BTEE-401 ASYNCHRONOUS MACHINES

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

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).

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.

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

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.

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

BOOKS RECOMMENDED:

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.

Note: *External question paper shall be set following guidelines to paper setter given at Page 61.*

BTEE-402 LINEAR CONTROL SYSTEMS

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

INTRODUCTORY CONCEPTS: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.

MODELING: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Use of Laplace transforms, Transfer function, concepts of state variable modeling. Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

TIME DOMAIN ANALYSIS: Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.

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.

COMPENSATION: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation.

CONTROL COMPONENTS: Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.

BOOKS RECOMMENDED

1. Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison –Wesley, Pearson New Delhi
2. Ogata K., *Modern Control Engineering*", Prentice Hall,
3. Kuo B. C., *Automatic Control System*", Prentice Hall
4. Nagrath I.J. and Gopal M., *Control System Engineering*, Wiley Eastern Ltd.

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BTEE-403 ELECTROMAGNETIC FIELDS

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

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.

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.

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.

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

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. Edward C. Jordan and Keith G Balmain, *Electromagnetic Waves and Radiating Systems*, Prentice-Hall Inc.
2. Kraus John D. *Electromagnetics, McGraw-Hill Publishers*
3. Edminister Joseph A., *Schaum's Theory and Problems of Electromagnetics, McGraw-Hill*
4. Rao N. Narayana, *Elements of Engineering Electromagnetics, Pearson Education*

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BTEC- 404 DIGITAL ELECTRONICS

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

NUMBER SYSTEM & CODES: Binary number system, octal number system, hexadecimal number system, 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.

COMBINATIONAL CIRCUITS: Concept of positive and negative logic, Introduction to Boolean variables, Boolean theorems and DeMorgan Theorem, Sum of product and Product of sum form of Logic expressions, Duality, Logical functions using Karnaugh map and Quine-McClusky methods, multiplexers, demultiplexers, encoders, decoders, adders, subtractors, parity generators, parity checkers, code converters.

SEQUENTIAL LOGIC CIRCUITS: Flip-flops, JK flip-flops, D flip-flops, T flip- flops, SR flip- flops, edge triggered and clocked flip-flops. Registers and Counters: Series and Parallel registers; Synchronous & Asynchronous counters, Up and Down counters, Ring counters & Mod- Counters.

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.

DIGITAL LOGIC FAMILIES: Introduction, characteristics of digital ICs, resistor-transistor logic, integrated-injection logic, direct-coupled transistor logic, diode-transistor logic & transistor-transistor logic, emitter-coupled logic and MOS logic

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, *AID* converter using voltage to frequency conversion, *A/D* converter using voltage to time conversion, countertype *AID* converters.

SEMICONDUCTOR MEMORIES: Introduction, memory organization, classification & characteristics of memories, sequential memories, read only memories, read & write memories, content addressable memories, Programmable array Logic, programmable logic arrays and Programmable Logic Device, Field Array Programmable Gate array

RECOMMENDED BOOKS:

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

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BTEE-405, POWER SYSTEMS – I (Transmission and Distribution)

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

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.

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.

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.

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.

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.

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.

RECOMMENDED 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.

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BTEE-406 POWER PLANT ENGINEERING

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

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.

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.

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.

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.

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.

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.

COMBINED OPERATION OF DIFFERENT POWER PLANTS: Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

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

RECOMMENDED 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

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BTEE-407 Laboratory-IV (Instrumentation & Measuring Devices)

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

List of Experiments:

1. To study the input-output characteristics of a potentiometer and to use a potentiometer as an error detector.
2. To measure Insulation Resistance by Megger.
3. To measure earth resistance by Earth Tester.
4. To observe phase sequence of three phase circuit using Rotating type Phase Sequence Indicator.
5. To measure frequency of A.C. supply using Weston Frequency Meter.
6. To measure power factor of single phase and three phase load by PF Meter and verifying through current, voltage and power measurement.
7. To measure circuit parameters and three phase load by PF Meter by LCR Meter.
8. Measurement of displacement using LVDT.
9. Temperature measurement using temperature sensor (RTD).
10. Light measurement using LDR and photo cell censor.
11. Water level measurement using capacitance transducer of a Liquid in a Tank
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. Study of the characteristics of a Thermistor
17. Study of the characteristics of a Thermocouple
18. Study of the characteristics of an Electromagnetic Flowmeter
19. Study of the characteristics of a Tachometer
20. Study of the characteristics of a Photo reflective sensor for Speed Measurement

BTEE-408 Laboratory-V (Control System)

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

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
14. (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.
15. To measure Force / Displacement using Strain Gauge in a wheat stone bridge
16. To design a Lag compensator and test its performance characteristics.
17. To design a Lead-compensator and test its performance characteristics.
18. To design a Lead-Lag compensator and test its performance characteristics.

Note: At least 10 Experiments, out of above list of experiments are to be performed in the semester.

BTEC-409 Laboratory-VI (Electronic Circuits)

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

List of Experiments:

1. To design a voltage regulator using zener diode and also see the effect of line and load regulation
2. To design various clippers and clampers using diodes.
3. To obtain the frequency response of an amplifier and calculate the gain bandwidth of the amplifier.
4. To investigate the emitter follower (Buffer) amplifier and determine A_V,R_i,R_O
5. To study the characteristics of a class B amplifier and also calculate the overall efficiency.
6. To study the characteristics of a class AB amplifier.
7. To study the characteristics symmetry amplifier.
8. To design and study various type of oscillators and to determine the frequency of oscillations.
9. To design a transistor series voltage regulator with current limits and observes current feedback characteristics.
10. To study the characteristics of a complementary symmetry amplifier.
11. Application of Op-Amp(741) as inverting and non-inverting amplifier.
12. To use the OP-AMP as summing, scaling and averaging amplifier.
13. Design differentiator and integrator using OP-AMP and also determine the time constant and cut-off frequency.
14. Application of OP-AMP as Schmitt Trigger.
15. Design a delay circuit using 555 timer and study the monostable, bistable and astable operations using 555.
16. a) Verification of the truth tables of TTL gates viz; 7400,7402, 7404, 7408,7432,7486.
    b) Design and fabrication and realization of all gates using NAND/NOR gates.
17. Verification of truth table of Mutiplexer(74150)/Demultiplexer(74154)
18. Design and verification of truth tables of half-adder, full-adder and subtractor circuits using gates 7483 and 7486(controlled inverter).
19. To study the operation of Arithmetic Logic Unit IC 74181.
20. Design fabrication and testing of
    a) Monostable multivibrator of t = 0.1ms approx. using 74121/123.testing for both positive and negative edge triggering, variation in pulse width and retriggering.
    b) Free running mutivibrator at 1KHz and 1Hz using 555 with 50% duty cycle. Verify the timing from theoretical calculations.
21. Design and test S-R flip-flop using NOR/NAND gates.
22. Design, fabricate and test a switch debouncer using 7400.
23. Verify the truth table of a JK flip flop using IC 7476,
24. Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.
25. 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.
26. 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.