BTEE-601 ELECTRIC POWER UTILIZATION

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

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.

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.

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.

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.

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

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

BOOKS RECOMMENDED:

- 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-602 POWER SYSTEM-II (SWITCH GEAR AND PROTECTION)

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

Total Marks: 100

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

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

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.

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.

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.

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.

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.

BOOKS RECOMMENDED

- 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-603 NON-LINEAR AND DIGITAL CONTROL SYSTEMS

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

Total Marks: 100

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

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

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.

LYAPUNOV'S STABILITY METHOD: Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods

SAMPLED DATA SYSTEMS: Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold. Z-transform 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.

BOOKS RECOMMENDED:

- 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-604 MICROCONTROLLER AND PLC

Internal Marks: 40 L T F External Marks: 60 3 1 0

Total Marks: 100

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

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)

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

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.

Programmable Logic Controllers (PLC): Introduction, operation of PLC, difference between PLC and Hardwired system, difference between PLC and Computer, relay logic and ladder logic, ladder commands and examples of PLC ladder diagram realization, PLC timers, PLC counters, PLC classification.

RECOMMENDED 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
- 8. Dunning Gary, *Introduction to PLCs*, Tata McGraw Hill
- 9. Kumar Rajesh, Module on PLCs and their Applications, NITTTR Chandigarh

BTEE-609 FUNDAMENTALS OF ELECTRICAL MACHINES

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

Total Marks: 100

Introduction: Basic Principle, Types and constructional features of electrical machines, torque, torque angle, basic electromagnetic laws, Induced EMF.

Transformers: Basic principle, turns ratio, types and parts of a transformer, ideal transformer, transformer on no-load and on-load, phasor diagram, transformer reactance and equivalent circuit, losses, efficiency, all day efficiency, regulation, basic concept of three-phase transformer and auto transformer (excluding analysis).

Direct Current (DC) Machines: Principle, Constructional features, Types of direct current (DC) machines, Electromotive force (EMF) and torque equations, circuit model, armature reaction, commutation, Types of armature winding(no detailed diagram), characteristics of dc motors, characteristics of dc generators, starting (three point and four point starters), speed control methods, efficiency and applications.

Three-phase Induction Machines: Concept of rotating magnetic field in three phase, Construction and principle of operation. slip frequency, rotor currents, rotor Magnetomotive force (MMF) and torque production, equivalent circuit; torque slip characteristics, power output, starting;

Single-phase Induction Motors: Principle of single phase induction motors, double field revolving theory, types of single phase induction motors.

Synchronous Machines: Construction and types, Electromotive force (EMF) equation, synchronous reactance.

Principle of Special Motors: Alternating current (AC) series motor, universal motor, reluctance motor, hysteresis motor, stepper motor, Brushless Motors, Switched reluctance motor and their applications.

BOOKS RECOMMENDED:

- 1. Thareja B.L., *Electrical Machines, VOL II*, S.Chand.
- 2. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, 6th Edition, McGraw Hill
- 3. Nagrath I.J. and Kothari D.P., *Electrical Machines*, Tata McGraw Hill
- 4. Bimbhra P.S., Electrical Machinery, Khanna Publishers

BTEE-610/BTEE-804B ENERGY AUDITING AND MANAGEMENT

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

Total Marks: 100

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 Act-2001 and its features.

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

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

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).

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

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

High Voltage 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.

BOOKS RECOMMENDED:

- 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-611/EE 803 NON-CONVENTIONAL ENERGY SOURCES

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

Total Marks: 100

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

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.

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.

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.

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

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

BOOKS RECOMMENDED:

- 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).
- 7. Chakrabarti A., Soni M. L., Gupta P. V. and Bhatnagar U. S., *Power System Engineering*, Dhanpat Rai and Co.
- 8. Kothari D.P., Singal K.C. and Ranjan R., Renewable Energy Sources and Emerging Technologies, Prentice Hall (India)

BTEE-612 ELECTRICAL MEASUREMENTS

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

Total Marks: 100

UNITS, DIMENSIONS AND STANDARDS: Introduction to MKS ((Meter-Kilogram-Second) and Rationalized MKSA (Meter-Kilogram-Second-Ampere) System, SI Units (International System of Units), Standards of electromotive force (EMF), Resistance, Capacitance and Inductance, Systematic errors

GENERAL THEORY OF ANALOG MEASURING INSTRUMENTS: Operating torque, damping and controlling torque, Torque-weight ratio, Pointers and Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. Permanent Magnet Moving Coil (PMMC), dynamometer, induction, thermal, etc. for direct current and alternating current measurement of voltage, current, power, frequency, phase and power factor etc., energy meter: their sources of error and compensation, shunts and multipliers, multi-meter.

POTENTIOMETERS: Basic direct current (DC) potentiometer circuit, Modern form of DC potentiometer, measurement of voltage, current, Resistance and calibration of voltmeter and ammeter using DC potentiometer, volt ratio box, Self balancing potentiometer, Alternating current (AC) potentiometers and their applications.

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.

MAGNETIC MEASUREMENTS: Flux meter, B-H Curve, Hysteresis loop, Permeameters, AC Testing of Magnetic materials, Separation of iron losses, iron loss measurement by Wattmeter and Bridge methods.

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.

BOOKS RECOMMENDED:

- 6. Bell David A., Electronics Instrumentation and Measurements, Prentice Hall, India
- 7. Golding Edward William and Widdis Frederick Charles, *Electrical Measurements and Measuring instruments*, Wheelers India
- 8. Helfrick A.D. and Cooper W.D., Modern *Electronic Instrumentation. and Measurement Techniques*, Prentice Hall
- 9. Murthy D. V. S., Transducers and Instrumentation, Prentice-Hall, India
- 10. Sawhney A. K., A Course in Electrical and Electronics Measurement and Instrumentation., Dhanpat Rai and Sons.

BTEE-605A COMPUTER AIDED ELECTRICAL MACHINE DESIGN

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

Review of Magnetic and insulating materials.

Principles of design of Machines: Factors and limitations in design, specific magnetic and electric loadings, output, real and apparent flux densities, separation of main dimensions for D.C., induction and synchronous machines.

Heating, Cooling and Ventilation: Temperature rise calculation, continuous, short time and intermittent ratings, types of ventilation, hydrogen cooling and its advantages.

Design of Transformers: General considerations, output equation, main dimensions, leakage reactance, winding design, tank and cooling tubes, calculation of magnetizing current, losses, efficiency and regulation.

Design Three-phase induction motors: General considerations, output equation, choice of specific electric and magnetic loadings, No. of slots in stator and rotor, elimination of harmonic torques, design of stator and rotor windings, leakage reactance, equivalent resistance of squirrel cage rotor, magnetizing current, temperature rise and efficiency.

Introduction to computer aided electrical machine design.

BOOKS RECOMMENDED:

- 1. Sawhney A.K., A Course in Electrical Machine Design, Dhanpat Rai.
- 2. Aggarwal R.K., Principles of Electrical Machine Design, S. K. Kataria and Sons.
- 3. Deshpande M.V., *Design And Testing of Electrical Machines* PHI Learning Pvt. Ltd.
- 4. Upadhyay K.G., *Design of Electrical Machine*, New Age International.
- 5. Hamdi Essam S., *Design of small electrical machines*, Wiley publications

BTEE-605B FLEXIBLE AC TRANSMISSION SYSTEMS

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

Total Marks: 100

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.

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

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.

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

Unified Power Flow Controllers (UPFC): Basic operating principles and characteristics, control UPFC installation applications, UPFC model for power flow studies.

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.

Transmission line steady State Operation: Lossless Transmission lines, Maximum Power Flow, Line loadability, reactive compensation techniques. Congestion management on transmission lines using FACT devices.

RECOMMENDED 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., *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-605C INSTRUMENTATION IN POWER SYSTEM

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

Total Marks: 100

Introduction: Measurement of electrical quantities, Active and reactive power in power plants, Energy meters, Instrument transformers and their transient response.

Instrumentation Techniques: Telemetry, Remote Control, remote signaling and supervisory control and data acquisition (SCADA), signal formation, conversion and transmission.

Signal Transmission Techniques: Analog pulse and digital modulation, Amplitude modulation(AM) and Frequency modulation (FM), AM and FM Transmitter and Receiver, Phase Modulation, Pulse modulation, Digital transmission techniques, error detection and correction.

Telemetry: Telemetry errors, DC, pulse and digital telemetry methods and systems.

Supervisory Control and Data Acquisition: Function of SCADA system remote terminal unit (RTU) details, Control center details, Communication between control centers, control center and remote terminal unit.

Power Plant Instrumentation: Hydroelectric power plant instrumentation, Thermal power plant instrumentation, Nuclear Power plant Instrumentation. Applications of SCADA system to Indian Power Systems.

RECOMMENDED BOOKS:

- 1. Cegrell, T., Power System Control Technology, Prentice-Hall of India Private Limited (2001).
- 2. Lindsley, D.M., Power Plant Control and Instrumentation, IEEE Press (2000).
- 3. Jarvis, E.W., *Modern Power Station Practice: Control and Instrumentation (Vol. F)*, British Electricity International (1980).

BTEE-605D BIOMEDICAL INSTRUMENTATION

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

Total Marks: 100

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.

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

characteristics.

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.

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.

Equipment for effecting the human body: Stimulator, defibrillator, pacemaker, diathermy.

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

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

RECOMMENDED 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.
- 5. Geddes L.A., Barker L.E., *Principles of Applied Medical Instrumentation*, John Willey and Sons, 1968.

BTEE-605E PRINCIPLES OF COMMUNICATION SYSTEMS

Internal Marks: 40 L T F External Marks: 60 3 1 0

Total Marks: 100

Review of Communication Engineering: Introduction, amplitude modulation (AM), Frequency modulation (FM), their side bands, comparison, sampling theorem, different pulse modulation techniques- Pulse-amplitude modulation (PAM), Pulse width modulation (PWM), Pulse-position modulation (PPM) and Pulse-code modulation (PCM), frequency-division multiplexing (FDM), Time division multiplexing (TDM). Introduction to Fourier series and Fourier transform of periodic signals. Transfer functions and properties of practically realizable filters.

Radio Transmitters: Block diagram explanation of low and high level amplitude modulation (AM) transmitter, amplitude modulation broadcast transmitter, double sideband (DSB) transmitter, single sideband (SSB) transmitter and Independent sideband transmitter, block diagram and explanation of reactance tube and Armstrong Frequency modulation (FM) transmitters, Stereophonic FM broadcast transmitter.

Radio Receiver: Amplitude modulation diode detector, characteristics of radio receiver: sensitivity, selectivity, fidelity and image rejections, classification of radio receivers, Tuned radio frequency (TRF) receiver and super heterodyne receiver, block diagram explanation of amplitude modulation receiver, amplitude modulation receiver using Phase lock loop (PLL), double sideband and single sideband receiver, Independent sideband receiver, amplitude modulation broadcast receiver, noise in amplitude modulation systems, Frequency modulation detection, block diagram explanation of Frequency modulation receiver and stereophonic Frequency modulation broadcast receiver, noise in Frequency modulation systems.

Television Engineering: Principle of camera, introduction of picture tube, scanning, frame, field, sync video signal, vestigial sideband transmission, block diagram of Television (TV) receiver and working, Television (TV) transmitter.

RECOMMENDED BOOKS:

- 1. Mittal G. K., *Radio and TV Engineering*, Khanna Publishers
- 2. Kennedy, *Electronic communication system*, McGraw Hill
- 3. Gulati R. R., *Monochrome and colour TV*, Dhanpat Rai and Sons.
- 4. Taub and Schilling, *Principles of communications*, McGraw Hill

BTEE-605F MICROELECTRONICS TECHNOLOGY

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

Total Marks: 100

Introduction: Classification, Scale thick film, Thin film and hybrid integrated circuits, hybrid Integrated Circuit (IC) Fabrication and component design, resistor, capacitor, and inductor, Design and fabrication.

Monolithic Architecture: Process on silicon crystal, line growth, refining substrate slicing, Polishing, chemical vapour deposition, thermal oxidation, photolithography, diffusion, dopant impurities, diffusion system, ion implantation, metallization, isolation.

Monolithic Components: Bipolar IC process, Metal Oxide Silicon (MOS) IC process, Bipolar Junction Transistor (BJT) construction, diode instruction, Field Effect Transistor (FET) and MOS construction and resistor, capacitor, and inductor, op –amp and voltage regulator, design and fabrication.

Large Scale Integrated (LSI) Circuits: Brief introduction to LSI circuits, realizations of inter connection and realization of integrated elements.

Basic Very Large Scale Integrated (VLSI) Design: Basic MOS transistor and working, n-channel MOS and Complementary MOS (CMOS) fabrication, thermal aspects MOS and VLSI, some electric properties of MOS, design process, circuit component, system design and layout and scaling of MOS circuit, some application of VLSI circuit like Programmable Logic Array (PLA).

RECOMMENDED BOOKS:

- 1. Botkar K. R., Integrated Circuits Interfacing Techniques in Digital design, Khanna Publishers
- 2. Sze, *VLSI Design*, TMH
- 3. Gray Paul R., *Analog MOS IC Circuit Design*, IEEE Press.

BTEE-606 Laboratory-X (Power Electronics and Drives)

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

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

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

BTEE-607 Laboratory-XI (Power System-II)

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

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

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.

BTEC-608 Laboratory-XII (Micro controller and PLC)

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

Note: Atleast TEN experiments are to be performed in a semester. list of experiments is given below:

List of Experiments:

- 1. Study of 8051/8031 Micro-controller kits.
- 2. Write a program to add two numbers lying at two memory locations and display the result.
- 3. Write a program for multiplication of two numbers lying at memory location and display the result.
- 4. Write a program to check a number for being ODD or EVEN and show the result on display.
- 5. Write a program to split a byte in two nibbles and show the two nibbles on display.
- 6. Write a program to arrange TEN numbers stored in memory location in ascending and descending order.
- 7. Write a program to find a factorial of a given number.
- 8. Study of interrupt structure of 8051/8031 micro-controllers.
- 9. Write a program to show the use of INT0 and INT1.
- 10. Write a program of flashing LED connected to port 1 of the micro-controller.
- 11. Write a program to control a stepper motor in direction, speed and number of steps.
- 12. Write a program to control the speed of DC motor.
- 13. Implementation of different gates using PLC.
- 14. Implementation of DOL and star delta starter using PLC.
- 15. Implement basic logic operations, motor start and stop operation using
 - (i) Timers
 - (ii) Counters
- 16. Motor forward and reverse direction control using PLC.
- 17. Write and implement the LD control program for rack feeder.
- 18. Make a PLC based system for separating and fetching work pieces.
- 19. Make a PLC based control system for conveyor belt.
- 20. Implement a PLC based traffic light control.