Dr. Babasaheb Ambedkar Technological University, Lonere

Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No XXIX of 2014)
P.O. Lonere, Dist. Raigad, Pin 402 103,
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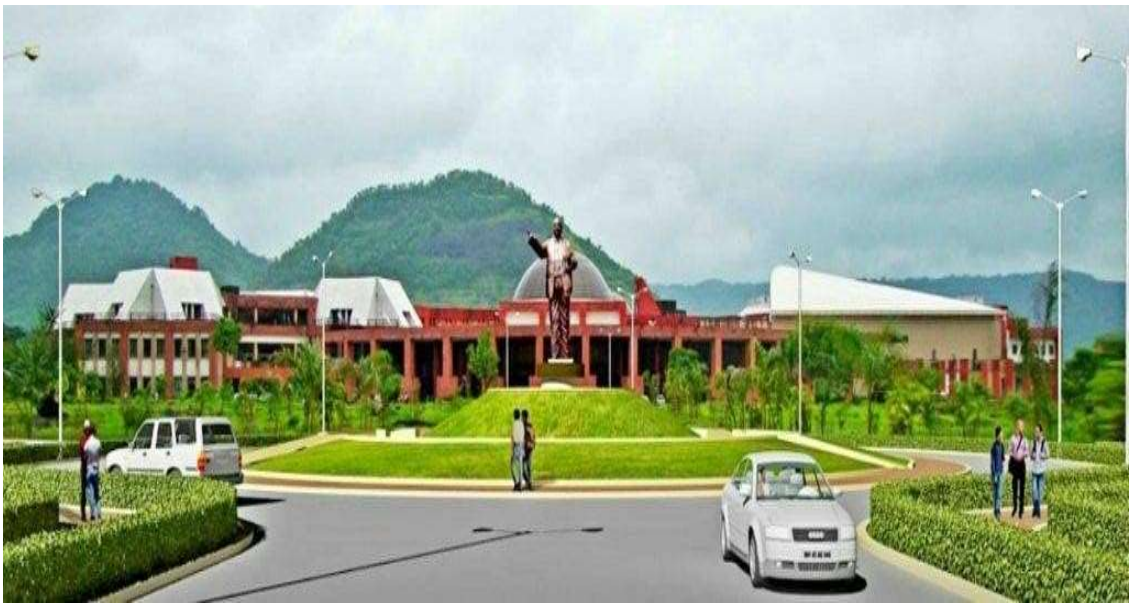
CURRICULUM

UNDERGRADUATEPROGRAMME

S. Y. B. Tech. (Electrical & Instrumentation Engineering)

With effect from the Academic Year2021-2022



DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

B. Tech in Electrical and Instrumentation Engineering
Curriculum for Second Year

Semester III										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
BSC	BTBS301	Engineering Mathematics – III	3	1	-	20	20	60	100	4
PCC 1	BTEIC302	**Network Theory**	3	1	-	20	20	60	100	4
PCC 2	BTEIC303	Sensor and Transducer	3	1	-	20	20	60	100	4
ESC	BTEIES304	Engineering Material Science	3	1	-	20	20	60	100	4
LC	BTEIL305	**Network Theory Lab**	-	-	2	60	-	40	100	1
LC	BTEIL306	Sensor and Transducer Lab	-	-	2	60	-	40	100	1
Seminar	BTEIS307	Seminar I	-	-	4	60	-	40	100	2
Internship	BTEIS211P	Internship – 1 Evaluation	-	-	-	-	-	50	50	1
		Total	**12**	**4**	**8**	**260**	**80**	**410**	**750**	**21**
Semester IV										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 1	BTEIC401	**Electrical and Electronics Measurements**	3	1	-	20	20	60	100	4
PCC 2	BTEIC402	Power System	3	1	-	20	20	60	100	4
HSSMC	BTHM403	Basic Human Rights	4	-	-	20	20	60	100	4
BSC	BTEIBS404	Instrumentation System Components	3	1	-	20	20	60	100	4
PEC 1	BTEIPE405	Group A	3	1	-	20	20	60	100	4
LC	BTEIL406	**Electrical and Electronics Measurement Lab**	-	-	2	60	-	40	100	1
LC	BTEIL407	Power System Lab	-	-	2	60	-	40	100	1
Seminar	BTEIM408	Mini Project I	-	-	4	60	-	40	100	2
Internship	BTEIP409	Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time).	-	-	-	-	-	-	-	Credits To be evaluated in V Sem.
		Total	**16**	**4**	**8**	**220**	**100**	**380**	**700**	**24**

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course
PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
HSSMC = Humanities and Social Science including Management Courses

- **Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject. Seminar based on Technical or communication skills. Mini Project either software based, hardware based on basic knowledge of subject.**

Group A [Sem- IV] (Professional Elective)

Sr. No.	Course Code	Course Title
01	BTEIPE405 A	Advanced Renewable Energy Sources
02	BTEIPE405 B	Automatic Control System
03	BTEIPE405 C	Industrial Electronics

Second Year B. Tech Classes (Common to all Branches)

Subject with code : Engineering Mathematics III (BTBS 301) **Semester: III**

Teaching Scheme	**Examination Scheme**
Theory : 03 Hrs/Week	Mid-term Test : 20 Marks
Tutorial : 01 Hr/Week	Internal Assessment: 20 Marks
Credits: 04	End Semester Exam: 60 Marks
	Duration: 03 Hrs.

Course Contents:

Unit 1: Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

[09 Hours]

Unit 2: Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

[09 Hours]

Unit 3: Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

[09 Hours]

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\text{i. e } \frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and one dimensional wave equation (i.e. $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$).

[09 Hours]

Unit 5: Functions of Complex Variables

Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs). **[09 Hours]**

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.
3. A course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

Reference Books

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and their Engineering Applications by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , New York.

BTEIC302 NETWORK THEORY 04 Credits

Unit 1: Active & Passive Circuit Element **7 Hours**

Independent & dependent voltage & current sources, R, L, C, self and mutual inductance circuit parameters, Their mathematical models, Voltage- current- power relations, Independent voltage and current sources, dependent sources, Source transformation, star-delta conversion.

Classification of element: Lumped and distributed, Linear and non-linear, Unilateral and Bilateral, Time invariant and variant.

Unit 2: Network theorems **7 Hours**

Kirchhoff‘s laws (KCL and KVL), Mesh analysis, nodal analysis, super node and super mesh analysis, Superposition theorem, Thevenin‘s theorem, Norton‘s theorem, Reciprocity theorem, Maximum power transfer theorem, Substitution theorem, Millman‘s Theorem, Tellegen's theorem for D.C and A.C. circuits.

Graph Theory: Network topology, graph, Tree, Branches, Chords, incidence, cut set and tie set matrix using network topology, Concept of duality & dual networks.

Unit 3: Transient Response Analysis in circuit **7 Hours**

initial and final condition of circuit, procedure for evaluating initial conditions, solution of first and Second order differential equations of series & parallel R-L, R-C, R-L-C circuits, Time constant, General & particular solutions, Particular integral & complimentary functions, Solution of D.C. resistive network, writing loop equations, Node equations directly in matrices form. Numerical

Unit 4: Application of Laplace’s Transform **7 Hours**

standard test input signal- Unit step, Impulse & ramp functions and their Laplace transform, Solution of differential equation using Laplace transform, solve of R-L, R-C, R-L-C circuits using Laplace transform, Transient and steady state response of RL and RC circuit to various functions using laplace transform.

Two port network: Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets.

Unit 5: Sinusoidal Steady State A. C. Circuit **12 Hours**

R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC & VL, Magnification, Bandwidth, Q factor.

Parallel Resonance: Resonance frequency for tank circuit frequency, Locus diagram of series R-L, R-C with variable R & X. Filter: Introduction classification, Low pass, High pass, Band pass & band reject filter, active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms. Active & Passive Circuit Element: Independent & dependent voltage & current sources, R, L, C, self and mutual inductance circuit parameters, Their mathematical models, Voltage- current- power relations, Independent voltage and current sources, dependent sources, Source transformation, star-delta conversion.

Classification of element: Lumped and distributed, Linear and non-linear, Unilateral and Bilateral, Time invariant and variant

Text/Reference Books

1. N Balabanian and T.A. Bickart, Linear Network Theory: Analysis, Properties, Design and Synthesis, Matrix Publishers, Inc. 1981.
2. L.O. Chua, C.A. Desoer, E.S. Kuh, Linear and Nonlinear Circuits, McGraw - Hill International Edition 1987.
3. Van Valkenburg, –Network Analysis‖, Third Edition, 2009, Prentice Hall of India.
4. Sudhakar, A.Shyammohan, –Circuits and Network‖, Third Edition, 2006, Tata McGraw-Hill
5. D. Roy Choudhury, –Networks and systems‖ New Age International Publishers
6. Kelkar and Pandit, –Linear Network Theory‖, Pratibha Publication.
7. Mahmood Nahvi, Joseph AEdminister, –Schaum's Outline of Electric Circuits‖, 6th edition, Tata McGraw-Hill.

BTEIC303 SENSORS & TRANSDUCERS 4 Credits

Unit 1: Instrumentation System **7 Hours**

Definition of sensor and transducer, classification of transducers, performance characteristics, selection criteria, transducer specification, test and operating conditions, roll of sensors in industry.

Unit 2: Displacement, Force & Torque Measurement **7 Hours**

Linear Displacement: Resistive potentiometer, capacitive displacement transducer, LVDT, Hall Effect sensor. Rotary Displacement- Tachometer, rotary encoder, stroboscope, gyroscope. Force: Basic methods of force methods, Strain gauge. Torque: Inductive torque transducers, digital method & magneto strictive torsion transducer.

Unit 3: Temperature Measurement **7 Hours**

Temperature scales, classification of Temperature sensors, selection criteria of temperature sensors. Thermometers- classification & specification of thermometers. Resistive Temperature detectors: - Principle, types, configuration (2 wire, 3 wire & 4. wire), construction and working. Thermistor- Principle, types (NTC, PTC), construction & working, testing & applications. Thermocouples– Principle, Terminology (Thermo electric, See beck, Peltier effect), types (A,B,C,D,E,J,K,R,S,T) and characteristics, cold junction compensation methods. Pyrometers: Principle, construction & working of total radiation pyrometer and optical pyrometer, applications.

Unit 4: Flow Measurement **7 Hours**

Properties of fluid, types of fluid flow, Reynolds number, continuity equation, Bernoulli's equation, and Selection criteria of flow sensors. Head Type Flow Meter- Orifice, venturi, nozzle, pitot tube. Variable Area Type Flow Meter: Rota-meter Open Channel: Turbine, Target, Electro Magnetic, Ultrasonic, Vortex Shedding, anemometers. Mass Flow Meter: Coriolis, Thermal & solid flow meters

Unit 5: Pressure and Level Measurement **10 Hours**

Pressure scales, classification, selection criteria of pressure sensors. Primary Pressure Sensors: Elastic elements- bourdon, diaphragm, bellows, types and properties, range and measurement, Non elastic : Manometer. Secondary/ Electrical Pressure sensors: Capacitive, LVDT,

photoelectric, Photo emissive-cell. Low Pressure- Mc-Leod gauge, pirani gauge, ionization gauge. High Pressure- Bridgeman type, Bulk modulus cell. Differential Pressure: Force balance, DP cell.

Level Measurement - Basic level measurement principals, Need for level measurement, types and classification, selection criteria for level sensors. capacitive, conductivity, Differential level sensor, Laser level sensor, microwave level switch, radar Laser, optical level devices, radiation level sensor, Ultrasonic level Detector. pH, Humidity and Vibration Measurement-pH : construction & working of pH sensor, temperature compensation. Humidity: Hygrometer (Hair, wire & electrolysis). Vibration: acceleration pick up, proximity probes.

Text Books/ Reference Books

1. C. S.Rangan ,G,R,Shrma , V.S.Mani - Instrumentation Devices and systems -TATA McGrawhill Publication.
2. A. J.Morris - Principles of measurement & Instrumentation - PHI Publication.
3. D.V.S Murthy : Transduers and Instrumentation - PHI Publication.
4. A.K.Ghosh - Introduction to Instrumentation and control - PHI Publication.
5. Sabric Soloman - Sensors and control systems in manufacturing -TATA McGrawHill Publication.
6. Nakra Chaudhry: Instrumentation measurement and analysis
7. A.K.Sawhney : Electrical and Electronic measurement and instrument
8. D.Patrick, Fardo- Industrial Process Control System- Thomson learning Inc.
9. E.O.Doebelin : - Measurement system application and Design IV edition.
10. Patranabis - principle of industrial instrumentation.
11. B.G.Liptak - Process measurement and analysis (Hand book).

BTEIES304 ENGINEERING MATERIAL SCIENCE 4 Credits

Unit 1: Electrical Conduction **7 Hours**

Electronic and Ionic Conduction , Conductivity in Metals , Ohm‘s Law , Relaxation Time, Collision Time , Mean Free Path of an Electron , Electron Scattering , Resistivity of Metals , Effect of Temperature and Impurity on Conductivity, Joule‘s Law , High Conductivity And Resistivity Materials , Superconductivity and Applications Conducting materials: quantum free electron theory- Fermi-Dirac distribution - Materials for electric resistances.

Unit 2: Dielectric Materials **7 Hours**

Introduction, Fundamentals, Atomic bonding, Crystalline structure-perfection/imperfection, phase diagrams, diffusion in solids, phase transformations; Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics.

Polarization of Dielectrics: Polar and Non-Polar Dielectrics, Basic Concept of Polarization, Types of Polarization, Dielectric Constant, Internal Field in Dielectrics Ferroelectric, Spontaneous Polarization, Curie-Weiss Law, Piezoelectric and Pyro electric , Dielectric Loss , Breakdown in Dielectrics, , Ionic Polarization , Frequency Dependence of Electronic Polarization

Unit 3: Magnetic Materials **7 Hours**

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. factors effecting permeability and hysteresis, Ferromagnetic materials, properties of ferromagnetic materials in static fields, curie point, anti-ferromagnetic materials, piezoelectric materials ,pyro electric materials

Magnetic Properties of Materials: Atomic Interpretation of Diamagnetic, Paramagnetic, Anti-Ferromagnetic and Ferromagnetic Materials. Ferromagnetic Domain, Magnetic Materials for Ferromagnetic Tape and Memory Devices 32 Magnetic materials: magnetic materials used in electrical machines instruments.

Unit 4: Semiconductor Materials **7 Hours**

Semiconductors: Mechanism of conduction in semiconductors. Properties of semiconductors, Silicon wafers, integration techniques, Large and very large-scale integration techniques (VLSI). **Properties of Semiconductors**: Electron-hole concentration, Fermi level, Generation and recombination, carrier life-time, diffusion length. Scattering and mobility of carriers. Einstein relation. LASER Plain carbon steels and their applications. Alloy steels: High speed steels, stainless steels, HSLA; Non-Ferrous alloys: Al alloys, Cu alloys, applications of these alloys,

Unit 5: Insulating materials and Special Purpose Materials **10 Hours**

Gaseous materials-Oxide gases, electronegative gases, hydrocarbon gases; Liquid materials-mineral oils, silicon liquids, hydrocarbon liquids; Solid materials-Paper and boards, Resins (Polymers), Rubbers-natural and synthetic, glass, ceramics, asbestos. Hybrid composites. Ceramics: Different ceramics available, Properties of ceramics, Crystal structure, Overview of Ceramic Applications, Processing of ceramics, Densification and sintering.

Refractory Materials, Structural Material‘s, Radioactive Materials, Galvanization and Impregnation of materials, Mechanical Characterization: Tension test, Fatigue test, Creep test, Hardness, Impact Tests, Fracture of materials, Modes of fracture. Non Destructive Testing: Ultrasonic Radiography, X-ray diffraction, Crystal Structure, Bragg‘s law.

Text Books/ Reference Books

1. Material Science and Engineering – V. Raghavan
2. Electrical Engineering Materials – A.J. Dekker
3. Science of Engineering Materials and Carbon Nanotubes - C.M. Srivastava and C. Srinivasan
4. Solid State Physics – A.J. Dekker

SEMESTER IV

BTEIC401 ELECTRICAL & ELECTRONICS MEASUREMENT 4 Credits

Unit 1: Philosophy of Measurement **7 Hours**

Basics of Measurement and Instrumentation, Instrument Examples: and Current Measurements; Theory, calibration, application, Errors and compensation. Static and dynamic characteristics of instruments. Different types of instruments. Operating forces required for working of indicating instruments. Different types of damping and control systems. Standards of Measurement & Errors, Voltmeter, Ammeter, Multimeter Wattmeter and Energy meter. Power and Energy Measurement and its errors, AC/DC Potentiometers. Loading effect of instrument. Measurement errors. - D'Arsonval Galvanometer - Direct Deflecting Instruments - Measurement of Current, Voltage and resistance – Insulation Resistance, Earth Resistance, Earth Tester Localization of Cable Fault Introduction of signals, Measurement and instruments, Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators

Unit 2: Analog Measurement of Electrical Quantities: **7 Hours**

Construction and working principles of PMMC, MI, Induction type, Electrodynamometer type, their applications advantages and disadvantages

Measurement of low, high and medium resistances. Measurement of power and energy in single phase and poly-phase circuits. Power factor meter, maximum demand indicator, tri-vector meter. Measurement of Power and energy: Dynamometer Type Wattmeter -Current transformer and potential transformer: -DC Potentiometers –A.C. Potentiometers Power and Power Factor, Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase, Measurement in three phase. Dynamic behavior of Galvanometer - equation of motion for different damping conditions. Response of galvanometer, operational constants, CDRX, relative damping, logarithmic decrement, sensibility. Ballistic Galvanometer and Flux meter construction and theory of operation. Methods of correction, LPF wattmeter, Phantom loading, Induction type KWH meter; Calibration of wattmeter, energy meter. Potentiometer and Instrument Transformer Instrument transformers (CT, PT):

Unit 3: A.C. & D.C bridges **7 Hours**

Measurement of inductance and capacitance. A.C. Bridges - Magnetic Measurements: Ballistic Galvanometer Flux Meter- Magnetic potentiometer- Hall effect devices Measurement of resistance, Wheatstone Bridge, Kelvin‘s Bridge, Kelvin‘s Double Bridge, Measurement of inductance, Capacitance, Maxwell‘s Bridge, Desauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Magnetic measurements, types of tests, Ballistic tests, measurement of flux density, determination of B.H. curve Measurement of resistance (law) by kelvins Double Bridge Method, insulation resistance by loss of charge method. A.C. & D.C. bridges - Maxwell‘s commutated D.C. bridge, Anderson bridge, Schering Bridge, Hays Bridge, Wagner Earthing device, Campbell‘s Mutual Inductance Bridge, Circuit diagram, phasor diagram, derivations of equations for unknown, O-factor, dissipation factor. Advantages and disadvantages. Measurement of low, medium and high resistances, insulation resistance measurement

Unit 4: Digital Measurement of Electrical Quantities **7 Hours**

Magnetic Measurements: Ballistic Galvanometer Flux Meter- Magnetic potentiometer- Hall effect devices- Hibbert‘s Magnetic Standard - Core Loss Measurement Spectrum & Wave analyzer. Digital counter, frequency meter, voltmeter, multimeter and storage oscilloscope.

Unit 5: Transducers and Digital signal processing **10 Hours**

classification & selection of transducers, strain gauges, inductive & capacitive transducers, piezoelectric thermistors, thermocouples, photo-diodes & photo-transistors, LVDT, RVDT Instrumentation amplifier, encoder type digital transducers, Signal conditioning and telemetry, basic concepts of smart sensors and applications. Data Acquisition Systems. Optoelectronic Measurement, Instruments for Generation and Analysis of Waveform, Signal Analyzers, High Frequency Measurements, Signal Conditioning, Data Acquisition Systems.

Digital signal processing-Telemetry systems, Microprocessor based basic power measurement and data acquisition systems. Oscilloscopes, spectrum analyzer, virtual instrumentation. Digital storage device, Signal conditioning and telemetry, basic concepts of smart sensors and applications. Digital Instrumentation. (DSO) Cathode Ray Oscilloscope (CRO)

Text/ Reference Books

1. Cooper W. D. and Helfrick A. D, –Modern Electronic Instrumentation and Measurement Techniques‖, Pearson Education.

2. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill.

3. Anand M. M. S., –Electronic Instruments and Instrumentation Technology‖, Pearson Education.

4. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai.

5. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books

H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill.

BTEIC402 POWER SYSTEM 4 Credits

Unit 1: Introduction **7 Hours**

Evolution of Power Systems, Typical Layout of an Electrical Power System–Present Power Scenario in India. Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. General layout, turbines, alternators, excitation system, governing system, efficiency. Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

Unit 2: Economics of Generation **7 Hours**

Introduction, definition of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer. Economic operation of power systems – economic dispatch of generation, unit commitment, automatic generation control, and frequency control

A.C. Distribution- Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation, Substation arrangements, Grounding in power systems.

Unit 3: Mechanical Design of Overhead Lines **7 Hours**

General consideration, Line supports, Span conductor configuration, spacing and clearances, sag and tension calculations, Conductor vibration. Overhead Line Insulators - Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators. , string efficiency, methods to improve string efficiency. Insulated Cables- Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables. Underground Cables**:** Insulator materials; Construction of single core and three core cables; classification of cables and their construction; laying of cables.

Unit 4: Inductance and Capacitance Calculations of Transmission Lines **7 Hours**

Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, concept of GMD and GMR, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance. Skin effect, proximity

effect

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines. Electromagnetic Induction, Electro Static induction, Reduction of interference.

Unit 5: Performance analysis and Reactive Power Control 10 Hours

Transmission line for power system analysis. Transmission lines lumped and distributed parameter models. Steady state operation Short, medium and long line models of transmission lines, nominal T/π network, ABCD parameters, surge impedance, Ferranti effect, power flow through a transmission line. Reactive Power Control- Real and reactive power flow on a transmission line, Single line diagram and per unit system. Line parameters and their calculations, Transmission line performance and analysis.

Text/Reference Books

1. W.D. Stevenson Jr.,Elements of power system analysis, McGraw-Hill publications,3rd Edition
2. I.J. Nagrath, D. P. Kothari, Power System Engineering, Tata McGraw-Hill publications,2008.
3. Prabha Kundur, Power System Analysis and Control, TMH, 2008
4. O. I. Elgerd, Electric Energy Systems Theory, McGraw-Hill publications 1971
5. John J Grainger, W.D. Stevenson, Power System Analysis, McGraw-Hill (India) Pub. , 2003
6. Hadi Saadat, Power System Analysis , TMH , 2002.

BTEIBS404 INSTRUMENTATION SYSTEM COMPONENTS 4 Credits

Unit 1: Industrial control devices **10 Hours**

Switches: Construction, types, symbolic representation, working and applications- toggle switch, slide switch, DIP switch, Rotary switch, thumbwheel switch, selector switch, push button, limit switch, temperature switch, pressure switch, level switch, flow switch. Photoelectric switch, Indicators & displays.

Relays: Types, working, specification/selection criteria and applications of electro-mechanical relay, reed relay, solid state relay. Contactors: Types, working, specification and applications, concepts of sequencing & interlocking.

Unit 2: Pneumatics and Hydraulics **10 Hours**

Pneumatic components. -Standards and symbols, Source of pneumatic power-Compressor, Filter regulation lubrication (FRL) Unit, Air receiver, Actuators-Rotary, Linear, Control Valves for pressure, flow and direction, Time delay valve, typical pneumatic circuits. Hydraulic components,: Standards and symbols, Hydraulic power pack, Hydraulic pumps, Actuator(Cylinder & motors),Control Valves, Hydraulic servo mechanism, Typical Hydraulic circuits

Unit 3: Transmitters **7 Hours**

Need of transmitter (concepts of field area and control room area), need for standardization of signal, current, voltage and pneumatic signal standards, concepts of line and dead zone. Converter: Working & Specifications of I/P and P/I converter, Span and zero adjustment.

Unit 4: Control Valve **7 Hours**

Necessity and comparison, final control elements, classification of control valve based on valve body, construction, type of actuation and application. Construction Advantages, disadvantages and application of globe: single, double, 3 way angle, gate, needle, diaphragm, rotary valve.

Unit 5: Auxiliary Components: **7 Hours**

Construction, working and applications of damper, alarm annunciater, square root extractor, high/low selector, flow totalizer, seals,

Electronic components and specifications: Fixed & Variable Resistors, capacitors, inductors, Transformer, Connectors, power supplies, batteries & relays. Safety measures, Hazardous area

classification and standards.

Text/Reference Books

1. Industrial Electronics – Petruzella
2. Industrial Hydraulics - Pipenzer
3. Pneumatic controls - Joji P , WIPL
4. Eton (VICKER‘S) Manual.
5. Process Control – Instrumentation Engineer Handbook – B.G. Liptak
6. Process Control & Instrumentation Technology – C. D. Johnson
7. Instrument Technology – E.B. Jones
8. Control system component center : Technical co-ordination
9. Manuals Pneumatics – Festo Didactic
10. Manuals Hydraulic – Festo Didactic

BTEIPE405A ADVANCED RENEWABLE ENERGY SOURCES 4 Credits

Unit 1: Introduction **7 Hours**

Renewable Sources of Energy- Introduction to renewable energy, various aspects of energy conversion, principle of renewable energy systems, Grid-Supplied Electricity-Distributed Generation- Renewable Energy Economics-Calculation of Electricity Generation Costs – Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems. Fuel Cells: The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues-Constructional Features of Proton Exchange-Membrane Fuel Cells –Reformers-Electrolyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit-Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

Unit 2: Wind Power Plants **7 Hours**

Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Appropriate Location -Evaluation of Wind Intensity -Topography -Purpose of the Energy Generated -General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines -Drag Turbines -Lifting Turbines-Generators and Speed Control used in Wind Power Energy -Analysis of Small Generating Systems. Aerodynamics of wind turbine rotor, site selection, wind resource assessment, wind energy conversion devices: classification, characteristics, and applications. Hybrid systems, safety and environmental aspects.

Unit 3: Photovoltaic Power Plants **7 Hours**

Solar Energy-Generation of Electricity by Photovoltaic Effect -Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics-Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems-Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy. environment and social implications Solar Energy: Solar radiation its measurements and prediction, solar thermal flat plate collectors, concentrating collectors, applications, heating, cooling, desalination, power generation, drying, cooking etc, principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, and water pumping, power generation schemes.

Unit 4: Bio-Energy **7 Hours**

Biomass resources and their classification, chemical constituents and physicochemical characteristics of biomass, biomass conversion processes, thermo chemical conversion: direct combustion, gasification, pyrolysis and liquefaction. Biochemical conversion: anaerobic digestion, alcohol production from biomass. Chemical conversion process: hydrolysis and hydrogenation. Biogas: generation, types of Biogas Plants, applications Storage Systems - Energy Storage Parameters-Lead–Acid Batteries-Ultra Capacitors-Flywheels -Superconducting Magnetic Storage System-Pumped Hydroelectric Energy Storage - Compressed Air Energy Storage -Storage Heat -Energy Storage as an Economic Resource.

Unit 5: Induction Generators, Interconnection of Plants 10 Hours Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated- Self-Excited Induction Generator-Magnetizing Curves and Self-Excitation-Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation -Speed and Voltage Control - Economical Aspects.

Integration- Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach-Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection. Interconnection Technologies - Standards and Codes for Interconnection-Interconnection Considerations - Interconnection Examples for Alternative Energy Sources.

Text/Reference Books

1. Rao and Parulekar, Energy Technology, Khanna Publishers, New Delhi, Second reprint 2002
2. G.D Rai, Non-conventional Energy Sources, Khanna Publishers, New Delhi, tenth reprint 2002
3. C. S. Solanki, –Solar Photovoltaic Fundamentals, Technologies and Applications‖, PHI, 2011
4. B. H. Khan, –Non-conventional Energy Resources‖, Tata Mc Graw hill Publishing Co. Ltd., 2006
5. S.P. Sukhatme, J.K. Nayak, –Solar Energy-Principals of Thermal Collection and Storage,‖, Tata Mc Graw hill Publishing Co. Ltd., New Delhi 2008
6. J. Twidell and T. Weir, –Renewable Energy Resources‖, E & F N Spon Ltd, London, 1999
7. Thomas Ackermann, –Wind Power in Power System‖, John Willey &Sons, 2005

BTEIPE405B AUTOMATIC CONTROL SYSTEM 4Credits

Unit 1: Introduction **7 Hours**

Definition. Elements of control systems, examples of control systems, open loop and closed loop control systems, linear Vs Non-Linear control system, SISO and MIMO system, continuous and sampled data control.

Unit 2: Mathematical Modeling and system Representation

Differential equations of physical systems such as Mechanical, Electrical, electromechanical, thermal, hydraulic, pneumatic, liquid level etc. Analogous systems, Force voltage analogy, force current analogy and torque current analogy, Transfer function, block diagram representation of control system, rules and reduction techniques. Signal flow graph-elements, definitions, properties, mason's gain formula, application of gain formula to block diagram.

Unit 3: Time domain analysis **7 Hours**

Standard test signals, transient response, steady state error and error constants. Time response of first order systems to unit and ramp input. Second order systems to unit step input, transient response specifications. Effect of adding poles & zeros to transfer function, dominant poles of transfer function. Time domain analysis using MATLAB. Introduction to MATLAB, Control system toolbox.

Unit 4: Root - Locus Technique **7 Hours**

Introduction, Basic properties of the root loci, general rules for construction of root loci . Sensitivity of the roots of the characteristics equation. , Root — locus analysis of control system using MATLAB.

Unit 5: Frequency domain analysis and Stability Analysis **10 Hours**

Concept of frequency response, performance specifications, co-relation between time domain and frequency domain responses. Frequency response plots- polar plots, Bode plots, gain margin, phase margin. Effect of gain variation, adding poles /zero on Bode plot .Frequency response analysis using MATLAB. **Stability Analysis-** Concept of stability, definition, condition for stability, relative stability, Routh - HURWITZ criterion. Nyquist stability criterion, Stability analysis using MATLAB.

Text/ Reference Books

1. Nise, Control systems Engineering - wse wiley publication
2. Ogatta, Modern Control Engineering - PHI Publication.
3. I.J.Nagrath and M.Gopal - Control systems Engineering.(New Edition)
4. S.C. Goya! and U.A.Bakshi - Principles of control systems
5. Hadi Saadat - Computational aids in control systems using MATLAB.
6. Kuo, Golnaraghi- Automatic Control System- WSE Willey Publication.
7. Rudra pratap –MATLAB

BTEIPE405C INDUSTRIAL ELECTRONICS 4 Credits

Unit 1: Transistor **7 Hours**

Transistor biasing, Analysis of common emitter, common collector and common base configurations- voltage and current gain, input and output impedance Classification of power amplifiers, Class A, Class B, Class AB, Class C, Applications of Amplifiers,

Unit 2: Operational Amplifiers **7 Hours**

Op-Amp parameters, frequency response, effect of temperature on Op-Amp parameters, differential versus single input amplifiers, instrumentation amplifier, bridge amplifier, adding versatility to the bridge amplifier, differentiator, integrator, Comparators, V to I and I to V Converters

Unit 3: Power devices **7 Hours**

SCR, Triac, DIAC, UJT, MOSFET, IGBT – Characteristic and principal of operation, Switching Characteristics.

Unit 4: Boolean algebra & Combinational Circuits **7 Hours**

Laws of Boolean algebra, De-Morgan‘s thermos. Relating a truth table to a Boolean expression. Combinational Circuits: K-Maps and their use in simplifying Boolean Expressions, min-term, max-term SOP & POS implementation. Implementing a logic function using universal gates.

Unit 5: Combinational and Sequential Logic Circuit Design **10 Hours**

Half subtraction, Full subtraction, Parallel Binary adders, BCD Adders, Parity Bit generating, Comparators, Multiplexer, De-multiplexer, encoder, Line Decoder (3 TO 8) 8421**,** designing using multiplexer, de-multiplexers, decoders. IC‘s of MUX, DEMUX, Decoders. Hazardous in combinational circuits. Sequential Logic Design-Flip flops, Counters, Shift registers, state machines

Text/ Reference Books

1. Integrated Electronics :- milluass Hall :- TATA McGraw Hill.
2. Pulse Digital & Switching waveforms :- Jacob Millman & Hilbert TATA McGraw Hill.
3. Electronic Devices & Circuit theory :- Boylestead Nashad.
4. Electronic Devices & Circuit theory :- M.Allen Mottershed

5. Applied Electronics :- R.S. Shreedhar.
6. Principles of Electronics :- V.K. Mehta.
7. Malvino leach, Digital Principles & electronics , TMH
8. A. Anand Kumar, Fundamental of Digital Circuit , PHI
9. Alan B Marcorits – Introduction to logic Design
10. Charles Roth – Fundamental & logic Design, Thomson
11. R.P. Jain – Modern Digital Electronics