and salient pole rotors.

UNIT II : WINDINGS

Classification of windings, pitch factor, distribution factor. Electromagnetic Force equation.

UNIT III: ALTERNATORS

Construction, Phasor diagram of cylindrical rotor alternator, ratings, nature of armature reaction, determination of synchronous reactance; open-circuit characteristics, shortcircuit characteristics, short-circuit ratio, short-circuit loss. Effect of variation of power factor on voltage. Determination of voltage regulation: EMF method, MMF. method. Zero power factor (Z.P.F).method. Alternator on infinite bus bar, operation at constant load and variable excitation, power flow through inductive impedance. Power-angle characteristics of synchronous machines:- cylindrical and salient pole. Two reaction theory of salient pole machines, power factor control.

UNIT IV: SYNCHRONOUS MOTORS

Operating characteristics, power-angle characteristics, conditions for maximum power developed. V-curves and inverted V-curves, methods of starting, synchronous motors applications, synchronous condensers. Hunting and damper windings.

UNIT V: PARALLEL OPERATION OF ALTERNATORS

Conditions for proper synchronizing for single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing

UNIT VI: TRANSIENTS

Transient reactances and time constants from equivalent circuits, synchronous machine reactances and their determination, Short circuit. Oscillogram, Synchronization with the grid system, Qualitative introduction to the transient stability of the synchronous machines.

Unit VII: SINGLE PHASE SYNCHRONOUS MOTORS

Reluctance and Hysteresis motors.

REFERENCE BOOKS:

1. Bimbhra P.S., Electrical Machinery, Khanna Publishers
2. Fitzgerald A.E., Kingsley C. and Umans S.D., Electric Machinery, 6th Edition, McGraw Hill
3. Langsdorff E.H., Principles of D.C. machines, McGraw Hill 4. Nagrath I.J. and Kothari D.P., Electrical Machines, 4th Edition, Tata McGraw Hill,
4. Say M G, Alternating Current Machines, 5th edition, Sir Isaac Pitman and Sons Ltd

(BTEE-602A) Power System-I (Transmission and Distribution)

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	1	0	4

Course outcomes:

The students will be able to

- Understand the different types of DC & AC supply system and have knowledge about transmission line conductors &insulators.
- Understand Transmission line parameters and analyse performance of transmission lines.
- Learn the concept of circle diagram and line compensation
- Solve problems related with different concepts of power system

UNIT-I : SUPPLY SYSTEM

Introduction to Transmission and Distribution systems, Comparison between DC and AC systems for Transmission and Distribution, comparison of cost of conductors, choice of working voltage for transmission and distribution, economic size of conductors - Kelvin's law, Radial and mesh distribution networks, Voltage regulation.

UNIT II : CONDUCTORS AND TRANSMISSION LINE CONSTRUCTION

Conductor materials; solid, stranded, ACSR, hollow and bundle conductors. Different types of supporting structures for overhead lines. Elementary ideas about transmission line construction and erection. Stringing of conductors, spacing, sag and clearance from ground, overhead line insulators, concept of string efficiency.

UNIT III: TRANSMISSION LINE PARAMETERS: Introduction to line parameters, Resistance of transmission line, inductance of single phase two wire line, concept of G.M.D., Inductance of three phase line, Use of bundled conductor, transposition of power lines, capacitance of 1-phase and 3-phase lines. effect of earth on capacitance of conductors.

UNIT IV: PERFORMANCE OF TRANSMISSION LINES

Representation of short transmission line, medium length line (nominal T & II circuits). long length line by hyperbolic equations and equivalent T & II circuits. Power flow through transmission lines, ABCD constants, Voltage regulation.

UNIT V: CIRCLE DIAGRAM AND LINE COMPENSATION

Receiving end circle diagram for long transmission lines based on ABCD constants, equivalent T circuits, power loci, surge impedance loading, reactive power requirement of system series and shunt compensation, Synchronous phase modifiers , rating of phase modifiers.

UNIT VI: UNDERGROUND CABLES

Classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, Capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

REFERENCE BOOKS:

1. Elgerd O.L., Electrical Energy System Theory - An introduction, Tata McGraw-Hill Publication
2. Gupta B.R.,Power System Analysis & Design, Wheeler Publishing.
3. Nagrath I.J. and Kothari D.P., Power System Analysis Tata McGraw-Hill Publication
4. Stevenson Jr. W.D., Elements of Power System Analysis, Tata McGraw-Hill Publication
5. Wadhwa C.L., Course in Electrical Power, New Age International (P)Ltd.

(BTEE-611A) Electric Power Utilization

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- Understand the concepts of drives, heating, welding, traction systems, Refrigeration, Airconditioning and electrolysis.
- Develop a clear idea on various illumination techniques and hence design lighting scheme for specific applications.
- Memorize the starting and operating characteristics of different types of electric motor for various drives and an electric circuit for a domestic appliance like refrigerator.
- Apply the knowledge acquired while solving numerical problems related to illumination, heating and welding, electrolysis.

UNIT-I : Electric Drives

Electrical drives & Mechanical drives, Concept of electrical drives, Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives (AC and DC motors). Estimation of rating and heating of motors, Load equalization (Fly wheel effect), Drives for particular services.

UNIT-II : Electric Traction

Introduction to Indian railways system , Electric Locomotive Classes, Various types of Traction system, single phase feeding arrangement prevalent in India. Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations.

UNIT-III: Electric Heating and Welding

Methods of electric heating, types of electric heating, constructional details and performance of resistance heating furnace. Dielectric heating, Alternating current (AC).and Direct current (DC) Welding, Resistance and Arc Welding. Electric Beam Welding, Laser Welding. Typical construction of electrical welding AC and DC set.

UNIT IV: Illumination

Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.

UNIT V : Refrigeration and Air conditioning

Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature.

UNIT-VI : Electrolysis

Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis.

REFERENCE BOOKS :

1. Partab H., Modern Electric Traction, Dhanpat Rai
2. De N.K. and Sen P.K., Electric Drives, PHI publication
3. Berde M.S., Electric Motor Drives, Khanna Publishers
4. Gupta J.B., Utilization of Electric Power and Electric Traction, S.K. Kataria and Sons
5. Tripathy S. C., Electric Energy Utilization and Conservation, Tata McGraw Hill
6. Taylor E.O., Utilization of Electric Energy, Orient Blackswan
7. Hughes Austin, Electric Motors and Drives: Fundamentals, Types and Applications, Newnes, (2005)

(BTEE-612A) Energy Auditing and Management

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- understand the industrial utilization of various forms of energy and its management
- analyse the financial management of energy conservation proposals
- understand the material and energy balance in industrial processes.
- find the energy conservation opportunities in electrical systems
- find the energy conservation opportunities in compressed air system and refrigeration systems.

UNIT-I : Energy Scenario

Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act2001 and its features.

UNIT-II: Energy Management and Audit

Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments

UNIT-III : Material and Energy balance

Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

UNIT-IV: Financial Management

Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of energy savings companies (ESCOs).

UNIT-V : Electrical system

Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors. Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues

UNIT-VI : Compressed air system

Types of air compressors, Compressor efficiency, efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency

UNIT-VII : HighVoltage Alternating Current and Refrigeration System

Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

REFERENCE BOOKS:

1. Abbi, Y.P. and Jain, S., Handbook on Energy Audit and Environment Management, Teri Bookstore
2. Diwan, P., Energy Conservation, Pentagon Press (2008).
3. Younger, W., Handbook of Energy Audits, CRC Press (2008)
4. Sawhney and Maheshwari, Solar Energy and Energy Conservation, Prentice Hall (India)
5. Rao S. and B. B. Parulkar, Energy Technology, Khanna Publishers
6. Sukhatme S. P., Solar Energy, Tata McGraw Hill
7. David S., Hand Book of Industrial Energy Conservation, Van Nostrand Reinhold Publishing Company

(BTEE-613A) Substation Equipment and Design

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- Understand the concept of substation, fuses, circuit breakers, relays and various protection schemes for feeders, generators and transformers.
- Memorize the concept behind protection against over voltages and earthing.
- Apply the knowledge acquired while solving problems related to protection devices and are able to analyze the results.

UNIT-I : Sub-Station

Types, Main equipment in Substation, substation layout, Busbar-arrangements.

UNIT II : Isolators and Fuses

Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, applications.

UNIT III: Circuit Breakers

Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers. Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.

UNIT IV: Protective Relays

Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negative sequence relay, introduction to static and up-based relays.

UNIT-V: Protection of Generators and Transformers

Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Gas relays.

UNIT-VI: Protection against over voltage and earthing

Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber.
Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

REFERENCE BOOKS:

1. Rao S., Switchgear and Protection, Khanna Publishers
2. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., A Textbook on Power System Engineering, Dhanpat Rai and Co.
3. Wadhawa C.L. , A Course in Electrical Power, New Age international Pvt. Ltd
4. Badri Ram and Vishwakarma D.N., Power system Protection and Switchgear, Tata McGraw Hill
5. Deshpande M.V., Switchgears and Protection, Tata McGraw Hill

(BTEE-614A) Digital Control System

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

The students will be able to

- Understand the basic concept behind digital control, digital filters, models of digital control systems
- Understand the concept Z-transforms, discrete fourier transforms.
- Analyze signals in discrete time and frequency domain.

UNIT I: Introduction

Signals, Systems and Signal processing, Classification of Signals, Concept of frequency in continuous time and discrete time signals.

UNIT II: Discrete Time Signals and Systems

Discrete time signals, Discrete time systems, Analysis of discrete time linear time-invariant systems, Discrete time systems described by difference equations, Implementation of discrete system, Correlation of discrete time signals.

UNIT III: Z-Transform

The Z-transformation, properties of Z-transformation, Rational Z-transformation, Inversion of Z-transform, Analysis of linear time invariant systems in Z domain

UNIT IV: Frequency Analysis of Signals and Systems

Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier Transform for discrete time signals, Frequency domain characteristics of linear time invariant systems, linear invariant systems as frequency selective filters, Inverse systems and de-convolution.

UNIT V: The Discrete Fourier Transform

Frequency domain sampling, Properties of Discrete Fourier Transform (DFT), Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-VI : Design of Digital Filters:

Structure of filters,General considerations, Design of Finite Impulse Response (FIR) filters, Design of Infinite Impulse Response (IIR) filters from analog filters, Frequency transformations, Design of digital filters based on least-square method and window method, Comparison of IIR and FIR filters.

REFERENCE BOOKS:

1. Oppenheim A.V. and Schafer, R.W., *Digital Signal Processing,* Prentice Hall (India)
2. Kuo, Sen-Maw and Gan, Woon-Seng, *Digital Signal Processing architectures, Implementations, and Applications* McGraw Hill
3. Proakais John G., Digital Signal *Processing: Principles, Algorithms, and Applications*, Pearson Education 4th Ed. (2007)
4. Richard G Lyons, *Understanding Digital Signal Processing,* Pearson Education Publications.
5. Mitra K. Sanjit, *Digital Signal Processing*, 3rd ed. Tata McGraw Hill
6. Hayes Mansen, Schaum's *Outline of Digital Signal Processing*, Tata MGraw Hill, (2001)

(BTEE-615A) **Energy Efficient Machines**

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- Understand the major issues related to energy management system and energy audits.
- Understand the appropriate induction motor for given applications.
- Learn the concept of power factor and efficiency parameters of energy efficient motors.
- Solve numerical problems related with the power factor and other concepts related with energy efficient machines.

UNIT I: Introduction

Need for Energy efficient machines, energy cost and two part tariff, energy conservation in industries and agricultural sector -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.

UNIT-II: Energy Efficient Motors

Standard motor efficiency, energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labeling, energy efficient motor standards.

UNIT-III: Power Factor

The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor

UNIT-IV: Application Of Electric Motors

Varying duty applications, Voltage variation, Voltage Unbalance, over motoring, Poly-phase induction motors supplied by adjustable frequency power supplies.

UNIT-V : Induction Motors and Adjustable Drive Systems

Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.

UNIT-VI: Economics Of Energy Efficient Motors And Systems

Motor life cycle, Direct Savings and pay back analysis, efficiency evaluation factor, present worth method with constant power costs, present worth method with increasing power costs, net present worth method.

REFERENCE BOOKS:

1. Andreas John C., Energy efficient electric motors, Marcel Dekker Inc. 1992.
2. Thuman Albert, Introduction to Efficient Electric System Design, The Fairmount Press Prentice Hall.
3. Tripathi S.C. , Electric Energy Utilization and Conservation, Tata McGraw-Hill 1991.
4. Belove Charles, Handbook of Modem Electronics and Electrical Engineering, John Wiley and Sons

(BTEE-616A) Virtual Instrumentation

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT-I : Introduction

Virtual Instrumentation - Definition, flexibility, Block diagram and Architecture of Virtual Instruments, Virtual Instruments versus Traditional Instruments, Review of LABVIEW software in virtual Instrumentation and programming techniques

UNIT-II : Data Acquisition In Virtual Instrumentation

Analog-to-Digital, Digital-to-Analog converters, plug-in Analog input/output cards, Digital Input/ Output cards, Organization of the Data acquisition (DAQ)-VI system, Opto-isolation, Performing analog input and analog output, Scanning multiple analog channels, Issues involved in selection of data acquisition cards, Data acquisition modules with serial communication.

UNIT-III : Communication Networked Modules

Introduction to Personal Computer (PC) Busses, Local busses: Industry Standard Architecture (ISA), Peripheral Component Interconnect (PCI), RS232, RS422, RS485, Interface Busses, Universal Serial Bus (USB), Personal Computer Memory Card International Association (PCMCIA), Virtualization eXperience Infrastructure (VXI), Signal Conditioning eXtensions for Instrumentation (SCXI), PCI eXtensions for Instrumentation (PXI). Instrumentation Buses: Modbus, General Purpose Interface Bus (GPIB) Networked busses, ISO (International Organization for Standardization)/OSI (Open Systems Interconnection) Reference model, Ethernet TCP (Transmission Control Protocol)/ IP (Internet Protocol) protocols

UNIT-IV : Real Time Control in Virtual Instrumentation and Applications

Design of ON/OFF controller, simulation of industrial instruments and systems, Virtual Instrumentation functions and objects including signal processing and analysis. Typical instruments and systems -digital storage oscilloscope, spectrum analyzer, waveform generator, Data visualization from multiple locations; Distributed monitoring and control devices

REFERENCE BOOKS

1. Wells L. K. and Travis J., Labview for everyone, Prentice Hall
2. Gupta S. and Gupta J.P., PC interfacing for data acquisition and process control, ISA
3. Rahman Jamal and Herbert Picklik, Labview — Applications and solutions, National Instruments Release
4. Gary Jhonson, Labview Graphical programming, McGraw Hill

(BTEE-617A) Flexible AC Transmission System Devices

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- understand the necessity of FACT devices for power transmission control
- understand the fundamentals and principles of series and shunt compensation and their applications in reactive power control.
- To understand the principle of operation of phase shifter and unified power flow controller (UPFC).
- To understand about the losses and maximum power flow.

UNIT-I : Power Transmission control

Fundamental of alternating current (AC) power transmission, transmission problems and needs, the emergence of Flexible Alternating Current Transmission Systems (FACTS), FACTS controller and consideration. Uncompensated transmission lines and compensated transmission lines

UNIT-II: Shunt Compensation

Principle, configuration, control and applications of Shunt Static Var Compensator (SVC) and Static Synchronous compensator (STATCOM).

UNIT-III : Series Compensation

Fundamental of series compensation, principle of operation, Application of Thyristor Controlled Series Capacitor (TCSC) for different problems of power system, TCSC layout, Static Synchronous Series Compensator (SSSC): principle of operation.

UNIT-IV: Phase Shifter

Principle of operation, steady state model of static phase shifter (SPS), operating characteristics of SPS, power current configuration of SPS application.

UNIT-V : Unified Power Flow Controllers (UPFC)

Basic operating principles and characteristics, control UPFC installation applications, UPFC model for power flow studies.

UNIT-VI : Reactive Power Control

Introduction, reactive power requirements in steady state, sources of reactive power, static var systems, reactive power control during transients. Harmonics and filters: Introduction, generation of harmonics, design of AC filters, DC filters, carrier frequency and RI noise.

UNIT-VII : Transmission line steady State Operation:

Lossless Transmission lines, Maximum Power Flow, Line load ability, reactive compensation techniques. Congestion management on transmission lines using FACT devices.

REFERENCE BOOKS:

1. Ghosh,A. and Ledwich,G., Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publishers (2005).
2. Hingorani, N.G. and Gyragyi,L., Understanding FACTS :Concepts and Technology of Flexible AC Transmission System, Standard Publishers and Distributors (2005).
3. Sang, Y.H. and John, A.T.,
4. Flexible AC Transmission Systems, IEEE Press (2006).
5. K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publisher, 2007.
6. Miller T.J.E., Reactive Power Control in Electric Systems, John Wiley.

(BTEE-618A) Non-conventional Energy Sources

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

The students will be able to

- understand need of alternate energy source and limitation of conventional energy sources.
- memorize the concept of MHD generation, Thermo-electric generation, Photovoltaic effect, Solar energy, fuel cells and miscellaneous sources
- solve numerical problems related with MHD generation

UNIT I: Introduction

Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.

UNIT II: Mhd Generators

Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.

UNIT III : Thermo-Electric Generators

Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.

UNIT IV: Photovoltaic Effect And Solar Energy

Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.

UNIT V : Fuel Cells

Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application.

UNIT-VI: Miscellaneous Sources

Geothermal system, hydro-electric plants, wind power, tidal energy, Bio-mass energy

REFERENCE BOOKS:

1. Gupta B. R., Generation of Electrical Energy, S. Chand.
2. Rai, G.D., Non Conventional Energy Sources, Khanna Publishers (2005).
3. Rao, S. and Parulekar, B.B., Energy Technology: Non Conventional, Renewable and Conventional, Khanna Publishers (2005).
4. Wadhwa, C.L., Generation, Distribution and Utilization of Electric Energy, New Age International (P) Limited, Publishers (2007).
5. Simon , Christopher A., Alternate Source of Energy, Rowman and LittleField Publishers Inc.(2007).
6. Venikov, V.A. and Putyain, E.V., Introduction to Energy Technology, Mir Publishers (1990)

(BTEE-621A) Industrial Measurements

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Industrial Control Fundamentals

Introduction to Feed forward control, Cascade Control , Multiple loop control, Adaptive Control.

UNIT II : Basic Control Algorithms:

Lag calculation, Lead/Leg calculation, PID controller calculation, Dead time calculation.

UNIT III: Electronic Process Controllers

Analog Electronic Process Controller, temperature controller using an analog electronic controller, Computer Control Strategy.

UNIT IV: Programmable Logic Controllers

Introduction ,History of PLC's, Programming units , Introduction to programming languages, PLC's Ladder diagram principles ,Simple introductory programs using ladder diagram ,Advantages of PLC's, Economy of PLC's .

REFERENCE BOOKS:

1. "Digital Control of Dynamic Systems" Franklin , G.F. and J.D. Powell, Addison-Wesley, Reading Massachusetts.
2. " Process/ Industrial instruments and controls Handbook" D.M. Considine ; McGraw Hill.
3. "Control Engg." ,Noel M. Morris, McGraw Hill

(BTEE-622A) Optimization Techniques

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

Engineering applications of optimization, Design variables, costraints, objective function, variable bounds, statement and formulation of an optimization problem, Examples of Chemical Engg. Optimization problems, classification of optimization problems, different optimization algorithms.

UNIT II : Optimal Point

Local optimal point, global optimal point and inflection point.

UNIT III : Single Variable Optimization Techniques

Optimality criterion. Bracketing method (Bounding Phase Method). Region elimation methods (Internal halving method, Golden section search method). - Point estimation method (successive quadratic estimation methods). - Gradient-based methods (Newton-Raphson method, Bisection method, Secant, Cubic search method). - Root finding using optimization techniques.

UNIT IV : Multivariable Optimization Techniques

Optimality criterion - Unidirectional search method - Direct Search method(Hooke-Jeeves Pattern Search method, Powell's conjugate direction method) - Gradient-based methods(Steepest descent method, Newton's method, Marquardi's methods)

UNIT V: Construined Optimization Algorithms

Kuhn-Tucker conditions. - Transformation method (Penalty function method) - Direct Search for constrained minimization(variable elimination method, complex search method)

UNIT VI : Linear Programming

Linear programming problems, Simplex method of linear programming technique.

REFERENCE BOOKS:

1. Engg. Optimization by S.S.Rao (New Age).
2. Optimization of Chemical Processes by T.I. Edgar & D.M/ Himmalblau (McGraw Hill).
3. Process Optimization with Applications to Metallurgy & Chemical Engg. by Ray & Szekely (Wiley).
4. Optimization: Theory & Practice by Beveridge & Schecter, (McGraw Hill).
5. Numerical Methods in Engg. & Sc. by B.S. Grewal (Khanna Publishers)

(BTEE-623A) Software Engineering

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

Engineering applications of optimization, Design variables, constraints, objective function, variable bounds, statement and formulation of an optimization problem, Examples of Chemical Engg. Optimization problems, classification of optimization problems, different optimization algorithms.

UNIT II : Optimal Point

Local optimal point, global optimal point and inflection point.

UNIT III: Single Variable Optimization Techniques

Optimality criterion. Bracketing method (Bounding Phase Method).Region elimation methods (Internal halving method, Golden section search method). - Point estimation method (successive quadratic estimation methods). - Gradient-based methods (Newton-Raphson method, Bisection method, Secant, Cubic search method). - Root finding using optimization techniques.

UNIT IV: Multivariable Optimization Techniques

Optimality criterion - Unidirectional search method - Direct Search method(Hooke-Jeeves Pattern Search method, Powell's conjugate direction method) - Gradient-based methods(Steepest descent method, Newton's method, Marquardi's methods)

UNIT V: Constrained Optimization Algorithms

Kuhn-Tuckerconditions. - Transformation method (Penalty function method) - Direct Search for constrained minimization(variable elimination method, complex search method)

UNIT VI : Linear Programming

Linear programming problems, Simplex method of linear programming technique.

REFERENCE BOOKS:

1. Engg. Optimization by S.S.Rao (New Age).
2. Optimization of Chemical Processes by T.I. Edgar & D.M/ Himmalblau (McGraw Hill).
3. Process Optimization with Applications to Metallurgy & Chemical Engg. by Ray & Szekely (Wiley).
4. Optimization: Theory & Practice by Beveridge & Schecter, (McGraw Hill).
5. Numerical Methods in Engg. & Sc. by B.S. Grewal (Khanna Publishers)

(BTEE-603A) Electrical Machines -II Laboratory

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course outcomes:

Students will be able to

- perform different tests on 3-ϕ Induction motors to obtain equivalent circuit parameters.
- understand speed control of three-phase Induction motor by different methods
- perform and analyse voltage regulation of an alternator by different tests.
- perform no-load and blocked–rotor test on single-phase and three- phase Induction motor

LIST OF EXPERIMENTS

1. To perform load-test on three-phase Induction motor and to plot torque versus speed characteristics.
2. To perform no-load and blocked–rotor tests on three-phase Induction motor to obtain equivalent circuit. Parameters and to draw circle diagram.
3. To study the speed control of three-phase Induction motor by Kramer's Concept.
4. To study the speed control of three-phase Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
5. To study star- delta starters physically and a) to draw electrical connection diagram b) to start the three-phase Induction motor using it. c) to reverse the direction of three-phase Induction motor
6. To start a three-phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And to plot torque –speed characteristics.
7. To perform no-load and blocked–rotor test on single-phase Induction motor and to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.
8. To perform load –test on single-phase. Induction motor and plot torque –speed characteristics.
9. To perform no load and short circuit. Test on three-phase alternator and draw open and short circuit characteristics.
10. To find voltage regulation of an alternator by zero power factor (ZPF.) method.
11. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw Voltage and inverted Voltage curves of motor.
12. To measure negative sequence and zero sequence reactance of Synchronous Machines.
13. Parallel operation of three phase alternators using • Dark lamp method • Two-Bright and one dark lamp method
14. To study synchroscope physically and parallel operation of three-phase alternators using synchroscope.
15. Starting of synchronous motors using • Auxiliary motor • Using Damper windings.

(BTEE-604A) Programming in MATLAB

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

To solve minimum ten problems related with Control System, Power Electronics and Power System using MATLAB software.

Semester-7th

(BTEE-701A) Non-linear and Digital Control System

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will able to

- Understand the basic concepts and functions of non-linear digital control system like describing function methods, role of controllability and observability and state variable models.
- Understand and analyze singular points and phase plane techniques like delta method and limit cycles.
- Analyze stability analysis of systems using Lyapunov's theory, Krasovskii's Method , Jury's test of stability and extension of Routh-Hurwitz criterion to discrete time systems.
- Understand linear and non linear state equations and to evaluate the sampled data systems using Z transform and Pulse transfer function.

UNIT I: State Variable Techniques

State variable representation of systems by various methods, solution of state variable model. Controllability and observability.

UNIT II: Phase Plane Analysis

Singular points, Method of isoclines, delta method , phase portrait of second order nonlinear systems, limit cycle.

UNIT III: Describing Function Analysis

Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hystersis, dead zone, saturation, coulomb friction and backlash.

UNIT IV: Lyapunov's Stability Method

Lyapunov's direct method, generation of Lyapunov's function, by Krasovskii's and Variable Gradient methods.

UNIT V : Sampled Data Systems

Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold. Ztransform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, State variable formulation of discrete time systems,solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

REFERENCE BOOKS:

1. Ogata K., Modern control engineering. Prentice Hall (India)
2. Nagrath I.J., Gopal M., Control system engineering, New Age Publications
3. Hsu J.C. and Meyer A.U., Modern control principles and application
4. Gopal M., Digital Control and State Variable Methods, Tata McGraw Hill
5. Kuo B.C. and Golnaraghi F., Automatic Control System, Wiley Publications
6. Dorf R.V. and Bishop R.H., Modern Control Systems, Adison Wesley

(BTEE-702A) Power System-II (Switch Gear and Protection)

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will be able to

- Understand the concept of substation, fuses, circuit breakers, relays and various protection schemes for feeders, generators and transformers.
- Memorize the concept behind protection against over voltages and earthing.
- Apply the knowledge acquired while solving problems related to protection devices and are able to analyze the results.
- Distinguish between various protection schemes available for feeders, generators and transformers.
- Develop layout of a substation and to draw different protection circuits for protection of feeders, generators and transformers.

UNIT-I: Sub-Station

Types, Main equipment in Substation, substation layout, Busbar-arrangements.

UNIT-II: Isolators and Fuses

Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, applications.

UNIT-III : Circuit Breakers

Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers. Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.

UNIT IV: Protective Relays

Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negative sequence relay, introduction to static and up-based relays.

UNIT V: Protection of Feeders

Time graded protection, Differential and Distance protection of feeders, choice between Impedance, Reactance and Mho relays, Elementary idea about carrier current protection of lines.

UNIT VI: Protection of Generators and Transformers

Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Gas relays.

UNIT VII: Protection against over voltage and earthing

Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

REFERENCE BOOKS:

- Rao S., Switchgear and Protection, Khanna Publishers
- Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., A Textbook on Power System Engineering, Dhanpat Rai and Co.
- Wadhawa C.L. , A Course in Electrical Power, New Age international Pvt. Ltd
- Badri Ram and Vishwakarma D.N., Power system Protection and Switchgear, Tata McGraw Hill
- Deshpande M.V., Switchgears and Protection, Tata McGraw Hill

(BTEE-711A) System Engineering and Reliability

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Basic concepts

Concept of system engineering, Generalized Principles of modelling, factors in modelling, some examples.

System Programming

Linear programming, dynamic programming, cost flow and routing problems. critical path scheduling.

System Reliability

Importance of reliability, reliability functions. causes of failure, modes of failure, failure rate, mortality curve, MTTF, repair rate, MTBF, Availability, uptime, down time, failure frequency, failure distributions, reliability modes statistical, structural, Markov and fault tree, Reliability, evaluation using various models, redundancy techniques, reliability allocation and optimization, basic principles of maintainability, availability and security.

REFERENCE BOOKS:

1. Optimization and problems in system Engineering J.G. Rau.
2. Introduction to dynamic and control R.J. Richards.
3. Optimization Techniques S.S. Rao.
4. Reliability Engineering E. Balagurusamy.
5. Reliability Engineering A.K. Govil.

(BTEE-712A) Digital Signal Processing

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

Signals, Systems and Signal processing, Classification of Signals, Concept of frequency in continuous time and discrete time signals.

UNIT II: Discrete Time Signals and Systems

Discrete time signals, Discrete time systems, Analysis of discrete time linear time-invariant systems, Discrete time systems described by difference equations, Implementation of discrete system, Correlation of discrete time signals.

UNIT III : Z-Transform

The Z-transformation, properties of Z-transformation, Rational Z-transformation, Inversion of Z-transform, Analysis of linear time invariant systems in Z domain.

UNIT IV: Frequency Analysis of Signals and Systems

Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier Transform for discrete time signals, Frequency domain characteristics of linear time invariant systems, linear invariant systems as frequency selective filters, Inverse systems and de-convolution.

UNIT V : The Discrete Fourier Transform

Frequency domain sampling, Properties of Discrete Fourier Transform (DFT), Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT VI : Design of Digital Filters

General considerations, Design of Finite Impulse Response (FIR) filters, Design of Infinite Impulse Response (IIR) filters from analog filters, Frequency transformations, Design of digital filters based on least-square method and window method, Comparison of IIR and FIR filters.

REFERENCE BOOKS*:*

1. Oppenheim A.V. and Schafer, R.W., Digital Signal Processing, Prentice Hall (India)
2. Kuo, Sen-Maw and Gan, Woon-Seng, Digital Signal Processing architectures, Implementations, and Applications McGraw Hill
3. Proakais John G., Digital Signal Processing: Principles, Algorithms, and Applications, Pearson Education 4th Ed. (2007)
4. Richard G Lyons, Understanding Digital Signal Processing, Pearson Education Publications.
5. Mitra K. Sanjit, Digital Signal Processing, 3rd ed. Tata McGraw Hill
6. Hayes Mansen, Schaum's Outline of Digital Signal Processing, Tata MGraw Hill, (2001)

(BTEE-713A) EHVAC Transmission

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course outcomes:

Students will able to

- Understand the basic concepts about EHV and HVDC transmission and also about the effect of high voltage on losses.
- Understand the concepts of generation of high voltage and Test procedures in high voltage.
- Memorize the characteristics of insulating materials used in power transformers, rotating machines, circuit breakers, cables and power capacitors.
- Analyze the Conduction and breakdown in solids, liquids and gases and also analyse Townsend's current growth equations.

UNIT I: E.H.V. Transmission and Corona Loss

Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.

UNIT II : HVDC Transmission

Advantages, disadvantages and economics of HVDC Transmission system. Types of D.C. links, converter station equipment, their characteristics.

UNIT III : Insulating materials used in H..V. Engg.

Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.

UNIT IV : Conduction and breakdown in Gases, Liquids & Solid Dielectrics

Solids - Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice. Liquids:- Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice. Gases:- Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.

UNIT V : Generation of High Voltages

D.C., A.C. (Power frequency and High frequency) Impulse voltage and impulse current Generation Tripping and contact of Impulse Generator

UNIT VI : Test procedures in H.V. Engg

Lab. Testing of cables, insulators, bushings, circuit breakers and transformers.

REFERENCE BOOKS:

1. E.H.V. A.C. Transmission Engg. By Rakesh Das Bagamudre, New Age International Publishers.
2. HVDC Transmission by Kimbark.
3. H.V. Engg. By Kamaraju and Naidu.
4. H.V. Engg. By R.S. Jha.
5. H.V. Engg, by Kuffel & Abdullah.
6. H. V. Engg. by C. L. Wadhwa.

(BTEE-721A) Entrepreneurship

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: Concept of Entrepreneurship

Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality, characteristics of entrepreneurship.

UNIT II: Identification of Investment Opportunities

Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, monopolies and restrictive trade practices act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start a SSI, list of items reserved for SSI. Scouting for project ideas, preliminary screening, project identification for an existing company.

UNIT III: Market and Demand Analysis

Information required for market and demand analysis, market survey, demand forecasting, uncertainties in demand forecasting.

UNIT IV: Technical Analysis

Materials and inputs, production technology, product mix, plant capacity, location and site, machinery and equipment, structures and civil works, need for considering alternatives.

UNIT V: Cost of project and means of financing

Cost of project, means of financing, planning the capital structure of a new company, term loan, financial institutions, cost of production.

UNIT VI : Financial Management

Concept and definition of financial management, types of capital, source of finance, reserves and surplus, assets and liabilities, profit and loss statement, balance sheet, depreciation, methods of calculating depreciation, break-even analysis and charts.

UNIT VII: Marketing Management

Marketing mix, strategies; product, place, price and promotion (four P's), market segmentation, product policies; types of product, product mix, packaging, branding, promotion; advertising, advertising media, personal selling, sales promotion, distribution channels.

UNIT VIII: Company laws

The basic principles of company laws, formation of company, choice of name, memorandum of association, articles of associations, registration and incorporation, alteration of object clause, situation clause, name clause and articles, kinds of companies, board meetings, power of board and delegation of powers, general meetings; postponement and adjournment and quorum for general meetings, revocation of proxy, kinds of general meetings.

REFERENCE BOOKS:

1. Entrepreneurship of Small Scale Industries Deshpande, M.D.
2. Marketing Management Kotler Philip
3. Dynamics of Industrial Entrepreneurship Hadimoni, R.N

(BTEE-722A) Introduction to Business Systems

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Concept of Entrepreneurship

Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality, characteristics of entrepreneurship.

UNIT II: Identification of Investment Opportunities

Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, monopolies and restrictive trade practices act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start a SSI, list of items reserved for SSI. Scouting for project ideas, preliminary screening, project identification for an existing company.

UNIT III : Market and Demand Analysis

Information required for market and demand analysis, market survey, demand forecasting, uncertainties in demand forecasting.

UNIT IV: Technical Analysis

Materials and inputs ,production technology, product mix, plant capacity, location and site, machinery and equipment, structures and civil works, need for considering alternatives.

UNIT V : Cost of project and means of financing

Cost of project, means of financing, planning the capital structure of a new company, term loan, financial institutions, cost of production.

UNIT VI: Financial Management

Concept and definition of financial management, types of capital, source of finance, reserves and surplus, assets and liabilities, profit and loss statement, balance sheet, depreciation, methods of calculating depreciation, break-even analysis and charts.

UNIT VII : Marketing Management

Marketing mix, strategies; product, place, price and promotion (four p's), marketsegmentation, product policies; types of product, product mix, packaging, branding, promotion; advertising, advertising media, personal selling, sales promotion, distribution channels.

UNIT VIII : Company laws

The basic principles of company laws, formation of company, choice of name, memorandum of association, articles of associations, registration and incorporation, alteration of object clause, situation clause, name clause and articles, kinds of companies, board meetings, power of board and delegation of powers, general meetings; postponement and adjournment and quorum for general meetings, revocation of proxy, kinds of general meetings.

REFERENCE BOOKS

1. Entrepreneurship of Small Scale Industries Deshpande, M.D.
2. Marketing Management Kotler Philip
3. Dynamics of Industrial Entrepreneurship Hadimoni, R.N

(BTEE-723A) Photovoltaic Technology

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

A review of energy, thermodynamic, and electrical quantities and units, The solar spectrum, blackbody radiation, direct and diffuse irradiance, modeling cloud cover, the projection effect, and computing the optimal tilt angle of a solar panel

UNIT-II : PV System

PV physics, band structure and Fermi level in semiconductors, pn-junctions, diode models, photon interactions with semiconductors. PV cell architecture and fabrication steps, Computing PV cell power, equivalent circuit models, short- and open-circuit properties, fill factor, and parasitic resistances. PV cell external and internal quantum efficiency, and computing the spectral response.

UNIT III: Characteristics of PV system

Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses.Solar PV power plants.

UNIT IV: Photovoltaic System Engineering

Thermo-photovoltaic generation of electricity, Concentration and storage of electrical energy, photovoltaic modules, system and application.

REFERENCE BOOKS:

1. Honsberg, C., and S. Bowden. Photovoltaics: Devices,Systems and Applications
2. Rai, G.D., Non Conventional Energy Sources, Khanna Publishers (2005).

BTEE-724A Data Communications

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

Basic Concepts of analog and digital signals, data transmission concepts, Analog and digital transmission, transmission impairments.

UNIT II:Transmission Media

Guided and Un-guided media, Performance, Shannon Capacity, Media Computerisation.

UNIT III:Encoding And Modulating

Digital –to-Digital conversion, Analog and digital conversion, Digital to Analog conversion , Analog to Analog conversion.

UNIT IV: Digital Data Communication

Digital data transmission , DTE-DCE Interface, EIA-449,EIA-530,X.21, Modems, Cable Modems.

UNIT V: Multiplexing And Switching

FDM, WDM,TD, Multiplexing application- telephone systems, DSL, Par Circuit switching , Packet Switching & Message switching virtual circuits..

UNIT VI: Spread Spectrum

Concept ,Frequency hoping spread spectrum ,direct sequence spread spectrum, codedivision Multiple Access

UNIT VII: Error Detection And Correction

Types of Errors ,Detection ,VRC,LRC,CRC, Checksum, Error Correction.

UNIT-VIII: Protocol Architecture

Protocols, Standards,OSI,TCP/IP Protocol Architecture.

REFERENCE BOOKS*:*

1. “Data Communications and Networking”–Behrouz A Ferouzan- 2nd Edition, TATA McGraw Hill.

2. “Data and Computer Communication” – William Stallings 7th Edition Pearson Eduction.

(BTEE-703A) **Project I**

Mid Sem	End Sem	MM	L	T	P	C
120	80	200	0	0	6	6

Project based on software should be done under the guidance of supervisor.

(BTEE-704A) Software Lab

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Electrical Engineering related problems should be solved using ETAP/MATLAB/FORTRAN/PLC

(BTEE-705A) **Power System-II Lab**

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

Students will be able to

- Understand practical measurement of electrical parameters of a 3-phase transmission line.
- Verify the characteristics of different type's relays, MCB and fuses.
- Develop hands-on experience of finding breakdown strength of transformer oil and earth resistance can be calculated
- Analyze different types of faults occurring in 3- phase transmission line

LIST OF EXPERIMENTS

1. To study the performance of a transmission line. Also compute its ABCD parameters.

2. Study of Characteristics of over current and earth fault protection.

3. To study the operating characteristics of fuse. (HRC or open type)

4. To find the earth resistance using three spikes .

5. To study over current static relay.

6. To study the different types of faults on transmission line demostration panel/model.

7. To study the radial feeder performance when a. Fed at one end b. Fed at both ends

8. To study the performance of under voltage and over voltage relay.

9. To study the characteristics of bimetal mini circuit breakers.

10. To study the characteristics of Distance Relay.

11. To find the breakdown strength of transformer oil.

Semester-8th

(BTEE-801A) Power System Analysis And Design

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course Outcomes:

Students will be able to:

- Formulate impedance and admittance matrices, model various power system networks and understand per unit system
- Perform load flow computations and analyze the load flow results
- Create computational models for analysis of both symmetrical and unsymmetrical conditions in power systems
- understand the basic concept of power system stability, and also able to analyse and control the power system stability problems

UNIT I : System Modelling

System modelling of synchronous machines, transformers, loads etc, per unit system, single line diagram of electrical networks, single phase impedance diagrams. Formulation of impedance and admittance matrices for the electrical networks.

UNIT II: Load Flow Studies

Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal method and Newton Raphson Method.

UNIT III: Fault Analysis

Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical Line-to-ground (LG), Line-to line (LL), double line to ground (LLG) faults using symmetrical components.

UNIT IV : Power System Stability

Steady state stability, Dynamics of a synchronous machine , Power angle equations , Transient stability, equal area criterion, Numerical solution of swing equation , factors effecting transient stability.

REFERENCE BOOKS:

1. Elgerd O.I., Electric Energy Systems Theory, Tata McGraw Hill
2. Nagrath I.J., Kolthari D.P., Modern Power System Analysis, Tata McGraw Hill
3. Stevenson W.D., Elements of Power System Analysis, McGraw Hill
4. Nagrath I.J. and Kothari D.P., Power System Engineering, Tata McGraw Hill
5. Arrillaga J. and Arnold C.P., Computer Analysis of Power Systems, John Wiley & Sons
6. Stagg Glenn W. and Ei-Abiad Ahmed H., Computer Methods in Power System Analysis, Tata McGraw Hill
7. Kusic G.L., Computer Aided Power System analysis, Prentice Hall, India

(BTEE-802A) High Voltage Engineering

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

Course Outcomes:

Students will be able to:

- knowledge about HV Engineering .
- understand the concept of travelling waves and lightening in power system.
- Testing of electrical apparatus.

UNIT I: INTRODUCTION

Power Systems Development and High Voltage Engineering; Contents of High Voltage Engineering; Applications of High Voltage Technology.

UNIT II: TRAVELING WAVES

Transient and traveling waves; Effects of Line Terminations; Junction of several lines; Bewley Lattice Diagram; Traveling wave in transformer and generator.

UNIT III: LIGHTNING IN POWER SYSTEMS

Lightning formation; Lightning overvoltages (strike and back flashover) in power systems; Lightning overvoltages protection devices in power systems; Lightning protection system of high buildings.

UNIT IV: SWITCHING OVER VOLTAGES

Types of internal overvoltages; The importance of switching overvoltages; Causes of various internal overvoltages; Control of switching overvoltages; EMTP and its applications.

UNIT V: ARRESTERS AND INSULATION COORDINATION

Surge arresters (MOA) and its performances; Voltage-Time Characteristics and coordination; Surge arresters selection and location in power systems; Principles of insulation coordination; Statistical and conventional insulation coordination.

UNIT VI: HIGH VOLTAGE TEST OF ELECTRICAL APPARATUS

Nondestructive insulation testing; Destructive insulation testing: AC, DC, and Impulse testing of apparatus; New high voltage measurement technology; Safety in high voltage lab. Applications of high voltages technology in other area.

REFERENCE BOOKS:

1. Khalifa M., High-Voltage Engineering, Theory and Practice, Marcel Dekker, Inc.
2.Ryan H.M., High Voltage Engineering and Testing, IEE Press.
3.Gonen T., Electric Power Distribution System Engineering: Analysis and Design, McGraw Hill

(BTEE-811A) Electrical Machine Design

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT-I: General

ISI specifications for conductors, Transformer, transformer oil and induction motors. Standard specifications for rotating electrical machinery as per IEC publications.Temperature Rise Calculations and Measurement Sources and position of heat generation, Solid body heating, Heating and cooling processes. Calculation of steady temperature rise of induction motor armature and transformer core. Machine ratings based on thermal considerations. Typical temperature gradients in transformers and three phase induction motors. Methods of measuring temperature in Electrical machines.

UNIT-II : Ventilation

Methods of cooling transformer. design of tank. Types of ventilation methods of cooling 3-phase induction motors, cooling circuits and type of enclosures. Quantity of cooling medium, Air,Hydrogen, water and Oil.

UNIT III: Magnetic Circuits:

Magnetic circuits of transformers and three phase induction motor. Specific slot permeance and slot leakage reactance of a three phase induction motor leakage reactance of cylindrical coils and equal length and sandwich coils of equal width in a transformer. Variation in magnetic losses with changes with changes in supply voltage frequency of a transformer.

UNIT-IV:Electric Circuits:

Types of low voltage and high voltage winding transformer. Calculation of resultant mechanical forces in transformer under normal and abnormal conditions. Characteristics of an armature windings. Types of windings used for induction motors, winding factors.

UNIT-V: Transformers

Design of single phase and three phase core type poser and distribution transformers, single phase shell type transformer, Magnetic and electric circuit, leakage reactance, regulation, no load current, cooling system, overall dimensions and weight. Recent advances in design of transformer.

UNIT VI: Induction Motors

Design of squirrel cage and wound rotor type of three phase induction motors. Stator and its winding, slot and its insulation, squirrel cage and slip ring rotors, no load current, short circuit current, efficiency, circle diagram, Stator temperature rise, weight. Recent advances in the design of induction motors.

REFERENCE BOOKS:

1. A Course in Electrical Machine Design A. K. Sawhney, Dhanpat Rai.
2. Principles of Electrical Machine Design, R. K. Aggarwal, S. K. Kataria & Sons.

(BTEE-812A) HVDC Transmission

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I: OVERVIEW

Comparison of EHV AC and DC transmission, description of DC transmission systems, modern trends in AC and DC transmission.

UNIT II: STATIC VAR SYSTEM

Reactive VAR requirements, Static VAR systems, SVC in power systems, design concepts and analysis for system dynamic performance, voltage support, damping and reactive support.

UNIT III: HVDC SYSTEM

Converter configurations and their characteristics, DC link control, converter control characteristics; Monopolar operation, converter with and without overlap, smoothing reactors, transients in DC line, converter faults and protection, HVDC Breakers.

UNIT IV: CORONA AND INTERFERENCE

Corona and corona loss due to EHV AC and HVDC, Radio and TV interference due to EHV AC and HVDC systems, methods to reduce noise, radio and TV interference.

UNIT V: HARMONIC FILTERS

Generation of harmonics, design of AC filters, DC filters.

UNIT VI: POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Component models, solution of DC load flow, per unit system for DC quantities, solution techniques of AC-DC power flow equations, Parallel operation of HVDC/AC systems, Multi terminal systems.

Suggested Readings/Books :

1. Padiyar K.R., HVDC Power Transmission Systems, Wiley Eastern Ltd., New Delhi.
2. Kimbark E., Direct Current Transmission, Vol-I, John-Wiley and sons, NY
3. Arrillaga J., HVDC Transmission, IEE Press, London.
4.Begamudre R.D., EHV AC Transmission Engineering, Wiley Eastern Press.
5. Arrillaga J. and Smith B.C., AC-DC Power System Analysis, IEE Press, London

(BTEE-813A) Fuzzy Logics And Systems

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT I : Introduction

Grip sets and fuzzy sets, properties of x-cuts, Representation of Fuzzy sets.

UNIT-II : Operations on Fuzzy sets

Types of operations, Fuzzy complements, intersections and unions.

UNIT-III : Fuzzy Arithmetic

Grip versus Fuzzy Relations, binary fuzzy relations, Fuzzy Equivalence. Compatibility and ordering relations, Fuzzy Morphisms, Fuzzy relation Equations and Approximate solutions.

UNIT-IV : Fuzzy Logic

Multi-valued Logics, Fuzzy propositions, Fuzzy Quantifier, Linguistic Hedges.

UNIT-V: Fuzzy Systems Controllers

An overview and example, Fuzzy dynamic systems, Pattern Recognition, Fuzzy data bases and information, Retrieval Systems.

REFERENCE BOOKS:

1. Fuzzy Sets and Fuzzy Logic : Theory and Applications by G. J. Klir and B. Yuan, PHI.

2. Fuzzy Logic with Engineering Applications, Timothy Ross(Mc-Graw Hill)

(BTEE-814A) Neural Networks

Mid Sem	End Sem	MM	L	T	P	C
40	60	100	3	0	0	3

UNIT-I

Neural Networks characteristics, History of development, Neural Networks Principles, Artificial Neural Net terminology, Model of a neuron, Topology Learning: types of learning, Supervised, unsupervised, re-inforcement learning. Basic Hopfield Model, the perceptron, linear separability,

UNIT-II

Basic learning Laws : Hebb's rule, Delta rule, Widrow & Hoff LMS learning rule, correlation learning rule, instar and outstar learning rules. Unsupervised learning, competitive learning, K-means clustering algorithms, Kohonen's feature maps. Radial Basis Function neural networks , basic learning laws in RDF nets, Recurrent networks, recurrent back propagation, Real time Recurrent learning algorithms. Introduction to Counter Propagation Networks, CMAC networks, ART networks. Application of neural nets such as pattern recognition, optimization, associative memories, vector quantization, control. Application in speech and decision making

REFRENCE BOOKS:

1. Artificial Neural Networks Yagna Narayanan

2. Neural Networks and Fuzzy Logic Bart Kosko Neural Networks

(BTEE-803A) **Project II**

Mid Sem	End Sem	MM	L	T	P	C
120	80	200	0	0	6	6

Design, Fabrication, Simulation, Evaluation, Testing etc. related to Electrical Engineering is to be carried out under the supervision of guide(s).

(BTEE-804A) Power System Analysis Lab

Mid Sem	End Sem	MM	L	T	P	C
30	20	50	0	0	2	1

Course Outcomes:

The students will be able to

- design of transmission system, Substation and Distribution system and perform Short circuit calculations and calculations of circuit breaker ratings for a power system network on ETAP software.
- formulate Z bus and Y bus Using MATLAB.
- perform load flow analysis and fault analysis using ETAP/MATLAB software.

LIST OF EXPERIMENTS

1. Design of transmission systems for given power and distance.
2. Short circuit calculations and calculations of circuit breaker ratings for a power system network.
3. Design of substations
4. Design of distribution systems
5. Y-bus formation
6. Z-bus formulation
7. Load flow analysis by Gauss Seidal method
8. Load flow analysis by Newton Raphson method
9. Fault analysis for line-to-line (L-L), Line-to-Ground (L-G) etc
10. Design of underground cabling system for substation.
11. To obtain power system stability on High Voltage Alternating current (HVAC) system with the help of Flexible Alternating Current Transmission Systems (FACTS) devices.
12. Optimal Capacitor placement on a system having variable reactive power and low voltage profile.
13. To obtain relay co-ordination on a power system.
14. To obtain optimal generator pricing on hydro-thermal and renewable energy systems.
15. To find synchronous reactance (Transient, sub-transient) during fault analysis.