GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA
ELECTRICAL ENGINEERING DEPARTMENT

Note: There will be 04 weeks BTEP-309 Institutional training after 2nd semester. "S" for Satisfactory and US for unsatisfactory

Semester-III

Course Code	Course Title	L	T	P	Marks Distribution		Total Marks	Credits
					Internal	External		
BTET-301	Engineering Mathematics-III	4	1	--	40	60	100	5
BTET-302	Network Analysis and Synthesis	4	1	--	40	60	100	5
BTET-303	Electrical Measurements & Measuring Instruments	4	1	--	40	60	100	5
BTET-304	Transformers & Direct Current Machines	4	1	--	40	60	100	5
BTET-305	Electronic Devices and Circuits	4	1	--	40	60	100	5
BTEP-306	Laboratory-I: Transformers & Direct Current Machines	--	--	2	30	20	50	1
BTEP-307	Laboratory-II: Electronic Devices and Networks	--	--	2	30	20	50	1
BTEP-308	Laboratory-III: Electrical Measurements & Measuring Instruments	--	--	2	30	20	50	1
BTEP-309	Institutional Training (Undertaken after 2nd semester)	--	--	--	60	40	100	S/US
Total		**20**	**5**	**6**	**350**	**400**	**750**	**28**

Semester-IV

Course Code	Course Title	L	T	P	Marks Distribution		Total Marks	Credits
					Internal	External		
BTET-401	Asynchronous Machines	3	1	--	40	60	100	4
BTET-402	Control Systems	3	1	--	40	60	100	4
BTET-403	Electromagnetic Field Theory	3	1	--	40	60	100	4
BTET-404	Power System-I (Transmission & Distribution)	3	1	--	40	60	100	4
BTET-405	Digital Electronics	3	1	--	40	60	100	4
BTET-406	Object Oriented Programming	3	1	--	40	60	100	4
BTEP-407	Laboratory-IV: Control Systems	--	--	2	30	20	50	1
BTEP-408	Laboratory-V: Digital Electronics	--	--	2	30	20	50	1
BTEP-409	Laboratory-VI: Object Oriented Programming	--	--	2	30	20	50	1
General Fitness					100	--	--	S/US
Total		**18**	**6**	**6**	**430**	**420**	**850**	**27**

Note: There will be 04 weeks BTEP-509 Institutional training after 4th semester. "S" for Satisfactory and US for unsatisfactory

Semester-V

Course Code	Course Title	L	T	P	Marks Distribution		Total Marks	Credits
					Internal	External		
BTET-501	Synchronous Machines	4	1	--	40	60	100	5
BTET-502	Numerical & Statistical Techniques	4	1	--	40	60	100	5
BTET-503	Industrial Electronics	4	1	--	40	60	100	5
BTET-504	Instrumentation Engineering	4	1	--	40	60	100	5
BTET-5XX	Elective-I	3	1	--	40	60	100	4
BTEP-505	Laboratory-VII: Asynchronous & Synchronous Machines	--	--	2	30	20	50	1
BTEP-506	Laboratory-VIII: Industrial Electronics	--	--	2	30	20	50	1
BTEP-507	Laboratory-IX: Instrumentation & Measuring Devices	--	--	2	30	20	50	1
BTEP-508	Laboratory-X: Numerical & Statistical Techniques	--	--	2	30	20	50	1
BTEP-509	Industrial Training (Undertaken after 4th semester)	--	--	--	60	40	100	S/US
Total		**19**	**5**	**8**	**380**	**420**	**800**	**28**

Semester-VI

Course Code	Course Title	L	T	P	Marks Distribution		Total Marks	Credits
					Internal	External		
BTET-601	Power System-II (Switchgear & Protection)	3	1	--	40	60	100	4
BTET-602	Electrical Drives & Utilization	3	1	--	40	60	100	4
BTET-603	Electrical Generation & Economics	3	1	--	40	60	100	4
BTET-604	Microcontroller & Programmable Logic Controllers	3	1	--	40	60	100	4
BTET-6XX	Elective-II	3	1	--	40	60	100	4
BTXX-XX	Open Elective	3	1	--	40	60	100	4
BTEP-605	Laboratory-XI: Power System	--	--	2	30	20	50	1
BTEP-606	Laboratory-XII: Electric Drives	--	--	2	30	20	50	1
BTEP-607	Laboratory-XIII: Microcontroller & Programmable Logic Controllers	--	--	2	30	20	50	1
General Fitness					100	--	--	S/US
Total		**18**	**6**	**6**	**430**	**420**	**850**	**27**

Semester-VII/VIII

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
Industrial Training (One Semester)					
BTEP-7801	Software Training *(08 weeks)	150	100	250	8
BTEP-7802	Project oriented Industrial Training (08 weeks)	300	200	500	10
Total		**450**	**300**	**750**	**18**

Semester-VII/VIII

Course Code	Course Title	L	T	P	Marks Distribution		Total Marks	Credits
					Internal	External		
BTET-7803	Computer Aided Power System Analysis	3	1	--	40	60	100	4
BTET-7804	Digital Control System	3	1	--	40	60	100	4
BTET-7805	High Voltage Engineering	3	1	--	40	60	100	4
BTET-7806	Flexible AC Transmission Systems	3	1	--	40	60	100	4
BTET-78XX	Elective-III	3	1	--	40	60	100	4
BTEP-7807	Laboratory-XIV: Computer Aided Power System Analysis	--	--	2	30	20	50	1
BTEP-7808	Laboratory-XV: High Voltage Engineering	--	--	2	30	20	50	1
BTEP-7809	Project	--	--	6	60	40	100	3
BTEP-7810	Seminar	--	--	2	100	--	100	2
General Fitness					100	--	--	S/US
Total		**15**	**5**	**12**	**520**	**380**	**900**	**27**

* The list of software which can be undertaken are as mentioned below:

a) Any Object Oriented Programming language
b) MATLAB/AMPL/KNITRO/MATPOWER/GAMS
c) NI-LabView
d) P-Spice.
e) MultiSim
f) PSCAD/ETAP/POWER WORLD SIMULATOR
g) PCAD/ CASPOC
h) PLC & Microcontrollers/Arduino
i) SCADA
j) Electrical AUTOCAD
k) Embedded Systems
l) VHDL/FPGA
m) Or any other software related to Electrical and Electronics Engineering.

Course Code	Course Title
Elective-I	
BTET-510	Renewable Energy Resources
BTET-511	Electrical Design & Illumination Engineering
BTET-512	Electrical Engineering Materials
BTET-513	Power System Planning
BTET-514	Energy Auditing & Management
BTET-515	Solar Technologies
BTET-516	Analog Integrated Circuits
Elective-II	
BTET-608	Power System Operation & Control
BTET-609	Computer Aided Electrical Machine Design
BTET-610	Optimization Techniques
BTET-611	Power System Restructuring & Deregulation
BTET-612	Energy Conversion
BTET-613	Robotic Control System
BTET-614	Process Dynamics and Control
Elective III	
BTET-7811	Digital Signal Processing
BTET-7812	Fuzzy Logics & Systems
BTET-7813	Neural Networks
BTET-7814	System Modeling & Simulation
BTET-7815	System Engineering & Reliability
BTET-7816	Advanced Microprocessors
BTET-7817	Signals and Systems
Open Elective ***(To be offered by Electrical Engineering Department to other Departments)***	
BTET-615	Non-Conventional Energy Sources
BTET-616	Fundamentals of Electrical Machines
BTET-617	Elements of Power System
BTET-618	Programmable Logic Controllers and Automation
BTET-619	Electrical Measurements and Instrumentation
BTET-620	Energy Auditing and Management
BTET-621	Sensors and Transducers

BTET-301ENGINEERING MATHEMATICS-III

Internal Marks : 40	L	T	P
External Marks : 60	4	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To provide students with a sound foundation in Mathematics and prepare them for graduate studies in Electrical Engineering.
2. To contrive students with adequate knowledge of mathematics that will enable them in formulating and solving engineering problems.
3. The course will enable students in handling linear systems using tools like Laplace transforms, Fourier transforms and Fourier series.

COURSE OUTCOMES

a. Students will demonstrate basic knowledge of Laplace Transform. Fourier series, Bessel Functions, Vector Algebra and Complex Variable.
b. Students will demonstrate an ability to identify formulate and solve Electrical Engineering problem using Applied Mathematics.
c. Students will be able to explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results.

CONTENTS

1. FOURIER SERIES

Periodic functions, Euler's formula, Even and Odd functions, Half range expansions, Fourier series of different wave forms.

2. LAPLACE TRANSFORMS

Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, periodic function, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

3. SPECIAL FUNCTIONS

Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind, Recurrence relations.

4. PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, Linear partial differential equations, Homogeneous partial differential equations with constant coefficients.

5. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Wave equation and Heat conduction equation in one dimension, Two dimensional Laplace equations in Cartesian Coordinates, Solution by the method of separation of variables.

6. FUNCTION OF COMPLEX VARIABLE

Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's Integral Formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

BOOKS RECOMMENDED

1. Kreyszing, E., *Advanced Engineering Mathematics*, 8th edition, John Wiley, New Delhi.
2. Grewal, B. S., *Higher Engineering Mathematics*, Khanna Publishers, New Delhi.
3. Ian N. Sneedon, *Elements of Partial Differential Equations*, McGraw- Hill Publisher.
4. Peter. V. O'Nil, *Advanced Engineering Mathematics*, Wadsworth Publishing Company.
5. Taneja, H. C., *Engineering Mathematics*, Volume-I& Volume-II, I. K. Publisher.
6. Babu Ram, *Advance Engineering Mathematics*, Pearson Education.
7. Bindra, J. S., *Applied Mathematics*, Volume-III, Kataria Publications.
8. O'Neil, *Advanced Engineering Mathematics*, Cengage Learning.

BTET- 302 NETWORK ANALYSIS AND SYNTHESIS

Internal Marks : 40	L	T	P
External Marks : 60	4	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To develop an understanding of the fundamental laws and elements of electric circuits.
2. To understand waveforms, signals and steady-state & transient response of RLC circuits.
3. To develop the ability to apply circuit analysis to DC and AC circuits.
4. To understand advanced mathematical methods such as Laplace transforms along with linear algebra and differential equations techniques for solving circuit problems.
5. To synthesize the given network.
6. To learn about filters and their applications.

COURSE OUTCOMES

a. To be able to solve basic electrical circuits.
b. To be able to analyze electrical circuits.
c. To predict response of a network using Network Theorems.
d. To be able to find circuit responses using Laplace transform.
e. To comprehend responses of a given network to various types of excitation.
f. To comprehend the topology of filters.

CONTENTS

1. DC CIRCUITS

Basic concepts: Current, Voltage and Power, Sources: Dependent and Independent sources; their circuit representation, Ideal Sources, source transformation, Ohm's law: applications and limitations, Kirchoff's laws: current and voltage, Nodal and Mesh analysis, Series and parallel circuit analysis, star and delta connected loads, Superposition theorem, Thevenin theorem, Norton theorem, Maximum Power transfer theorem, Tellegen's Theorem.

2. NETWORK TOPOLOGY

Concept of graph, tree, co-tree, branch, link of a network and their application to formation of incidence matrices, Tie-set, Cut-set matrix formation.

3. STEADY STATE AND TRANSIENT ANALYSIS

Concept of steady state and transient state, Introduction to Laplace transform, Conversion of circuit from Time domain to frequency domain, Test signals: Unit Impulse, Unit step, Unit Ramp, Unit Doublet, Parabolic signals and their graphical and mathematical representation, Application of Laplace transform to solution of transient state of a simple network with

independent sources only, First order and Second order networks, Poles and zeros and transfer function, Convolution theorem and Convolution Integral.

4. AC CIRCUITS

Instantaneous Power, Average Power, Effective Power, Apparent Power and Reactive Power, Polyphase circuits, Analysis of series and parallel RLC circuits, Application of Superposition, Thevinin, Norton and Maximum power transfer theorems to AC circuits.

5. TWO PORT NETWORKS & FILTERS

Concept of two port network, Impedance parameters, Admittance parameters, ABCD parameters, h-parameters, g-parameters, Concept of filters, Need for filters, Prototype filters, half section, m-derived filters, Composite filters.

6. NETWORK SYNTHESIS

Synthesis of simple networks using Foster and Cauer forms.

BOOKS RECOMMENDED

1. Hayt W. H., Kemmerly J. E. and Durbin S. M., *Engineering Circuit Analysis*, McGraw Hill Publications, 7th edition.
2. Bruce Carlson A., *Circuits*, Cengage Learning.
3. David Irwin J. and Robert M. Nelms, *Engineering Circuit Analysis*, Wiley Publications, 10th edition.
4. Sudhakar A. Rao and Shyammohan, *Circuits and Networks*, Tata McGraw Hill Publications.
5. Sukhija M. S. and Nagsarkar T. K., *Circuits Networks*, Oxford University Press.
6. Chakravorty Abhijeet, *Circuit Theory*, Dhanpat Rai and Sons.

BTET-303 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Internal Marks : 40	L	T	P
External Marks : 60	4	1	0
Total Marks :100			

COURSE OBJECTIVES

1. To understand the principle and working of measuring instruments and their applications.
2. To be able to inculcate the knowledge regarding different types of bridges.
3. To understand the concept of instrument transformers, potentiometers and magnetic circuits.
4. To identify the details of instrumentation and devices intended for a particular application.

COURSE OUTCOMES

a. An ability to gain knowledge of different types of analog measuring instruments and their applications.
b. An ability to use different types of bridges in various electrical applications.
c. Students can make use of instrument transformers and various magnetic measurements in the field applications.
d. An ability to use techniques, skills related to potentiometers for calibration of different instrument.

CONTENTS

1. UNITS, SYSTEMS AND STANDARDS

Review of MKS & Rationalized MKSA System, SI Units, Standards of EMF, Resistance, Capacitance and Inductance, Systematic errors.

2. ANALOG MEASURING INSTRUMENTS

Operating, damping & controlling torques, Torque/Weight ratio, Pointers & Scales. Principles of operation of various types of electro-mechanical indicating/registering instruments viz. PMMC, moving iron, dynamometer, induction, thermal for DC & AC measurement of voltage, current, power, frequency, phase & power factor, energy meter(Single Phase induction type): their sources of error & compensation, shunts & multipliers, insulation testing using Meggar.

3. POTENTIOMETERS

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

4. 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, Anderson bridge, DeSauty's bridge, Insulation testing, Sources of errors in bridge circuits, Shielding of bridge elements, Wagner Earthing Device.

5. MAGNETIC MEASUREMENTS

Determination of B–H curve and hysteresis loop, Flux meter, Measurement of iron losses by Wattmeter and Bridge methods.

6. 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, Burden and its ratings.

BOOKS RECOMMENDED

1. Golding Edward William and Widdis Frederick Charles, *Electrical Measurements and Measuring Instruments*, Wheelers India.
2. Bell David A., *Electronics Instrumentation and Measurements*, Prentice Hall, India.
3. Reissland Martin V, *Electrical Measurements Fundamentals, Concepts, Applications*, Wiley Eastern Limited, New Delhi.
4. Erenest O. Doebelin, *Measurement Systems-Application and Design*, McGraw Hill, 5th edition, 2005.
5. Helfrick A.D. and Cooper W.D., *Modern Electronic Instrumentation & Measurement Techniques*, Prentice Hall.
6. Murthy D. V. S., *Transducers and Instrumentation*, Prentice-Hall, India.

BTET-304 TRANSFORMERS AND DIRECT CURRENT MACHINES

	L	T	P
Internal Marks : 40			
External Marks : 60	4	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To make students aware about constructional details, principle of operation and analysis of single-phase transformer, three-phase transformer and auto transformer.
2. To aware the students about applications of transformer in power system and industry.
3. To make students understand the concept of DC machines.
4. To impart knowledge for applications of DC machines in industrial sector.

COURSE OUTCOMES

Students attain ability to:

a. Describe how a transformer is constructed and how does it work.
b. Perform testing on transformer and to evaluate efficiency and voltage regulation.
c. Develop equivalent circuit, phasor diagram and circuit parameters.
d. Comprehend the construction, working and characteristics of dc machines.
e. Explore knowledge in context of applications of dc machines in industry.

CONTENTS

1. SINGLE PHASE TRANSFORMERS

Overview: Magnetic circuits, Working principle of transformer, constructional features and E.M.F equation, Phasor diagram on no-load and loaded conditions, Referred parameters equivalent circuit, In rush phenomenon, Voltage regulation and efficiency, All day efficiency. Testing: Open-circuit test, short-circuit test and back-to-back test.

2. THREE PHASE TRANSFORMERS

Construction of three phase transformer & its comparison with single-phase transformer, poly phase transformer connections, Scott connections, power and distribution transformers, Operational features of on-load tap changer (OLTC), Parallel operation of transformers, Different diagnostic techniques of transformers.

3. SPECIAL TYPE TRANSFORMERS

Constructional details and principle of Auto transformer, Saving of copper, Applications of auto transformer, Introduction to special purpose transformer: dry type and amorphous core.

4. D.C. GENERATOR

Working principle, construction of DC machines, armature windings, E.M.F. and torque equations, armature reaction: effect of brush shift and compensating winding. Commutation:

Causes of bad commutation, methods of improving commutation. D.C. generator characteristics.

5. D.C. MOTOR

Working principle, characteristics, starters (3-point, 4-point and soft starters), speed control methods (field and armature control). Braking: plugging, dynamic and regenerative braking. Estimation of losses and efficiency by Swinburn's test and Hopkinson test. Introduction to brushless direct current (BLDC) machines.

BOOKS RECOMMENDED

1. Say M. G., *Alternating Current Machines*, 5th edition, Sir Isaac Pitman & Sons Ltd.
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. Bimbhra P.S., *Electrical Machinery*, Khanna Publishers.
5. Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th edition, Tata McGraw Hill.
6. Charles I. Hubert, *Electrical Machines*, 2nd edition, Pearson Education.
7. B.H.E.L., *Transformers*, Tata McGraw-Hill Education.

BTET-305 ELECTRONIC DEVICES AND CIRCUITS

Internal Marks : 40	L	T	P
External Marks : 60	4	1	0
Total Marks : 100			

COURSE OBJECTIVES

The subject aims to provide students with

1. Capability to understand the principle, construction, characteristics, operation and application of various electronic devices. Modeling of various electronic devices.
2. The ability to use these models in analysis and design of useful circuits.
3. The capabilities to troubleshoot, design, take measurements to understand the circuit behavior, performance and create electronic circuits meant for different applications.

COURSE OUTCOMES

Students attain ability to:

a. Comprehend the principle, construction, characteristics, operation and application of various electronic devices viz: Diode, BJT, FET, Special purpose Diodes and MOSFET.
b. Analyze and understand different electronic devices as a circuit element.
c. Troubleshoot, design and create electronic circuits meant for different applications.
d. Acquire experience in building and troubleshooting simple projects employing semiconductor devices.

CONTENTS

1. SOLID STATE DEVICSS

Solid-State electronic materials, Characterize resistivity of insulators, semiconductors, and conductors. Diode, *pn* junction electrostatics, Space charge region formation at the *pn* junction, Internal diode currents, diodes I-V characteristics, Diode as a circuit element Half wave rectifier, Full wave (Center tap and Bridge type) rectifier. Wave shaping and voltage multiplier circuits. Special purpose diodes Principle, construction, characteristics and applications of LED's, Schottky, Varactor and Photodiodes.

2. BIPOLAR JUNCTION TRANSISTOR (BJT)

Physical structure and operation regions of Bipolar transistors, *I-V* Transistor characteristics and parameters, Common Base, Common Emitter and Common Collector Configurations. Transistor biasing (Two resistor bias networks and four resistor biasing), Four resistor bias network for BJT: Design objectives. Transistor thermal runaway and thermal stability, transistor cut off region model (switch).

3. BJT AC ANALYSIS

Basics characteristics of an amplifier, Simple transistor model (r_e model), hybrid equivalent circuit, circuit analysis using h-parameters. CE Fixed bias configuration, emitter follower,

Difference between BJT and FET. Junction field effect transistor (JFET) and Metal oxide semiconductor field effect transistor (MOSFET): Characteristics, parameters and biasing. BJT Frequency Response Decibels, General Frequency considerations, Low frequency response-BJT amplifier.

4. OPERATIONAL AMPLIFIERS AND APLICATIONS

Introduction, Differential amplifier circuit, Op-Amp basics, Practical Op-Amp circuits, Op-Amp specification- DC offset parameters, Op-Amp specifications- Frequency parameters, Op-Amp unit specifications, differential and common mode operation. Constant gain multiplier, voltage summing, voltage buffer, controlled sources, Instrumentation circuits, Active filters.

5. POWER AMPLIFIERS

Difference between small signal and large signal amplifiers Introduction and types. Series fed Class A amplifier and transformer coupled amplifier, Class B amplifier circuits. Amplifier Distortion, Heat Sinks, Class C and Class D amplifier

6. POWER SUPPLIES

RC and LC filters and their design. Surge Current and PIV rating, discrete voltage regulators, Line and Load regulations, Transistor Series and Shunt regulators, Current limiting, IC voltage regulators, Practical applications of Power Supply.

BOOKS RECOMMENDED

1. Mottershead A., *Electronic Devices and Circuits: An Introduction*, Prentice Hall of India Learning Pvt ltd, 2011, New Delhi.
2. Boylestad R.L., and Nashelsky L., *Electronic Devices and Circuit Theory*, 10th edition, Pearson (LPE) India.
3. Floyd T. L., *Electronic Devices*, 9th Edition, Pearson (LPE), India.
4. Malvino A., *Electronic Principles*, Tata Mc-Graw Hill.
5. Millman and Halkias, *Electronic Devices and Circuits*, Tata Mc-Graw Hill.
6. Jaeger R.C. and Blalock T.N., *Microelectronic Circuit Design*, 4th Edition, Mc-Graw Hill.
7. Deshpande N.P., *Electronic Devices and Circuits: Principles and Applications*, 2007, Mc-Graw Hill companies.

BTEP-306 LABORATORY-I: Transformers & Direct Current Machines

Internal Marks : 30	L	T	P
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

1. To make students able to perform various tests on transformers.
2. To understand the intricacies of three phase transformer connections and its performance.
3. To throw light on use of transformer in enhanced power system loading conditions.
4. To attain capability to analyze operation of DC generators.
5. To get familiar with basic concept, operation and testing of DC motors.

COURSE OUTCOMES

Students attain ability to:

a. Perform testing on transformer and to evaluate equivalent circuit parameters, efficiency and voltage regulation.
b. Explain the concept of three phase transformer and make the various connections.
c. Comprehend the need for parallel operation in power system.
d. Analyze performance characteristics of DC generators.
e. Perform various tests, control of speed and draw speed-torque characteristics.

LIST OF EXPERIMENTS

1. To perform open circuit and short circuit tests on a single-phase transformer and hence find equivalent circuit parameters, voltage regulation and efficiency.
2. To find the efficiency and voltage regulation of single-phase transformer under different loading conditions.
3. To perform back-to-back test (Sumpner's Test) two single-phase transformers.
4. To perform polarity test and parallel operation of two single-phase transformers.
5. To make Scott connections on three-phase transformer to get two phase supply.
6. To verify the outputs of various connections in three-phase transformer.
7. To start the dc motor and study in detail the three-point and four-point starters.
8. To measure armature and field resistance of direct current (d.c.) shunt generator and to obtain its open circuit characteristics.
9. To perform speed control on dc shunt motor by field current and armature voltage.
10. To draw speed-torque characteristics of dc shunt/series /compound motor.
11. To perform Swinburne's test (no load test) to determine losses of dc shunt motor.
12. Application of MATLAB for solution of problems regarding transformers and dc machines.

BTEP-307 LABORATORY-II: ELECTRONIC DEVICES AND NETWORKS

	L	T	P
Internal Marks : 30			
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

The subject aims to provide students with:

1. Identification, well versed understanding and testing of electrical and electronic components and their data specification sheets.
2. The ability to make simple and complex circuits on bread-board, understand the use of various equipment's viz: CRO, DMM, AMM, Signal generators, Power supplies, LCR meters etc.
3. The ability to take measurements to understand the circuit behavior, performance and design electronic circuits meant for different applications.
4. The ability to troubleshoot and explain any discrepancies in electronic circuits.

COURSE OUTCOMES

Students will:

a. Be able to identify and test different types of electrical and electronic components.
b. Have ability to make circuits on bread-board and understand the use and importance of various types of equipment's used in the Lab.
c. Be able to analyze, take measurements to understand circuit behavior and performance under different conditions.
d. Be able to troubleshoot, design and create electronic circuits meant for different applications.
e. Acquire experience in building and troubleshooting simple projects employing semiconductor devices.

LIST OF EXPERIMENTS

1. Verification of KVL and KCL law.
2. Verification of Superposition theorem.
3. Verification of Thevenin's and Maximum Power Transfer theorem.
4. Verification of Norton's theorem using Current sources.
5. To obtain transient response of RL& RC circuits (dc).
6. To obtain frequency response of RLC Circuits.
7. To design a full wave and half wave rectifier and observe the waveforms with and without filters.
8. To design a voltage regulator using Zener diode and also see the effect of line and load regulation.
9. To design various clippers and clampers using diodes.

10. To plot the transistor characteristics in common emitter configuration and also determine the h-parameters from these characteristics.
11. To design, study and compare various transistor biasing techniques and also see the effect on operating point (Q-point) when using various transistors at different temperatures.
12. To obtain the frequency response and calculate the gain bandwidth of the amplifier.
13. To analyze a voltage follower circuit.
14. To plot the VI characteristics of FET.
15. To plot the characteristics of a class B amplifier and also calculate the overall efficiency.
16. To plot the characteristics of a class AB amplifier.
17. To plot the characteristics of symmetry amplifier.
18. To design various type of oscillators and to determine the frequency of oscillations.
19. To design a transistor series voltage regulator with current limits and observe current feedback characteristics.
20. To plot the characteristics of a complementary symmetry amplifier.

BTEP-308 LABORATORY-III: ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Internal Marks : 30	L	T	P
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

1. To make the students aware of various types of measurements, requirement of calibrations, instruments used in measurement.
2. Enable the students to have in depth knowledge of various bridges.
3. Familiarize the students with potentiometers, CRO, current & potential transformers.
4. To understand the concept of precision measurement and measuring instrument for any engineering system.

COURSE OUTCOMES

a. An ability to perform well for precision measurement of Resistance, Inductance, Capacitance, Frequency by different bridges.
b. To be able to calibrate the various types of instruments.
c. Demonstrate, through technical report writing, competency in mathematical and graphical analysis of data.

LIST OF EXPERIMENTS

1. Measurement of resistance using Wheatstone bridge.
2. Measurement of resistance using Kelvin's Bridge.
3. Measurement of frequency using Wein's Bridge.
4. Measurement of capacitance using Schering Bridge
5. Measurement of self-inductance using Anderson's Bridge.
6. To find the ratio error of Current and Potential Transformers.
7. To measure power consumed by a 3-phase load and to find its power factor using 2 Wattmeter methods.
8. To plot EMF vs. Displacement characteristics of a potentiometer.
9. To plot Hysteresis loop for a magnetic material using Flux Meter.
10. To calibrate the induction type Energy Meter.
11. To find ‘Q’ of an inductance coil and verify its value using Q-meter.
12. To measure insulation resistance using Meggar.
13. To measure the earth resistance by Earth Tester.
14. To measure frequency of ac supply using Weston Frequency meter.

BTET-401 ASYNCHRONOUS MACHINES

Internal Marks : 40	L	T	P
External Marks : 60	3	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To clear the concepts of three-phase induction motors, single-phase induction motors and special purpose motors.
2. To make students able to perform tests and develop induction motor equivalent circuit.
3. To make them capable of knowing motor characteristics and its applicability.
4. To train students to get exposed to applications of induction machines.

COURSE OUTCOMES

Students attain ability to:

a. Comprehend the basics of induction machines mostly used in industry.
b. Analyze different types of fractional horse power motors.
c. Draw equivalent circuit and evaluate various parameters after testing.
d. Comprehend and solve industry related problems in context of induction motors.

CONTENTS

1. THREE PHASE INDUCTION MOTORS

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

2. STARTING METHODS AND SPEED CONTROL

Starting methods, Speed control methods, Motor tests for estimation of equivalent circuit parameters, Introduction to variable frequency drives (VFD).

3. INDUCTION GENERATOR

Operation: Isolated and Grid mode, method of excitation, application of induction generator in wind mills and micro hydel power plants.

4. SINGLE –PHASE MOTORS

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

5. SPECIAL PURPOSE MOTORS

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

BOOKS RECOMMENDED

1. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, McGraw Hill.
2. Say M. G., *Alternating Current Machines*, Sir Isaac Pitman & Sons Ltd.
3. Bimbhra P.S., *Electrical Machinery*, Khanna Publishers.
4. Nagrath I.J. and Kothari D.P., *Electrical Machines*, Tata McGraw Hill.
5. Guru B.S. and Hiziroglu H.R., *Electric Machinery and Transformers*, Saunders College Publishing.
6. Bandyopadhyay M.N., *Electrical Machines*, PHI Learning Private Ltd.

BTET- 402 CONTROL SYSTEMS

Internal Marks : 40	L	T	P
External Marks : 60	3	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To understand the methods of representation of control systems and to design their transfer function models.
2. To provide adequate knowledge in the time response of systems and steady state error analysis.
3. To accord basic knowledge in obtaining the open loop and closed loop frequency response of systems.
4. To understand the concept of stability of control system and study methods of stability analysis.
5. To study the different ways of designing compensation for a control system.

COURSE OUTCOMES

The students will be able to:

a. Represent the Control Systems by Transfer Function Models.
b. Find the Time Response of Control Systems.
c. Find the Frequency Response of Control Systems.
d. Do Stability Analysis of Control Systems.
e. Design Compensators.

CONTENTS

1. SYSTEMS AND THEIR REPRESENTATION

Basic elements in Control Systems, Open and Closed loop systems, Electrical analogy of Mechanical and Thermal systems, Concept of Linear and Non Linear System, Use of Laplace Transforms, Transfer function, Block Diagram reduction techniques, Signal Flow Graphs, Synchros, potentiometers, AC and DC servomotors, AC and DC Tacho-generators.

2. TIME RESPONSE

Time response, Time domain specifications, Types of Test Input, first and second order system response, Error Coefficients, Generalized error series, Steady State Error, Proportional (P), Proportional Integral (PI), Proportional Integral Derivative (PID) modes of feedback control.

3. FREQUENCY RESPONSE

Frequency response, Bode plot, Polar plot, Determination of Closed loop response from Open loop response, Correlation between Frequency domain and Time domain specifications.

4. STABILITY OF CONTROL SYSTEM

Characteristics Equation, Location of roots in S- plane for stability, Routh-Hurwitz Criterion, Root Locus construction, Effect of Pole-Zero addition, Gain Margin and Phase Margin, Nyquist Stability criterion.

5. COMPENSATOR DESIGN

Performance Criterion, Lag, Lead and Lag-Lead networks, Compensator design using Bode Plots.

BOOKS RECOMMENDED

1. Nagrath I.J. and Gopal M., *Control Systems Engineering*, New Age International Publishers, 2003.
2. Benjamin C. Kuo, *Automatic Control systems*, Pearson Education, New Delhi, 2003.
3. Ogata K, *Modern Control Engineering*, 4th edition, PHI, New Delhi, 2002.
4. Norman S. Nise, *Control Systems Engineering*, 4th Edition, John Wiley, New Delhi, 2007.
5. Gopal M., *Control Systems, Principles and Design*, Tata McGraw Hill, New Delhi, 2002.

BTET- 403 ELECTROMAGNETIC FIELD THEORY

Internal Marks : 40	L	T	P
External Marks : 60	3	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To introduce students with the concept of vector analysis and physical interpretation of Gradient, Curl and Divergence.
2. To make students understand the basic principle of Electric and Magnetic Fields.
3. To inculcate the understanding of static and time varying fields.
4. To make students familiar with the concept of Maxwell's equations and electromagnetic wave propagation.

COURSE OUTCOMES

Student will have ability to:

a. Comprehend the relations between divergence, curl & gradient along with their applications.
b. Apply knowledge of mathematics, science, and engineering to the analysis and design of systems involving electric and magnetic fields as well as electromagnetic waves.
c. Acquire skills to examine technical issues and make use of electromagnetic field concepts in various applications.

CONTENTS

1. 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.

2. ELECTROSTATIC FIELD AND APPLICATIONS

Introduction, Coulomb's Law, Charge Distribution, Gauss's Law (Integral & Differential Form) and its Applications; Potential Function; Field due to Continuous distribution of charges; Equipotential Surfaces; Poisson's and Laplace's Equation, Capacitors and its applications, Energy Stored in a Capacitor, Electric Dipole, Dielectric Constant and Dielectric Strength, Polarization Density, Electrostatic Energy, Uniqueness Theorem, Boundary Conditions between Dielectrics Interface.

3. MAGNETOSTATIC FIELD AND APPLICATIONS

Biot-Savart's Law, Faraday's Laws of Electromagnetic Induction; 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, Magnetic Boundary Conditions.

4. TIME VARYING FIELD AND MAXWELL'S EQUATIONS

Equation of Continuity for Time Varying and Steady Fields, Maxwell's Equations in Integral and Differential form for Static and Time Varying Fields, Conditions at a Boundary Surface, Poynting Theorem and Physical Interpretation of E X H.

5. 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.

BOOKS RECOMMENDED

1. William Hayt, *Engineering Electromagnetics*, McGraw Hill, 7th edition, 2005.
2. Halliday D., Resnick R. and K. S. Krane, *Engineering Electromagnetics*, Volume II, Wiley-Hayt, TMH.
3. Edward C. Jordan and Keith G Balmain, *Electromagnetic Waves and Radiating Systems*, Prentice- Hall Inc.
4. Kraus John D., *Electromagnetics*, McGraw-Hill Publishers .
5. Edminister Joseph A., Schaum's*Theory and Problems of Electromagnetics*, McGraw-Hill.
6. David J Griffiths, *Introduction to Electrodynamics*, PHI, 3rd edition, 2008.

BTET-404 POWER SYSTEM - I (Transmission & Distribution)

Internal Marks : 40	L	T	P
External Marks : 60	3	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. The student will learn about the equipments/components used in transmission and distribution system.
2. To make the student aware of different tower configurations and conductors used in overhead transmission lines.
3. To give knowledge to students about different electrical parameters and its significance in transmission lines
4. To make the students learn about ABCD parameters and surge impedance loading of transmission lines.
5. To give students knowledge about different types of underground cables, its laying and comparison with overhead lines.

COURSE OUTCOMES

The students will be able to:

a. Calculate the economical size of conductor.
b. Distinguish the transmission lines of on the basis of tower and conductor configuration.
c. Evaluate surge impedance loading, string efficiency of insulators and voltage regulation of transmission line.
d. Calculate insulation resistance, dielectric stress and capacitance of cables.

CONTENTS

1. POWER 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.

2. 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.

3. 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.

4. PERFORMANCE OF TRANSMISSION LINES

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

5. 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.

6. 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, testing of cables, heating effect, Maximum current carrying capacity, causes of failure, comparison with overhead transmission lines.

BOOKS RECOMMENDED

1. Elgerd O. I., *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.

BTET- 405 DIGITAL ELECTRONICS

Internal Marks :40	L	T	P
External Marks : 60	3	1	0
Total Marks :100			

COURSE OBJECTIVES

1. To differentiate between analog and digital systems.
2. To introduce basic postulates of Boolean algebra and methods to simplify Boolean expressions.
3. Ability to analyze, understand and design different combinational and sequential circuits.
4. To introduce the basic concept of VHDL entity declaration and writing Boolean expressions in VHDL.
5. Ability to understand different types of DAC, ADC and memory devices.

COURSE OUTCOMES

Students will be able to:

a. Explain the difference between analog and digital systems.
b. Describe different laws and rules of Boolean.
c. Explain the steps involved in designing digital systems which may involve combinational, sequential and state machines.
d. Do programming in VHDL.
e. Acquire experience in building different DAC and ADC.

CONTENTS

1. NUMBER SYSTEM & CODES

Review of numbers system and conversions, BCD Code, Gray code, signed & unsigned binary numbers, 1's & 2's complement of a number, different types of codes, Binary operations-addition, subtraction, multiplication, division, Parity for error detection, Check sum and Hamming Code for error detection and correction.

2. COMBINATIONAL CIRCUITS

Review of Logic gates, Concept of positive and negative logic, Introduction to Boolean operations and expressions, Laws and rules of Boolean algebra and De-Morgan's Theorem, Standard forms of Boolean expressions, Duality, Minimization of logical functions using Karnaugh maps. Combinational Logic Analysis Basic combinational logic circuits, Universal property of NAND and NOR gates, adders, comparators, decoders, encoders, code converters, multiplexers, demultiplexers, parity generators and parity checkers.

3. SEQUENTIAL LOGIC CIRCUITS

Latches, Edge triggered and clocked flip-flops (SR, D, JK and T), Flip-Flop operating characteristics and applications. Analysis of Synchronous & Asynchronous circuits, Counters:

Synchronous & Asynchronous counters, Up and Down counters. Design of synchronous counters and counter applications. Registers: Series and Parallel registers. Bidirectional shift registers and shift register applications.

4. INTRODUCTION TO VHDL

Overview of digital design with very-high-speed integrated circuits (VHSIC) hardware description language (VHDL), HDL format and Syntax, entity, Data representation in VHDL, Truth table using VHDL, Decision Control structure and Sequential Circuit using VHDL.

5. DIGITAL TO ANALOG (D/A) AND ANALOG TO DIGITAL (A/D) CONVERTERS

Introduction, weighted register *D/A* converter, binary ladder, *D/A* converter, specifications for *D/A* converters, parallel *A/D* converter, successive approximation *A/D* converter single & dual slope *A/D* converter, *A/D* converter using voltage to frequency conversion, *A/D* converter using voltage to time conversion, countertype *A/D* converters.

6. SEMICONDUCTOR MEMORY

Basics of semiconductor memories**,** Random-Access memories (RAM), Read Only Memories (ROM), Programmable ROM's and Flash Memories. Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Complex programmable logic devices (CPLD), Field Programmable Gate Array (FPGA).

BOOKS RECOMMENDED

1. Floyd Thomas S., *Digital Fundamentals*, Pearson Education.
2. Jain R.P., *Modern Digital Electronics*, Tata McGraw Hill.
3. Kumar Anand, *Fundamentals of Digital Circuits*, Prentice Hall of India.
4. Malvino Albert Paul, *Principles of Digital Electronics*, Tata McGraw Hill.
5. Mano Morris, *Digital Logic and Computer Design*, Prentice Hall of India.
6. Tocci Ronald J. Widmer Neal S. and Moss Gregory L., *Digital Systems: Principles and Applications*, Prentice Hall of India.

BTET- 406 OBJECT ORIENTED PROGRAMMING

	L	T	P
Internal Marks : 40			
External Marks : 60	3	1	0
Total Marks : 100			

COURSE OBJECTIVES

1. To make students conversant with the basic concepts of object oriented programming.
2. To develop proficiency in students for handling classes and objects.
3. Ability to do dynamic memory management using pointers.
4. Ability to understand polymorphism, inheritance, virtual functions and file handling.
5. To make students acquainted with the applications of C++.

COURSE OUTCOMES

Students will be able to:

a. Explain the concept of Object Oriented programming and its importance.
b. Handle classes and objects.
c. Do dynamic memory management using pointers.
d. Comprehend polymorphism, inheritance, virtual functions and do file handling.
e. Apply Object Oriented approach in analyzing and applying in solving problems related to Electrical Engineering.

CONTENTS

1. OBJECT-ORIENTED PROGRAMMING CONCEPTS

Introduction, Comparison between procedural programming paradigm and object-oriented programming paradigm, Basic data types, Derived data types, Constants, Tokens, Keywords, Identifiers and variables, Concepts of an object and a class, Abstraction, Encapsulation, Data hiding, Inheritance, Overloading, Polymorphism, Messaging.

2. CONTROL STRUCTURES

Input and Output statements in C++, Various operators, Operator precedence, if statement, Switch-case, break, goto, continue, for, while and do-while loops, Dynamic initialization, Type modifiers, Type casting.

3. CLASSES, OBJECTS, FUNCTIONS AND ARRAYS

Implementation of a class, Operations on objects, Relationship among objects, Specifying a class, Creating class objects, Accessing class members, Access specifiers, Static members, Empty classes, Nested classes, Local classes, Abstract classes, Container classes, Bit fields and Classes. Function components, Passing parameters, Call by reference, Call by value, Return by reference, Inline functions, Default arguments, Function prototyping, Overloaded function, Recursion, Array of objects, Dynamic allocation operators, Dynamic objects.

4. DYNAMIC MEMORY MANAGEMENT USING POINTERS

Declaring and initializing pointers, Accessing data through pointers, Pointer arithmetic, Memory allocation (static and dynamic), Dynamic memory management using new and delete operators, Pointer to an object, this pointer, Pointer related problems - dangling/wild pointers, Null pointer assignment, Memory leak and Allocation failures.

5. CONSTRUCTORS, DESTRUCTORS AND OPERATOR OVERLOADING

Need for constructors and destructors, Copy constructor, Dynamic constructors, Explicit constructors, Destructors, Constructors and destructors with static members, Initializer lists, Order of execution of constructors and destructors. Overloading operators, Rules for overloading operators, Overloading of various operators, Type conversion - basic type to class type, class type to basic type, class type to another class type.

6. INHERITANCE, VIRTUAL FUNCTIONS AND POLYMORPHISM

Introduction, Defining derived classes, Forms of inheritance, Ambiguity in multiple and multipath inheritance, Virtual base class, Objects slicing, overriding member functions, Object composition and delegation. Concept of binding - early binding and late binding, Virtual functions, Pure virtual functions, Abstract classes, Virtual destructors, Function overloading, Friend function.

7. EXCEPTIONS AND FILE HANDLING

Review of traditional error handling, Basics of exception handling, Exception handling mechanism, Throwing mechanism, Catching mechanism, Rethrowing an exception, Specifying exceptions. Files Handling: File streams, Hierarchy of file stream classes, Error handling during file operations, Reading/writing of files, Accessing records randomly, Updating files.

BOOKS RECOMMENDED

1. Lafore R., *Object Oriented Programming in C++*, Waite Group.
2. Balagurusamy E., *Object Oriented Programming with C++*, Tata McGraw Hill.
3. Kanetkar Yashwant P., *Let Us C++*, BPB Publications.
4. Bjarne Stroustrup, *The C++ Programming Language*, Addison Wesley.
5. Herbert Schildt, *The Complete Reference to C++ Language*, McGraw Hill-Osborne.
6. Lippman F. B, *C++ Primer*, Addison Wesley.
7. Farrell, *Object Oriented using C++*, Cengage Learning.

BTEP-407 LABORATORY-IV: CONTROL SYSTEMS

Internal Marks :30	L	T	P
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

In addition to helping the students practice paper based or PC-based design techniques, most of which they may have seen in their lecture course on control systems, we believe that experiments of control system needs to help the students acquire the following skills associated with converting the paper-based or PC-based design into a practical system:

1. Ability to identify the hardware and software that are required in a basic control system.
2. To teach students the concepts of block diagrams and transfer functions and an ability to debug small errors that may show up during practical implementation.
3. To teach students the characteristics of closed-loop control systems, including steady-state and transient response, error, and stability.
4. To teach students basic control system design methods, including diagrams and plots.
5. Introduce students to the basic concepts of proportional, integral, and derivative (PID) control.
6. Introduce the students to existing software tools (MATLAB & SIMULINK) used for control system design.

COURSE OUTCOMES

Students will be able to:

a. Explain how to imply basic control hardware models in software based approach.
b. Differentiate linear and nonlinear control with their applications.
c. Analyze errors and debug physical system models from an electrical equivalent.
d. Explain the concept of stability and able to apply various techniques to find out stability.

LIST OF EXPERIMENTS

1. To verify the control action of P, PI and PID controllers and their applications.
2. To verify the characteristics of potentiometers and to use two potentiometers as an error detector in a control system.
3. To determine the time domain response of a first order and second order system for step input and obtain performance parameters.
4. To verify the characteristics of synchro transmitter-receiver set and to use it as an error detector.
5. To draw the speed-torque characteristics of a DC servo motor and to explore its applications.
6. To draw the speed-torque characteristics of an AC servo motor and explore its applications.

7. To verify the variations of time lag by changing the time constant using control engineering trainer.
8. To obtain the transfer function of a D.C. motor – D.C. generator set using transfer function trainer.
9. To design a Lag compensator and test its performance characteristics.
10. To design a Lead-compensator and test its performance characteristics.
11. To design a Lead-Lag compensator and test its performance characteristics.
12. Design of PID controller using MATLAB/SIMULINK.
13. Application of MATLAB to draw a) Root Locus b) Bode plot c) Nyquist Plots for a given control system and predict its stability.

BTEP-408 LABORATORY-V: DIGITAL ELECTRONICS

Internal Marks : 30	L	T	P
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

The subject aims to provide students with:

1. Identify different types of Digital IC's packages, pin identification and how to handle them. Use of logic probe and Logic Analyzer.
2. To verify truth tables of all gates and laws and theorem's of Boolean algebra.
3. The ability to analyze, understand, design and testing different combinational and sequential circuits.

COURSE OUTCOMES

Students will able to:

a. Identify different types of digital IC's, read their specification sheets and the way to handle them.
b. Verify the truth tables of various gates and different laws and rules of Boolean Algebra.
c. Design and test different types of combinational and sequential circuits.
d. Make working projects using digital logic.

LIST OF EXPERIMENTS

1. Verification of the truth tables of TTL gates viz: 7400, 7402, 7404, 7408, 7432, 7486.
2. Design and realization of all gates using NAND/NOR gates.
3. Verification of theorems and laws using gates.
4. Design and verification of the truth tables of Half-Adder using different gates and Full Adder circuit using 7483 IC.
5. Design and verification of the truth table of four bit subtractor using 7483 and 7486 IC's.
6. Design and verification of binary to gray code converter or vice-versa.
7. Verification of truth table of Multiplexer (74150) / Demultiplexer (74154).
8. Design, fabrication and testing of Mon-stable multivibrator of t = 0.1ms approx. using 74121/123IC.Testing for both positive and negative edge triggering, variation in pulse width and retriggering.
9. Design and test S-R flip-flop using NOR/NAND gates.
10. Design, fabricate and test a switch debouncer using 7400.
11. Verify the truth table of a JK flip flop using IC 7476.
12. Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.

13. Operate the counters 7490, 7493 and 74193(Up/Down counting mode). Verify the frequency division at each stage. Using a frequency clock (say 1 Hz) display the count of LED's.
14. Verify the truth table of decoder driver7447/7448. Hence operate a 7 segment LED display through a counter using a low frequency clock. Repeat the above with the BCD to Decimal decoder 7442.

BTEP-409 LABORATORY-VI: OBJECT ORIENTED PROGRAMMING

Internal Marks : 30	L	T	P
External Marks : 20	0	0	2
Total Marks : 50			

COURSE OBJECTIVES

1. To make students conversant with the Object Oriented Programming Paradigm.
2. To develop proficiency in students for use of Control Structures.
3. To develop model of Object Oriented Programming: Abstract data types, encapsulation, inheritance and polymorphism.
4. To develop suitable logic for solving the problems.
5. Apply Object Oriented approach in analyzing and applying in solving problems related to Electrical Engineering.

COURSE OUTCOMES

Students will be able to:

a. Comprehend Object Oriented Programming Paradigm.
b. Do Programming using control structures.
c. Develop model of Object Oriented Programming.
d. Develop suitable logic for solving problems.
e. Apply Object Oriented Approach in analyzing and applying in solving problems related to Electrical Engineering.

LIST OF EXPERIMENTS

1. Program to find the area and circumference of the circle
2. Program to interchange the values of two numbers.

[Control statements]

3. Program to find all roots of quadratic equations.
4. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C++ program to find the 2's complement of a binary number.
5. Program to reverse an integer number.
6. Write a program that will read the value of x and evaluate the following function: Y= 2 for x > 0, Y=0 for x=0 Use nested statements with the conditional control statement.
7. Program to display the different colors using the switch statement.
   [Arrays and Strings]
8. Program to find the minimum and maximum element of an array and to do bubble sorting
9. Program to perform different operations on matrices including – addition, subtraction, multiplication, transpose.

[Classes and Objects]

10. Program to illustrate the concept of classes and object.
11. Program to illustrate the concept of nesting of member functions.
12. Program to illustrate the concept of inline function within a class.
13. Program to show the working of static members in a class.

[Constructors and Destructors]

14. Program to illustrate the concept of default constructor, parameterized constructor and copy constructor.
15. Program to illustrate the concept of destructors.

[Overloading and Type Conversions]

16. Program to overload the unary operator and binary operator.
17. Program to illustrate the concept of type conversions basic to class type, class to basic type, class to class type.

[Inheritance]

18. Program to illustrate the concept of inheritance.
19. Program to illustrate the concept of ambiguity in multiple inheritance.
20. Program to illustrate the concept of virtual base class in inheritance.
21. Program to illustrate the order of execution of constructors and destructors in inheritance.

[Polymorphism]

22. Program to illustrate the concept of overloaded function having different number of arguments in the different overloaded forms.
23. Program to illustrate the concept of virtual functions and pure virtual functions.

[File handling]

24. Program to illustrate the concept of file pointers.
25. Program to perform read and write operations on a file.