B.Tech. (EE) : Syllabus Revision in 2017-18.

S.No	Course Code	Session 2016-17	Session 2017-18	Remark Syllabus Change/ new course
1	BT 101	**Engineering Physics-I** UNIT-I Atomic Structure and Solid State: Atomic energy levels and electronic configuration, Intermolecular forces and binding, phases of matter, crystal structure simple cubic , body centered cubic and face centered cubic structures, energy bands in solids , band structure of metals, semiconductors and insulators. UNIT-II Semiconductor Physics: Extrinsic and intrinsic semiconductors, Fermi levels of undoped and doped semiconductors, p-n junction, depletion region, forward and reverse biased p-n junction, volt-Ampere characteristics of a diode , effect of temperature on diode characteristics, Zener diode , tunnel diode, photodiode and LEDs , their structure and characteristics. UNIT-III Theory of Relativity : Absolute and relative frames of reference, Galilean transformations, importance of Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformations, time dilation and length contraction, velocity addition , mass-energy relationship, elementary ideas about general theory of relativity. UNIT-IV Elementary Quantum Mechanics: Wave particle duality, deBroglie	**ENGINEERING MATHEMATICS-I** Unit-I Differential Calculus: Asymptotes (Cartesian coordinates only), concavity, convexity and point of inflection, Curve tracing (Cartesian and standard Polar curves-Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral only). Unit-II Limit, continuity and differentiability of functions of two variables, Partial differentiation, Euler's theorem on homogeneous functions, change of variables, chain rule. Unit-III Taylor's theorem (two variables), approximate calculations, Jacobian, maxima & minima of two and more independent variables, Lagrange's method of multipliers. Unit-IV Integral Calculus: Double integral, change of order of integration, Double integral by changing into Polar form, Applications of Double integrals for evaluating areas & volumes, triple integral; Beta function and Gamma function (simple properties). Unit-V Vector Calculus: Scalar and vector field, differentiation & integration of vector functions: Gradient, Directional derivative, Tangent planes and Normals. Divergence, Curl and Differential Operator; Line, Surface and Volume integrals; Green's theorem in a plane, Gauss's and Stoke's theorem (without proof) and their applications.	**Syllabus change** **Title change** **Code change**

		waves, experimental evidence of wave nature of matter, Schrodinger wave equation in One dimension, eigen values and eigen functions, physical interpretation of wave function, Heisenberg uncertainty principle, tunneling phenomenon. UNIT-V Oscillation & Waves : Simple harmonic oscillator with example, energy of oscillator, Damping oscillator, viscous & solid friction damping, Qualityfactor, Resonance standing waves, elastic waves.		
2	**BT102**	**INTRODUCTION TO COMPUTER FUNDAMENTAL AND IT** **UNIT-I** **Computer System**: Basics of computer systems, history, types and Generation of computer, capability and limitations of computer systems. Hardware organization: Anatomy of a digital computer, CPU.Internal architecture of CPU.Memory Units: Memory Hierarchy, Primary Memory, Secondary Memory, cache memory. Storage Devices, Input and Output Devices. **UNIT-II** **Operating Systems**: DOS Internal, External commands, Windows (2000 and NT) , Overview of architecture of Windows, tools and system utilities including registry , partitioning of hard disk , Overview	**COMMUNICATION SKILLS** Unit-I Communication: Meaning, Importance and Cycle of Communication, Media and Types of Communication, Formal and Informal Channels of Communication, Barriers to Communication, Division of Human Communication and Methods to Improve Interpersonal Communication, Qualities of Good Communication. Unit-II Grammar: Passive Voice, Indirect Speech, Conditional Sentences, Modal Verbs, Linking Words. Unit-III Composition: Curriculum Vitae Writing, Business Letter Writing, Job Application Writing, Paragraph Writing, Report Writing. Unit-IV Short Stories: 'The Luncheon' by Somerset Maugham, 'How much Land does a Man Need?' by Leo Tolstoy, 'The Night Train at Deoli' by Ruskin Bond. Unit-V Poems: 'No Men are Foreign' by James Kirkup, 'If' by Rudyard Kipling, 'Where the Mind is without Fear' by Rabindranath Tagore.	**Syllabus change** **Title change** **Code change**

		of Linux architecture , File system , file and permissions , concept of user and group , installation of rpm and deb based packages. **UNIT-III** **Number system & Conversions:** decimal, binary, octal and hexadecimal number systems and their inter conversions, 1's and 2's complement representation, negative numbers and their representation, BCD, EBCDIC , ASCII and Unicode. Binary Arithmetic operations: addition, subtraction, multiplication, division. **UNIT-IV** **Networking Basics** - Uses of a Network and Common types of Networks, Network topologies and protocols, Network media and hardware, Overview of Database Management System. **UNIT-IV** **Data Processing:** Introduction to MS office, MS-Power Point and MS-Excel, Introduction to Electronic Spreadsheets, Applications of Electronic Spreadsheets, Types of Spreadsheets, Features of MS-Excel, Starting MS-Excel, Contents of the MS-Excel window, Cell Referencing, Ranges and Functions, Formatting Worksheets and Creating Charts, Data Forms and Printing		

		Introduction to MS-PowerPoint : Introduction to MS-PowerPoint, What is a Presentations?, Slides, Working with Slides, Slides Show and Printing Presentation		
3	**BT103**	**Applied Mathematics I** **UNIT-I** Functions of variables: Geometric representation, limit, continuity and differentiability of functions of several variables , partial and full derivatives, derivatives of composite functions, Euler's theorem on homogeneous functions, harmonic functions, directional derivatives, Taylor's formula, maxima and minima of functions, Lagrange's multipliers. **UNIT-II** Asymptotes and curvature: Rolle's Theorem, Cauchy's mean value theorem, Taylor and Maclaurin theorems, concavity and convexity of a curve, points of inflexion, asymptotes and curvature. **UNIT-III** Analytical functions: Limit, continuity and differentiability of analytic functions, Cauchy-Reimann equations, complex functions, line integrals, Cauchy's integral theorem, Cauchy's integral formula, power series, zeroes and singularity, residue theorem. **UNIT-IV** Integral calculus: Definite integral as	**ENGINEERING PHYSICS** Unit-I Interference of light: Michelson's Interferometer: Production of circular & straight line fringes; Determination of wavelength of light; Determination of wavelength separation of two nearby wavelengths. Optical technology: Elementary idea of anti-reflection coating and interference filters. Unit-II Diffraction and Polarization of light: Fraunhofer Diffraction at Single Slit. Diffraction grating: Construction, theory and spectrum; Determination of wavelength of light. Resolving power: Raleigh criterion; Resolving power of diffraction grating and telescope. Plane, circularly and elliptically polarized light on the basis of electric (light) vector: Malus law; Double Refraction; Phase retardation plates and their use in production and detection of circularly and elliptically polarized light; Optical activity and laws of optical rotation; specific rotation and its measurement using half-shade device. Unit-III Elements of Material Science: Bonding in solids; covalent bonding and Metallic bonding; Classification of solids as Insulators, Semiconductors and Conductors; X-Ray diffraction and Bragg's Law. Hall Effect: Theory, Hall Coefficient and applications. Unit-IV Quantum Mechanics: Compton effect & quantum nature of light; Derivation of time dependent and time independent Schrodinger's Wave Equation; Physical interpretation of wave function and its properties; boundary conditions; Particle in one dimensional box. Unit-V Coherence and Optical Fibers: Spatial and temporal coherence; Coherence length; Coherence time and 'Q' factor for light; Visibility as a measure of Coherence and spectral purity; Optical fiber as optical wave guide; Numerical aperture; Maximum angle of acceptance and applications of optical fiber.	**Syllabus change** **Code change**

		limit of sum, properties of definite integrals, mean value theorem, fundamental theorem, evaluation of definite integrals, reduction formula. **UNIT-V** Differential equations: Order and degree of a differential equation, general and particular solutions, solution of differential equations by separation of variables method, integrating factor method, homogeneous differential equations of first order and their solutions, solution of linear differential equation $dy/dx+f(x)y=Q(x)$ and their application in electrical, nuclear and mechanical systems.	Laser and Holography: Theory of laser action; Einstein's coefficients; Components of laser; Threshold conditions for laser action; Theory, Design and applications of He-Ne and semiconductor lasers; Holography versus photography, Basic theory of holography; basic requirement of a Holographic laboratory; Applications of Holography in microscopy and interferometry.	
4	**BT104**	**Introduction to Electrical and Electronic Engineering** **UNIT-I** **Basic Electrical Quantities:** Electromotive force, Electric Power ,Charge, current, voltage, Energy,Electric potential and field, magnetic flux,resistance, capacitance and inductance. Ohm's law, Voltage and current sources. **UNIT-II** **Network analysis:** Circuit principles, Kirchoff's Laws, Node Voltage and Mesh Current Analysis;Delta-Star and Star-Delta Transformation, Source Conversion. Classification of Network Elements, Superposition Theorem, Thevenin's Theorem.Norton Theorem.,MaximumPower Transfer Theorems. **UNIT-III**	**COMPUTER PROGRAMMING-I** **Unit-I** **Computer Fundamentals:** Flow chart, pseudocode. binary, octal and hexadecimal number system. ASCII, EBCDIC and UNICODE. boolean operations, **Unit-II** primary and secondary memory. Difference among low-level & high-level languages. **Unit-III** **C Programming:** Structure of a 'C' program, Data types, enumerated, assignment statements, input output statements, **Unit-IV** If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement. Datatype conversion. **Unit-V** Functions & program structure (function call and return), scope of variables, parameter passing methods, recursion v/s iteration.	**Syllabus change** **Title change** **Code change**

		AC circuits: Alternating Quanitities,Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3-Phase AC System.Power in a circuit, reactive power, power factor, impedance in ac circuit, series and parallel resonance, Q factor, Introduction to 3-Phase AC System. **UNIT-IV** **Transformers:** Faraday's Law of Electromagnetic Induction Basic principle of operation of transformer, construction, working, voltage and current relations, Phasor Diagram of Ideal Transformer.open circuit and short circuit test, transformer losses and efficiency, ferrite core transformers. **Electrical DC Machine:** Principle of DC Machines, Types, Different Parts ofDC Machines **UNIT-V** **Power Supplies:** Half wave, full wave and bridge rectifiers, ripple factor and reduction by use of inductor,capacitor, L and pie section filters, voltage regulation using Zener diode.		
5	**BT105**	**English and Communication Skills** **UNIT –I** Grammar and Vocabulary:	**ENVIRONMENTAL ENGINEERING AND DISASTER MANAGEMENT** Unit-I	**New Course**

		Basic sentence pattern, use of tense, modals, active and passive voice, Direct and Indirect Speech, One word substitution, Synonyms and Antonyms and Common Erros in English. **UNIT-II** Phonetics: IPA symbols, Correct pronunciation of commonly used words, sounds (vowel and consonants) **UNIT-III** Literature : Poetry : where the mind is without fear – Rabindra Nath Tagore, Mending wall – Robert Frost, Night of Scorpion – Nissim Ezekiel Essays: of studies: Francis Bascon, what is science? George Orwell. **UNIT-IV** Writing skills : Paragraph writing, Letter writing, covering letter and C.V., Writing E-mails. **UNIT-V** Fundamentals of Communication: (A) Communication: definition and meaning of communication, functions of communication, process of communication. (B) Types of communication: Verbal and Non verbal communication, Formal and informal communication. (C) Barriers to communication, qualities of good communication, the art of listening.	Basics of Environment: Environmental Pollution, Environmental Acts and Regulations, Ecosystem, Hydrological and chemical cycles, Energy flow in ecosystems. Biodiversity, population dynamics. Unit-II Water Pollution: Water pollutants, effects of oxygen demand, water quality in lakes, reservoirs and groundwater, contaminant transport, self cleaning capacity of streams and water bodies, water quality standards, Waste water management, Treatment & disposal of wastewater. Rain water harvesting: Reuse and saving in use of water, methods of rain water harvesting. Unit-III Solid Waste Management: Classification of solid waste, Collection, transportation, treatment, and disposal of solid waste. Economic recovery of solid waste. Sanitary landfill, on site sanitation. Energy interaction from solid waste. Unit-IV Air and Noise Pollution: Primary and Secondary air pollutants, Air Pollution, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful effects of noise pollution, control of noise pollution, Global warming, Acid rain, Ozone depletion, Green House effect Unit-V Natural Disasters: Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions. Man made Disasters: Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Study of recent major disasters. Disaster Management Cycle and its components. Disaster Management: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, technical terminology involved, impact and preventive measures.	
6	**BT106**	**Engineering Chemistry** **UNIT -I** **Water:** The sources of water,		**Syllabus change** **Code change**

		common Impurities, soft and hard water, Hardness of water, degrees of hardness and its effects, determination of hardness by various techniques, Municipal Water supply, requisites of drinking water, purification of water by sedimentation, filtration, reverse osmosis (RO), sterilization, chlorination. Water for boilers, corrosion, sludge and scale formation, caustic embitterment, treatment by preheating, lime-soda process, permutit de-ionizer or demineralization. **UNIT- II** **Electrochemistry:** Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion. **Analysis:** Volumetric Analysis, Types of titrations, Theory of indicators. **Spectral Analysis:** Electromagnetic radiation, Lambert-Beer's Law, UV-VIS, IR, NMR instrumentation & applications. **Thermal Methods of Analysis:** principle, working and applications of Thermogravimetry, Differential		

		thermal analysis and Differential scanning calorimetry. **UNIT- III** **Fuels:** The need of fuel, origin and classification of fuels, Solid fuels, coal and its constituents, calorific value and its determination, coke: carbonization process, various types of coke ovens. **Liquid Fuels:** advantages, petroleum and its refining, synthetic petrol, reforming of gasoline, knocking, octane number and anti knocking agents, cracking. Gaseous Fuels advantages, composition and calorific value of coal gas and oil gas and its determination. **Lubricants:** Need of Classification, types of lubricants, their properties and uses, lubricants, viscosity and viscosity index and flash points, cloud and pour point, emulsification **UNIT- IV** **Phase Rule:** Statement, definition of terms involved, application to one component system (water-sulphur system), two component systems (Ag-Pbsystems). **Polymers:** Plastics, preparation, properties and uses of polyethylene, bakelite, terylene and nylon, Rubber; natural rubber, synthetic rubber such as butyl and neoprene rubbers, vulcanization process and its advantages. **Corrosion:** its significance, theories of corrosion, Galvanic cell and concentration cell, pitting and stress corrosion, protection techniques. **UNIT-V**		

		Explosives: Introduction, classification of explosives, preparation of commercially important explosives, blasting fuses, uses and abuses of explosives. **Cement:** properties, Portland cement and its manufacture, chemistry of setting and hardening of cement, RCC structures. **Refractories:** definition, classification, properties of silica and fireclay refractories, **Glass:** preparation, properties and uses.		
7	**BT107**	**Electrical and Electronics Lab-I** **List of Experiments** 1. Identification, Study & Testing of various electronic components: (a) Resistances-Various types, Colour coding (b) Capacitors-Various types, Coding, (c) Inductors (d) Diodes (e) Transistors (f) SCRs (g) ICs (h) Photo diode (i) Photo transistor (j) LED (k) LDR (l) Potentiometers. 2. Study of symbols for various Electrical & Electronic Components, Devices, Circuit functions etc. 3. Study of Analog & digital multi-meters. 4. Study of Function/ Signal generators. 5. Study of Regulated d. c. power supplies (constant voltage and constant current operations). 6. Study of analog CRO, measurement of time period, amplitude and frequency.	**COMMUNICATION SKILLS LAB** 1. Phonetic Symbols and Transcriptions 2. Extempore 3. Group Discussion 4. Dialogue Writing 5. Listening Comprehension 6. Word Formation 7. Synonyms and Antonyms 8. Affixes (Note: Wherever appropriate, Language Lab Software is to be used to improve listening comprehension and speaking skills.)	**Syllabus change** **Title change** **Code change**

		7. Perform half wave rectifier experiment and effect of filters on output. 8. Perform bridge rectifier experiment and measure the effect of filter output. 9. Application of diode as clipper and clamper. 10. Soldering & desoldering practice.		
8	**BT108**	**Engineering Physics Lab-I** **List of Experiments** 1. To study the charging of a condenser to plot a graph of voltage (V) across it against time (T) and to determine the time constant from this graph 2. To study the discharging of a condenser to plot a graph of voltage (V) across it against time (T) and to determine the time constant from this graph. 3. To determine the specific resistance of a material and difference between two small resistances using "Carey Foster's Bridge ". 4. To determine band gap of a semiconductor- diode. 5. To study the Zener diode as a constant voltage regular. 6. To verify Malus Law (Cosine square law) for plane polarized light with the help of a Photo voltaic cell.	**ENGINEERING PHYSICS LAB** 1. To determine the wave length of monochromatic light with the help of Michelson's interferometer. 2. To determine the wave length of sodium light by Newton's Ring. 3. To determine the specific rotation of glucose (sugar) solution using polarimeter. 4. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer. 5. To study the variation of a semiconductor resistance with temperature and hence determine the band gap of the semi conductor in the form of reverse baised P-N junction diode. 6. To determine the height of water tank with the help of sextant. 7. To determine the dispersive power of material of a prim for violet and yellow colour's of mercury light with the help of spectrometer. 8. To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted. 9. To verify the expression for the resolving power of a Telescope. 10. To determine the coherence length and coherence time of laser using He – Ne laser. 11. To determine the specific resistance of the material of a wire by Carey Froster's bridge.	**Syllabus change**

		7. To determine the transmission coefficient by using Lummer Brodhum Photometer. 8. To determine minimum deviation angle for different light using prism and spectrometer. 9. To determine the profile of He -Ne Laser beam. 10. To study the variation of thermo e.m.f. of iron copper thermo couple with temperature. 11. To determine the wavelength of sodium light using Michelson Interferometer. 12. To determine the curie temperature of Monel metal 13. The determination of viscosity.		
9	**BT109**	**IT FUNDAMENTAL LAB** **LIST OF EXPERIMENTS** 1. Dismantling a PC Part -1. 2. Dismantling a PC Part -2. 3. Internal and External commands of DOS. 4. System utilities of windows. 5. Understanding and Working knowledge of Linux/Unix OS. 6. Understanding of File system of Linux. 7. Creating user and group. 8. Understanding and Working knowledge of MS Office, Power Point and Excel: Editing and Reviewing,	**COMPUTER PROGRAMMING LAB** The programs shall be developed in C language related with the following concepts: 1. Eight programs using input output statements, if statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, datatype conversion etc. 2. Check a number- palindrome, prime, etc. 3. Eight programs using functions. 4. Two programs using recursion and Iteration.	**Syllabus change** **Code change**

		Drawing, Tables, Graphs, Templates.		
10	**BT110**	**Engineering Chemistry Lab** **List of Experiments** 1. To determine the strength of a given unknown copper sulphate solution (Iodometrically) with titrate Hypo (sodium thio sulphate) solution. 2. To determine the strength of a given unknown FAS solution with titrate potassium dichromate solution using N-phenyl anthranilic acid (internal indicator). 3. To determine the strength of a given unknown potassium dichromate solution (Iodometrically) with titrate Hypo (sodium thio sulphate) solution. 4. Determine the percentage of available chlorine in a given sample of bleaching powder. 5. Determine the amount of free chlorine in a given water sample. 6. To determine the viscosity and viscosity index of a given sample of lubricating oil using Redwood viscometer No.1 7. To determine the flash and fire point of a given sample of lubricating oil using Pensky Marten's apparatus. 8. Determine the cloud and pour	**COMPUTER AIDED ENGINEERING GRAPHICS** 1.Projections of Point & Lines: Positions of Point, Notation system, systematic Approach for projections of points, Front view & Top view of point, Positions of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line Inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book) 2.Projections of planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both RPs, True shape of the plane, Distance of a point from plane, Angle between two planes (no drawing sheet required, only assignment in sketch book) 3.Projection of solids: Basic solids, Frustums and truncated solids, Positions of the solids, solid with Axis perpendicular to an RP, solid with axis inclined to one RP and parallel to the other solid with axis Inclined to Both the RPs Solid with Axis parallel to Both the RPs (One drawing sheet, one assignment in sketch book) 4.Section of solids: Theory of sectioning, section of prisms and cubes, sections of pyramids and Tetrahedron section of Cylinders, Section of cones, Section of spheres (One drawing sheet, one assignment in sketch book) 5.Development of surfaces: Methods of development, parallel line developments, Radial line Development, Anti- Development (One drawing sheet, one assignment in sketch book) 6.Isometric Projection: Principle of Isometric Projection Isometric scale, Isometric projections and Isometric Views, Isometric Views of standard shapes, Isometric views of standard solids (One drawing sheet, one assignment in sketch book) 7.Computer Aided Drafting: Introduction to CAD, Advantages of CAD software's, Auto CAD, Auto CAD Commands and tool bars, Creating the Drawing, Charging properties,	**Title change** **Code change**

		point of a given sample of lubricating oil. 9. Determination of hardness of water by complexometric method (using EDTA). 10. Determine the pH of an acid (strength of an acid) pH – metrically. 11. Determine the strength of a given unknown HCl solution by titrating it against NaOH solution (Conductometric analysis). 12. To estimation the amount of sodium hydroxide and sodium carbonate in the given alkali mixture solution (or in water sample) by titrating against an intermediate hydrochloric acid using phenolphthalein and methyl orange indicator.	Dimensioning other object, Text editing, Isometric drawing (Four assignments on the computer)	
11	**BT111**	**(Engineering workshop)** **FITTING AND SHEET METAL SHOP** 1. Finishing of two sides of a square piece by filing and to cut a Square notch using hacksaw. 2. To drill three holes and Tapping on the given specimen. 3. Tin smithy for making mechanical joint and soldering of joint **WELDING SHOP**	**MECHANICAL WORKSHOP PRACTICE** 1.Carpentry Shop: 1. T – Lap joint 2. Bridle joint 2. Foundry Shop: 1. Mould of any pattern 2. Casting of any simple pattern 3.Welding Shop: 1. Lap joint by gas welding 2. Butt joint by arc welding 3. Lap joint by arc welding 4. Demonstration of brazing, soldering & gas cutting 4.Machine Shop Practice: 1. Demonstration of various machine tools such as Lathe, Shaper, Milling, Grinding and Drilling 5.Fitting Shop 1. Finishing of two sides of a square piece by filing 2. Making mechanical joint and soldering of	**Title change**

		4. To prepare Lap Joint with the help of Arc welding 5. To prepare Butt Joint with the help of arc Welding 6. Gas welding practice by students on mild steel flat **MACHINE SHOP PRACTICE** 7. Job on lathe M/C with centering and one step turning 8. Job on lathe M/C with grooving and chamfering operations	joint on sheet metal 3. To cut a square notch using hacksaw and to drill a hole and tapping 6.Sheet Metal Shop Making of Funnel using sheet metal	
12	**BT201**	**Engineering Physics II** **UNIT-I** **Electric and Magnetic Fields** :Coulomb's law, Gauss's law, electrostatic potential and field due to discrete and continuous charge distributions, dipole and quadrupole moments, dielectric polarization, electrostatic energy, conductors and capacitors, Biot-Savart law, Ampere's law, magnetic induction due to current carrying conductors, force on a charged particle in electric and magnetic field, Faraday's law of electromagnetic induction. **UNIT-II** **Thermodynamics**: Work-Thermodynamic definition of work, examples, displacement work, path dependence of displacement work, thermal equilibrium, Zeroth law , definition of temperature, heat/work interaction systems , First law and its consequences, isothermal and	**ENGINEERING MATHEMATICS-II** Unit-I Linear Algebra: Rank of a matrix, Normal forms, consistency of systems of linear simultaneous equations and its solutions, Linear dependence and independence of vectors, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), orthogonal matrices, diagonalization ofmatrix. Unit-II Fourier Series: Orthogonal functions, periodic functions, Fourier series of periodic functions, Euler formula, change of intervals, Even and Odd functions, half range Fourier sine and cosine series; Harmonic analysis. Unit-III Differential Equations: Linear differential equations of first order, Reducible to linear form, Exact differential equations, reducible to exact form; Linear Differential Equations of Higher order with constant coefficients, Simultaneous linear differential equations. Unit-IV Second order linear ODE with variables coefficients, Homogenous and exact forms, Change of dependent and independent	**Syllabus change** **Title change** **Code change**

		adiabatic processes, reversible, irreversible and quasi-static processes. Second law and entropy. Carnot engine and cycle. Absolute temperature scale. **UNIT-III** **Optical phenomena** : Principle of superposition, coherent and incoherent sources, temporal and spatial coherence, interference phenomena(Newton's ring and Michelson interferometer), diffraction of waves, diffraction from single and diffraction grating, polarization : types of polarization , Malus law, quarter and half wave plates, optical activity, specific rotation. **UNIT-IV** **Lasers and Holography** : Spontaneous and stimulated emission (Einstein A and B coefficients), population inversion, basic principles of operation of He-Ne, Ruby and semiconductor lasers. **Optical Fibers** : Types of optical fibers and their characteristics, characteristics of step, graded , mono mode and multi mode fibers, numerical aperture and its measurement, fiber optical communication. Principles and applications of holography **UNIT-V** **Magnetic Materials**: Magnetization- origin of magnetic moment, classification of magnetic materials- die, Para and ferromagnetism, hysteresis curve, soft and hard magnetic materials. Superconductivity: General	variables; Variation of parameters, Method of Undetermined coefficients, Euler-Cauchy equations. Unit-V Partial Differential Equations: Order and Degree, Formation; Linear partial differential equations of first order: Lagrange's form, Standard forms, Charpit's method. Solutions of PDE of Second order using separation of variable method.	

		properties of superconductors, Meissonier effect, penetration depth, type I and Type II superconductors, flux quantization, magnetic levitation, high temperature superconductors, superconducting materials, Cooper pairs and postulates of BCS theory.		
13	**BT202**	**INTRODUCTION TO COMPUTER PROGRAMMING** UNIT I Concept of algorithms, Flow Charts, Overview of the compiler (preferably GCC) , Assembler, linker and loader , Structure of a simple Hello World Program in C ,Overview of compilation and execution process in an IDE (preferably Code Block) UNIT II Programming using C: Preprocessor Directive, C primitive input output using get char and put char , simple I/O Function calls from library , data type in C including enumeration , arithmetic, relational and logical operations, conditional executing using if, else, switch and break .Concept of loops , for, while and do-while , Storage Classes: Auto, Register, Static and Extern	**HUMAN VALUES** Unit-I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfill the above human aspirations: understanding and living in harmony at various levels Unit-II Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs,	**New course**

		UNIT III Arrays and Strings: Declaring an array, Initializing arrays, accessing the array elements, working with multidimensional arrays, declaring and initializing string variables, arithmetic operations on characters. Pointers: Declaring and initializing pointers, pointer expressions, pointer increment and scale factor, pointers and arrays, pointers and strings. UNIT IV Functions: Defining functions, passing arguments to functions, returning values from functions, reference arguments, variables and storage classes, static functions, pointers and functions. Structures: Declaring and initializing a structure, accessing the members of a structure, nested structures, array of structures, using structures in functions, pointers and structures. UNIT V: File Handling in C Using File Pointers, fopen( ), fclose( ), Input and Output using file pointers, Character Input and Output with Files , String Input / Output Functions , Formatted Input / Output Functions, Block Input / Output Functions, Sequential Vs Random Access Files , Positioning the File Pointer.	meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya Unit-III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! Unit-IV Understanding Harmony in the Nature and Existence - Whole existence as Co-existence Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation innature Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space Holistic perception of harmony at all levels of existence Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Unit-V Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and	

			ecologically responsible engineers, technologists andmanagers	
14	**BT203**	**ENGINEERING MECHANICS** **Unit I** Force System: Introduction, force, principle of transmissibility of force, resultant of a force system, resolution of a force, moment of force about a line. Varigon's theorem, couple, resolution of force into force and a couple, properties of couple and their application to engineering problems. Lami's theorem. Force body diagram. **Unit II** Centroid & Moment of Inertia: Location of centroid and center of gravity, Moment of inertia, Parallel axis and perpendicular axis theorem, Radius of gyration, M.I of composite section, Polar Moment of inertia, Lifting Machines: Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of Pulleys, Wheel and differential axle, differential pulley Block, **Unit III** Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction. Belt Drive: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Length of belt, Ratio of tensions and power transmission by flat belt	**ENGINEERING CHEMISTRY** Unit-I Water: Common natural impurities, hardness, determination of hardness by complexometric (EDTA method), degree of hardness. Municipal water supply, requisite of drinking water, purification of water, sedimentation, filtration, sterilization, breakpoint chlorination. Water for steam making and boiler troubles, formation of solids (Scale and Sludge formation), carryover (Foaming and Priming), boiler corrosion and caustic embrittlement, Methods of boiler water treatment(water softening) preliminary treatments, preheating, Lime-Soda process, Zeolite (Permutit) process, Deionization (Demineralization) process. Numerical problems based on hardness, Lime-Soda and zeolite process. Unit-II Organic Fuels: Origin and classification of fuels. Solid fuels-, coal, classification of coal, significance of constituents, proximate and ultimate analyses of coal, gross and net calorific value, determination of calorific value of coal by Bomb Calorimeter. Metallurgical coke, carbonization processes- Beehive coke oven and Hoffmann Oven (by-products oven) method. Liquid fuels- Advantages of liquid fuels, petroleum and refining of petroleum, reforming, cracking, synthetic petrol, knocking, octane number, anti-knocking agents. Gaseous fuels-advantages, manufacture, composition and uses of coal gas and oil gas, determination of calorific value of gaseous fuels by Junker's calorimeter, flue gas analysis by Orsat's apparatus. Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel. Unit-III Polymers: Classification, constituents, general properties of polymers and their uses. Preparation properties and uses of polyethylene, polyethylene terephthalate (PET), nylon 6, nylon 66, nylon 6, 10, Kevlar, Bakelite. Elastomers – natural rubber and vulcanization, synthetic rubbers viz. Buna-S, Buna –N, Butyl and Neoprene Rubbers. Conducting polymers-.	**Syllabus change** **Code change**

		drives. **Unit IV** Kinematics of Particles and Rigid Bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular Acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion. Newton's laws, Equation of motion in rectangular Coordinate, radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle. **Unit V** Work, Energy and Power: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Nonconservative Force, Conservation of energy. Impulse and Momentum: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a Particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular	Unit-IV Lubricants: Classification, types of lubrication, properties and uses. Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number. Corrosion and its control: Definition and its significance. Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration type corrosion and pitting corrosion. Protection from corrosion- protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design. Unit-V Inorganic Engineering Materials: Cement: Manufacture of Portland cement. Rotary kiln technology. Chemistry of hardening and setting of cement. Role of gypsum. Refractories: Definition properties and classification. Silica and fire clay refractories. Glass: Definition, type and properties of glasses. Manufacture of glass, annealing of glass. Optical fibre grade glass.	
15	**BT204**	**Digital Electronics** **UNIT I** **BASIC LOGIC GATES &**		**Syllabus change** **Code change**

		BOOLEAN ALGEBRA: Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vice-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion. **UNIT II** **DIGITAL LOGIC GATE CHARACTERISTICS:** TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another. **UNIT III** **MINIMIZATION TECHNIQUES:** Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques. **UNIT IV** **COMBINATIONAL SYSTEMS:** Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to		

		decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers. **UNIT V** **SEQUENTIAL SYSTEMS:** Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters : Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications, Registers: buffer register, shift register.		
16	**BT 205**	**Applied Mathematics II** **UNIT I** Vector spaces, linear dependence of vectors, basis and linear transformations, scalar and vector fields, level surfaces, directional derivatives, gradient, divergence and curl of fields, Green, Gauss and Stokes theorems. **UNIT II** Matrix algebra, rank of a matrix, adjoint and inverse of a matrix, Solution of algebraic equations using matrix algebra , consistency conditions, eigenvalues and eigenvectors , Hermitian matrices. **UNIT III** Numerical solution of matrix equations using Gauss, Gauss-Seidel, LU decomposition and other iterative methods.	**BT 205.A BASIC ELECTRICAL AND ELECTRONICSENGINEERING** Unit-I Basic Concepts of Electrical Engineering: Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series- Parallel Circuits, Node Voltage Method, Mesh Current Method, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. Unit-II Transformers: Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers Unit-III Alternating Quantities: Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3-Phase AC System. Unit-IV	**Syllabus change** **Title change** **Code change**

		UNIT IV Convergence of improper integrals, tests of convergence, elementary properties of beta and gamma functions, differentiation under integral sign, Leibnitz rule, integrals dependent on a parameter, trapezoidal and Simpson's integration rules, applications in engineering. **UNIT V** Numerical methods; round off and truncation errors, approximations, order of convergence, Newton's forward and backward interpolation formula, central difference interpolation, solutions of polynomial equations using bisection, Newton-Raphson and Regula-falsi methods.	Rotating Electrical Machines; DC Machines: Principle of Operation of DC Machine as Motor and Generator, EMF Equation, Applications of DC Machines. AC Machines: Principle of Operation of 3-Phase Induction Motor, 3-Phase Synchronous Motor and 3- Phase Synchronous Generator (Alternator), Applications of AC Machines. Unit-V Basic Electronics: Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behaviour of the PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Rectifiers, Bipolar Junction Transistor, Field Effect Transistor, Transistor as an Amplifier. Digital Electronics: Boolean algebra, Binary System, Logic Gates and Their Truth Tables. Electrical Measuring Instruments: DC PMMC instruments, shunt and multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.	
17	**BT-205.B**		**BT-205.B BASIC CIVIL ENGINEERING** Unit-I Introduction: Specialization of Civil Engineering, scope of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country. Surveying: Object & principles of Surveying, Unit-II Linear measurements: Direct measurements- Tape & Chain, Ranging out survey lines, taking measurements of sloping ground. Tape correction, conventional symbols. Introduction to Compass Surveying & Leveling. Introduction to totalstation. Unit-III Building & Building materials: Construction materials: Stone, Brick, Cement, Mortar, Concrete, Steel – their properties & uses. Unit-IV Selection of site for Buildings, types of buildings, plinth area, carpet area, floor space index, Introduction to building byelaws,	

			concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation. Unit-V Transportation, Traffic and Road Safety: Types and characteristics of various modes of transportation, various road traffic signs, causes of accidents and road safety measures.	
	BT-205.C		**BT-205.C BASIC MECHANICAL ENGINEERING** Unit-I Fundamentals: Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers, Steam Turbines and Power Plants: Introduction, classification and types of steam boilers and steam turbines. Discuss working of steam boilers and steam turbines. Introduction and Classification of power plants. Unit-II Pumps and IC Engines: Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components. Unit-III Refrigeration and Air Conditioning: Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration an Air-conditioning. Transmission of Power: Introduction and types of Belt and Rope Drives. Introduction to Gears and Gear Trains. Unit-IV Primary Manufacturing Processes: Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering. Metal Removal or Machining Processes: Introduction to machining process and various machine tools. Unit-V	**New Course**

			Engineering Materials and Heat Treatment of Steel:Introduction to various engineering materials and their properties. Introduction to Heat Treatment and types of Heat Treatment Processes. Introduction to CAD, CAM, FMS, MEMS and CIM:Introduction to modern manufacturing systems and their applications.	
18	**BT-205.D**		**BT-205.D ENGINEERING MECHANICS** Unit-I Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem. Centroid & Moment of inertia (M.I): Location of centroid, Moment of inertia (mass and area), Parallel axis and perpendicular axis theorems, M.I of composite section, M.I. of solid bodies, Polar moment of inertia. Unit-II Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium. Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction. Unit-III Kinematics of particles and rigid bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion. Kinetics of particles and rigid bodies: Newton's second law, Equation of motion in rectangular coordinate, Equation of motion in radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle. Unit-IV	**Code change**

			Work, Energy and Power: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservation of energy. Unit-V Impulse and Momentum: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body, Principle of impulse and momentum for a rigid body, Central impact, System of variable mass.	
19	**BT206-**	**Environmental Sciences** **UNIT I** **Ecosystem and Biodiversity:** Components and types of ecosystem, Structure and functions of Ecosystem, Values, Type and levels of Biodiversity, Causes of extension, and Conservation methods of biodiversity. **UNIT II** **Air Pollution:** Definition, different types of Sources, effects on biotic and abiotic components and Control methods of air pollution. **UNIT III** **Water pollution:** Definition, different types of Sources, effects on biotic and abiotic components and treatment technologies of water pollution. **UNIT IV** **Noise Pollution:** Introduction of noise pollution, different Sources, effects on abiotic and biotic environment and Control measures. **UNIT V**	**BT- 206 HUMAN VALUES: ACTIVITIES** PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you diffierentiate between right and wrong? What have been your salient achievements and shortcomings in your life ? Observe and analyze them. PS 2: Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environemental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats threats to human happiness and peace - what could be the way out in your opinion? PS 3: 1. Observe that each of us has the faculty	**New course**

		Non Conventional energy sources: Introduction, Renewable Sources of Energy: Solar energy, wind energy, Energy from ocean, energy from biomass, geothermal energy and Nuclear Energy.	of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following: (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others? (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it? 2. Out of the three basic requirements for fulfillment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine. PS 4: list down all your important desires. Observe whether the desire is related to Self (I) or the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body. 1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment! 2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and	

			Body. 3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes. PS 6: 1. Chalk out some programs towards ensuring your harmony with the body - in tearms of nurturing, protection and right utilisation of the body. 2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases. PS 7: Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST'; 1a. Do I want to make myself happy? 2a. Do I want to make the other happy? 3a. Does the other want to make himself/herself happy? 4a. Does the other want to make me happy? What is the answer? Intention (Natural Acceptance) 1b. Am I able to always make myself happy? 2b. Am I able to always make the other happy? 3b. Is the other able to always make himself/herself happy? What is the answer? Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence. PS 8: 1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation. 2. Also, observe whether your feeling of respect is based on treating the other as you would treat youself or on differentiations based on body, physical facilities or belieds.	

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to balues in a difficult situation.

PS 10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

			a. Thought b. Behavior c. Work and d. Relization 3. What practical steps are you able to visualize for the transition of the society from its present state. 4. 5. 6. Project: 7. 8. Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work	
20	**BT207**	**Electrical and Electronics Lab-II** **List of Experiment:** 1. To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR. 2. To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates. 3. To realize an SOP and POS expression. 4. To realize adder and Subtractor using universal gates. 5. To verify the truth table of Encoder and decoder. 6. To verify the truth table of multiplexer and demultiplexer. 7. To study and perform Various types of Flip-Flops. 8. To study and perform various types of counters. 9. To study and perform various types of shift registers. 10. To study and perform various types of Multivibrators. 11. To study and perform	**ENGINEERING CHEMISTRY LAB** 1. To determine the hardness of water by HCL method. 2. To determine the hardness of water by EDTA method 3. Measurement of conductivity of a given sample by conductivity meter. 4. Study of BombCalorimeter. 5. To determine the strength of Ferrous Ammonium sulphate solution with the help of $K_2Cr_2O_7$ solution. 6. To determine the strength of $CuSO_4$ solution with the help of hypo solution. 7. To determine the strength of NaOH and Na_2CO_3 in a given alkali mixture. 8. To determine the flash and fire point of a given lubricating oil. 9. To determine the viscosity of a given lubricating oil by Redwood viscometer. 10. To determine cloud and pour point of lubricating oil.	**Syllabus change** **Code change**

		Schmitt Trigger.		
21	**BT208**	**Engineering Physics Lab-II** **List of Experiments:** 1. Conversion of a Galvanometer in to an ammeter and calibrate it. 2. Conversion of a Galvanometer in to voltmeter and calibrate it. 3. To determine the value of "g" by using compound pendulum. 4. To determine Plank's constant using LED. 5. To measure the Numerical Aperture (NA) of an optical fiber. 6. To determine the profile of He-Ne Laser beam. 7. To determine the wavelength of different lights using diffraction grating and spectrometer. 8. To determine the wavelength of sodium light by Newton's ring method. 9. To determine the specific rotation of glucose using Polarimeter. 10. To determine minimum deviation angle for different light using prism and spectrometer. 11. To study of detergent on surface tension of water by observing capillary rise 12. To determine the speed of sound in air at room temperature using a resonance tube by two resonance position.	**COMPUTER PROGRAMMING-II LAB** The programs shall be developed in C language related with the following concepts: 1. Input roll numbers of your friends in an array & print in reverse order. 2. Input names of your friends in an array & print in reverse order. 3. Input two matrices and output third matrix after performing add/subtract the corresponding elements. 4. Four programs using malloc, calloc, free & sscanf()/sprintf() functions. 5. Two programs using macro and online functions. 6. Two programs using structure & union. 7. Two programs using pointers. 8. Three programs belonging to file operations and multi-file handling. 9. Three programs belonging to graphics using C.	**Syllabus change** **Code change**
22	**BT209**	**COMPUTER PROGRAMMING LAB** **LIST OF EXPERIMENTS** 1 Write a program to calculate the area & perimeter of rectangle. 2 Write a program to calculate the area and circumference of a circle for a given radius. 3 Write a program to calculate	**COMPUTERS AIDED MACHINE DRAWING** 1.Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning. 2.Conversion of pictorial views into orthographic views: (1 drawing sheet)	**New course**

		simple interest for a given principal/amount. 4 Write a program to convert temperature given in ◦C to temperature in ◦F. 5 Write a program to find profit and loss (in percentage) of a given cost price and selling price. 6 Write a program to find out the maximum among the three given numbers. 7 Write a program to calculate the factorial of a given number. 8 Write a program to print the list of first 100 odd number. 9 Write a program to calculate the sum of the digits of a number and display it in reverse order. 10 Write a program to generate a Fibonacci series. 11 Write a program to generate the following series: 1 2 1 2 3 1 2 3 4 1 2 3 4 5 12 Write a program to generate the following series: 0 1 0 1 0 0 1 0 1 0 1 0 1 0 13 Write a program using a function to check whether the given number is prime or not. 14 Write a program to check whether the given string is a palindrome or not. 15 Write a program to find the length of a string, reverse the string and copy one string to another by using library function. 16 Write a program to swap two variables a & b using pointers. 17 Write a program to enter a line of text from keyboard and store it in the file. User should enter file name. 18 Write a recursive program for tower of Hanoi problem 19 Write a menu driven program for matrices to do the following	Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems. 3.Sectional view : (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials. 4.Fasteners: (1 drawing sheet) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, types of rivets, types of riveted joints etc. 5.Assembly drawing: (1 drawing sheet) Introduction to assembly drawing, assembly drawing of simple machine elements; like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc. 6.Free hand sketching: Need for free hand sketching, Free hand sketching of conventional representation of materials, screw fasteners, foundation bolts, studs. 7.Bearing: Ball, roller, needle, foot step bearing. 8.Coupling: Protected type, flange, and pin type flexible coupling. 9.Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc. 10.Computer aided drafting: Concepts of computer aided 2D drafting using any drafting software like AutoCAD/ Solid works/Creo/Catia etc., basic drawing and modify commands, making 2D drawings of simple machine parts.	

		operation depending on whether the operation requires one or two matrices • Addition of two matrices • Subtraction of two matrices • Finding upper and lower triangular matrices • Transpose of a matrix • Product of two matrices. 20 Write a program to copy one file to other, use command line arguments. 21 Write a program to perform the following operators an Strings without using String functions • To find the Length of String. • To concatenate two string. • To find Reverse of a string. • To Copy one sting to another string. 22 Write a Program to store records of an student in student file. The data must be stored using Binary File.Read the record stored in "Student.txt" file in Binary code.Edit the record stored in Binary File.Append a record in the Student file. 23 Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.		
23	**<u>BT210</u>**	**<u>Engineering Drawing</u>** Sheet 1 Orthographic Projections (3 Problems) Sheet 2 Riveted joints: Lap joints, butt joints, chain riveting, zig-zag riveting Sheet 3 Screw fasteners, different threads, Nuts & bolts locking devices, set screws, Sheet 4 Scale, plain scales, diagonal scales, scale of chords Sheet 5 Conic Sections: Construction of ellipse, parabola and hyperbola Sheet 6 Engineering Curves: Cycloid, Epicycloids, Hypo-cycloid, Involutes, Archemedian and logarithmic spirals Sheet 7 Projection of points and lines, True inclinations and true length of straight lines, Traces of straight lines		**Title change** **Code change**

		Sheet 8 Projection of planes and solids: Projection of planes, Projection of polyhedra, Pyramids.		
24	**BT211**	**Communication Skills Lab** 1. Introducing yourself. 2. Role Plays. 3. Word Formation. 4. Listening and Speaking Skills. 5. Words often mis-spelt and Mis-Pronounced. 6. One word for many. 7. Synonyms and Antonyms. 8. Seminar Presentation. 9. Group Discussion. 10. Job Interview.		**Code change**
25	**BTEE301**	**Electronic Devices & Circuits** **UNIT-I** Semiconductor Physics: Mobility and conductivity, charge densities in a semiconductor, Fermi Dirac distribution, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics, carrier concentrations and Fermi levels in semiconductor. Generation and recombination of charges, diffusion and continuity equation, transport equations, Mass action Law, Hall effect. **UNIT-II** Junction Diodes: Formation of homogenous and hetrojuntion diodes and their energy band diagrams, calculation of contact potential and depletion width, V-I characteristics, Small signal models of diode, Diode as a circuit element, diode parameters and load line concept, C-V characteristics and dopant profile. Applications of diodes in rectifier, clipping, clamping circuits and voltage multipliers.Transient behavior of PN diode.Breakdown diodes, Schottky diodes, and Zener diode as voltage	**Advance Mathematics** **UNIT1.** Numerical Methods: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae.Stirling's Formulae. **UNIT-2.** Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method. **UNIT -3** Transform Calculus:Laplace Transform: Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. **UNIT-4** Fourier Transform: Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem. Z-Transform: Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation. **UNIT-5** Complex Variable: Differentiation, Cauchy-Riemann equations, analytic functions,harmonic functions,	**New Course**

		regulator.Construction, characteristics and operating principle of UJT. **UNIT-III** Transistors: Characteristics, Current Components, Current Gains: alpha and beta. Variation of transistor parameter with temperature and current level, Operating point, Hybrid model, DC model of transistor, h-parameter equivalent circuits.CE, CB and CC configuration DC and AC analysis of single stage CE, CC (Emitter follower) and CB amplifiers AC & DC load line, Ebers-Moll model.Biasing & stabilization techniques.Thermal runaway, Thermal stability. **UNIT-IV** JFET & MOSFET:Construction and operationofJFET & MOSFET, noise performances of FET, parasitic of MOSFET, small signal models of JFET & MOSFET Biasing of JFET's & MOSFET's. Low frequency single stage CS and CD (source follower) JFET amplifiers.FET as voltage variable resistor and active load. **UNIT-V** Small Signal Amplifiers at Low Frequency: Analysis of BJT and FET multistage amplifier, DC and RC coupled amplifiers. Frequency response of single and multistage amplifier, mid-band gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem, use of Miller and bootstrap configuration.Cascade and cascade configuration of multistage amplifiers (CE-CE, CE-CB, CS-CS and CS-CD), Darlington pair.	finding harmonic conjugate; elementary analyticfunctions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	

26	BTEE302	**Circuit Analysis-I** **UNIT-I** Introduction: Introduction to circuit elements and their characteristics. Current and voltage reference. Response of single element, double element and triple element circuits. Resonance, selectivity & Q-factor in ac circuits. Network Analysis: Network voltages. Mesh & node systems of network equations and their comparison. Graph of network, tree, incidence matrix, fundamental circuit functions, cut sets, f-circuits analysis and f-cut set analysis, node and node pair analysis. Duality. Method of obtaining dual network. **UNIT-II** Network Theorems:Thevenis's, Norton's, Superposition, Reciprocity, Compensation, Millman's theorem Tellegen's, Maximum power transfer and Miller`s theorems in DC & AC Circuits. **UNIT-III** Polyphase Circuits: General Circuit Relations: Three Phase Star, Three Phase Delta, Star and Delta Combination, Four Wire Star Connection.Balanced and unbalanced Three Phase Voltages, currents and Impedances. Power and Reactive Volt-Amperes in a 3-Phase System Power Relations in AC Circuits: Instantaneous Power in AC Circuits, Power Factor, Apparent Power, Reactive Power, Power Triangle, Complex Power. **UNIT-IV** Non-Sinusoidal Waves: Complex Periodic Waves and Their Analysis By Fourier Series. Different Kinds of Symmetry, Determination of Co-Efficient. Average and Effective Values of a Non-Sinusoidal Wave, Power in a Circuit of Non-	**Managerial Economics and Financial Accounting** **UNIT -1** **Basic economic concepts-**Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economicproblems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement. **UNIT -2** **Demand and Supply analysis**-Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting – purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply. **UNIT- 3** **Production and Cost analysis**-Theory of production-production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation **UNIT -4** **Market structure and pricing theory**-Perfect competition, Monopoly, Monopolistic competition, Oligopoly. **UNIT- 5** **Financial statement analysis**-Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	**New Course**

		Sinusoidal Waves of Current and Voltage Form Factor, Equivalent Sinusoidal Wave and Equivalent Power Factor. Response of Linear Network to Non-Sinusoidal Periodic Waves. **UNIT-V** Time Domain and Frequency Domain Analysis: Response of networks to step, ramp, impulse, pulse and sinusoidal inputs. Time domain and frequency domain analysis of circuits. Shifting theorem, initial and final value theorems. Special signal waveforms with Laplace transform & applications to circuit operations.		
27	**BTEE303**	**Liner Integrated Circuits** **UNIT-I** OPERATIONAL AMPLIFIERS: Basic differential amplifier analysis, Basic structure and principle of operation, Single ended and double ended configurations ,, calculation of differential gain, common mode gain, Op-amp configurations with feedback, Op-amp parameters, Inverting and Non-Inverting configuration, Comparators, Adder. **UNIT-II** OPERATIONAL AMPLIFIER APPLICATIONS: Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge, Quadrature, precision rectifier, half and full wave rectifiers, square wave, triangular wave, sawtooth oscillators. Voltage controlled oscillators. **UNIT-III** **ACTIVE FILTERS**:	**Power Generation Process** **<u>Unit 1</u>** **Conventional Energy Generation Methods** Thermal Power plants: Basic schemes and working principle. (ii)Gas Power Plants: open cycle and closed cycle gas turbineplants, combined gas & steam plants-basic schemes.Hydro Power Plants: Classification of hydroelectric plants. Basicschemes of hydroelectric and pumped storage plants. (iv) NuclearPower Plants: Nuclear fission and nuclear fusion. Fissile andfertile materials. Basic plant schemes with boiling water reactor,heavy water reactor and fast breeder reactor. Efficiencies ofvarious power plants. **<u>Unit 2</u>** **<u>New Energy Sources</u>** Impact of thermal, gas, hydro and nuclear power stations on environment.Green House Effect (Global Warming).Renewable and nonrenewable energy sources.Conservation of natural resources and sustainable energy systems.Indian energy scene.Introduction to electric energy generation by	

		Low pass, high pass, band pass and band reject filters, All pass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design. **UNIT-IV** **LINEAR ICs**: Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators. , A/D and D/A converters, analog switches, The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger and its applications. **UNIT-V** **Non- linear Applications of OP-AMP**: log and antilog amplifiers, and multipliers. Solution of differential equation and analog computer PHASE-LOCKED LOOPS: Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM 565 PLL.	wind, solar and tidal. **Unit 3** **Loads and Load Curves** Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization. **Power Factor Improvement** Causes and effects of low power factor and advantages of powerfactor improvement. Power factor improvement using shuntcapacitors and synchronous condensers **Unit 4** **Power Plant Economics** Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost.Role of load diversity in power system economics. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation. **Unit 5** **Tariff** Objectives of tariffs.General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three part tariff. Spot (time differentiated) pricing. **Selection of Power Plants** Comparative study of thermal, hydro, nuclear and gas powerplants. Base load and peak load plants. Size and types ofgenerating units, types of reserve and size of plant.Selection andlocation of power plants.	
28	**BTEE304**	**Object Oriented Programming** **UNIT-I** Introduction: Review of structures in C, accessing members of structures using structure variables, pointer to structures, passing structures to functions Structures as user defined data types. **UNIT-II** Introduction to Programming Paradigms: (Process oriented and Object oriented). Concept of object, class, objects as	**Electrical Circuit Analysis** **UNIT I** **Network Theorems** Superposition theorem, Thevenin theorem, Norton theorem,Maximum power transfer theorem, Reciprocity theorem,Compensation theorem. Analysis with dependent current andvoltage sources.Node and Mesh Analysis.Concept of dualityand dual networks. **UNIT II**	**Syllabus Change** **Code Change** **Title Change**

		variables of class data type, difference in structures and class in terms of access to members, private and public Basics of C++: Structure of C++ programs, introduction to defining member functions within and outside a class, keyword *using*, declaring class, creating objects, constructors & destructor functions, Initializing member values with and without use of constructors, simple programs to access & manipulate data members, *cin* and *cout* functions. Dangers of returning reference to a private data member, constant objects and members function, composition of classes, friend functions and classes, using *this* pointer, creating and destroying objects dynamically using *new* and *delete* operators. Static class members, container classes and iterators, proxy classes. Members of a class, data & function members. Characteristics of OOP- Data hiding, Encapsulation, data security. **UNIT-III** Operator Overloading: Fundamentals, Restrictions, operator functions as class members v/s as friend functions. Overloading stream function, binary operators and unary operators.Converting between types. **UNIT-IV** Inheritance: Base classes and derived classes, protected members, relationship between base class and derived classes, constructors and destructors in derived classes, public, private and protected inheritance Relationship among objects in an inheritance hierarchy, abstract classes, virtual functions and dynamic binding, virtual destructors.	**Solution of First and Second order networks** Solution of first and second order differential equations forSeries and parallel R-L, R-C, RL- C circuits, initial and finalconditions in network elements, forced and free response, timeconstants, steady state and transient state response. **UNIT III** **Sinusoidal steady state analysis** Representation of sine function as rotating phasor, phasordiagrams, impedances and admittances, AC circuit analysis,effective or RMS values, average power and complex power.Three-phase circuits. Mutual coupled circuits, Dot Conventionin coupled circuits, Ideal Transformer. **UNIT IV** **Electrical Circuit Analysis Using Laplace Transforms** Review of Laplace Transform, Analysis of electrical circuits usingLaplace Transform for standard inputs, convolution integral,inverse Laplace transform, transformed network with initialconditions. Transfer function representation. Poles and Zeros.Frequency response (magnitude and phase plots), series and parallel resonances. **UNIT V** **Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters,transmission parameters and hybrid parameters,interconnections of two port networks.	

		UNIT-V Multiple inheritance, virtual base classes, pointers to classes and class members, multiple class members. Templates, exception handling.		
29	**BTEE305**	**Electrical Machines-I** **UNIT-I** (I)Magnetic circuits:Magnetic circuits, magneto motive force magnetic field strength, permeability, reluctance, analogy between electric and magnetic-circuits, B-H curve, hysteresis, series and parallel magnetic circuits, practical magnetic circuits, permanent magnet and their applications. (ii)Electromechanical energy conversion: Basic principles, conservation of energy, physical phenomenon involved in conversion, energy balance, energy stored in magnetic field. **UNIT-II** DC Generators: Introduction, construction, types, emf equation, lap and wave windings, armature reaction, commutation, methods of improving commutation, equalizer rings Demagnetizing and cross magnetizing ampere turns, various characteristics of shunt, series and compound generators, voltage build up, losses and efficiency, condition for maximum efficiency. **UNIT-III** DC Motors: Introduction, principals, back-emf, torque of motor, types, characteristics of shunt, series and compound motors, speed control (field and armature control methods), basic idea of solid state devices in controlling of DC motors Starting of DC motors, three point and four point starters, losses and	**Analog Electronics** **UNIT I** **Diode circuits** P-N junction diode, I-V characteristics of a diode; review of halfwaveand full-wave rectifiers, Zener diodes, clamping and clipping circuit. **UNIT II** **BJT circuits** Structure and I-V characteristics of a BJT; BJT as a switch.BJTas an amplifier: small-signal model, biasing circuits, currentmirror; common-emitter, common-base and common collectoramplifiers; Small signal equivalent circuits, high-frequencyequivalent circuits **UNIT III** **MOSFET circuits** MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits,common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit. **UNIT IV** **Differential, multi-stage and operational amplifiers** Differential amplifier; power amplifier; direct coupled multi-stageamplifier; internal structure of an operational amplifier, ideal opamp,non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product) **UNIT V** **Linear applications of op-amp** Idealized analysis of op-amp circuits. Inverting	**Syllabus Change** **Code Change**

		efficiency, testing (brake test and swimburnes test), electric braking of DC motors, Applications. **UNIT-IV** Transformer: Construction, Principal, Types, emf equation, no load and short circuit test, equivalent circuits, back-to-back (Sumpner's test), phasor diagram, Voltage regulation Efficiency, Condition for maximum efficiency, all day efficiency, parallel operation , auto-transformer, basic idea of welding transformer, current and potential transformer,separation of losses. **UNIT V** Polyphase Transformer: Construction,Various connections and groups, choice of connections, open delta connection, Scott connection, three phase to two phase conversion and vice-versa, Applications, Parallel operation and its conditions Three to six phase conversion.Excitation phenomenon in transformers, magnetizing harmonic currents and their effects,switching currents in transformers, inrush of magnetizing current.Three winding transformer.	and non-invertingamplifier, differential amplifier, instrumentation amplifier,integrator, active filter, P, PI and PID controllers and lead/lagcompensator using an op-amp, voltage regulator, oscillators (Weinbridge and phase shift).Analog to Digital Conversion. **Nonlinear applications of op-amp** Hysteretic Comparator, Zero Crossing Detector, Square-wave andtriangular-wave generators, Precision rectifier, peak detector.Monoshot	
30	**BTEE306**	**ADVANCED ENGINEERING MATHEMATICS-I** **UNIT-I** Laplace Transform: Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant coefficients with special reference to wave and diffusion equations, digital transforms. **UNIT-II** Fourier Transform: Discrete Fourier	**Electrical Machine – I** **UNIT I** **Magnetic fields and magnetic circuits** Review of magnetic circuits - MMF, flux, reluctance, inductance;review of Ampere Law and BiotSavart Law; Visualization of magneticfields produced by a bar magnet and a current carrying coil -through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines. **UNIT II** **Electromagnetic force and torque** B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a	**Code Change**

		transform, Fast Fourier transform, Complex form of Fourier transform and its inverse applications Fourier transform for the solution of partial differential equations having constant coefficients with special reference to heat equation and wave equation. **UNIT-III** Fourier Series: Expansion of simple functions in Fourier series, half range series, change of interval, harmonic analysis. Calculus of Variation: Functional, strong and weak variations, simple variation problems, Euler's equation **UNIT-IV** Complex Variables: Analytic functions, Cauchy–Riemann equations, Elementary conformal mapping with simple applications Line integral in complex domain, Cauchy's theorem, Cauchy's integral formula. **UNIT-V** Complex Variables: Taylor's series, Laurent's series, poles, Residues. Evaluations of simple definite real integrals using the theorem of residues.Simple contour integration.	moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency **UNIT III** **DC machines** Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction. **UNIT IV** **DC machine - motoring and generation** Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torquespeed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines. **UNIT V** **Transformers** Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase. transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current,Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.	
31	**BTEE307**	**Electronic Devices Lab** 1. Study the following devices: (a) Analog & digital multimeters (b) Function/ Signal generators (c) Regulatedd. c. power	**Electromagnetic Field** **UNIT I** **Review of Vector Calculus** Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products,	**Code Change**

		supplies (constant voltage and constant current operations) (d) Study of analog CRO,measurement of time period, amplitude, frequency & phase angle using Lissajous figures. 2. Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse saturation current and static & dynamic resistances. 3. Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator. 4. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product. 5. Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss&Vp. 6. Application of Diode as clipper & clamper. 7. Plot gain- frequency characteristic of two stage RC coupled amplifier & calculate its bandwidth and compare it with theoretical value. 8. Plot gain- frequency characteristic of emitter follower & find out its input and output resistances. 9. Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters. 10. Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor. 11. Study bridge rectifier and measure the effect of filter network on DC voltage output and ripple factor.	three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another. **UNIT II** **Static Electric Field** Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. **UNIT III** **Conductors, Dielectrics and Capacitance** Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations. **UNIT IV** **Static Magnetic Fields** Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Magnetic Forces, Materials and Inductance Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances. **UNIT V** **Time Varying Fields and Maxwell's Equations** Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions. Electromagnetic WavesDerivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.	
32	**BTEE308**	**Electrical Circuit Lab**	**Analog Electronics Lab**	**Code Change**

		1. Draw the circuit symbols. 2. Verify theorems for A. C. & D. C. circuits. 3. PSPICE Programs for Circuit Analysis: a. DC: Analysis resistor networks to determine node voltages, components voltages, and component currents. b. DC: Analysis of resistor networks that have several voltage and current sources and variable load resistors. c. Transient: Analysis of RC & RL circuits to produce tables of component voltage & current levels for a given set of time instants & to produce graphs of voltages & currents versus time. d. AC: Analysis of impedance networks to determine the magnitude & phase of node voltages, components voltages and component currents. 4. Determine the magnitude & phase and component voltages and currents in resonant circuits & produce.voltage and current verses frequency graphs. 5. Programs for Circuit Analysis: a. Calculate the resistance of a conductor, given its dimensions & resistivity or determine the change in conductor resistance when the temp changes. b. D.C.: Analysis of resistor networks to determine all junction voltages, component voltages, and component currents.Transient: c. Analysis RC & RL circuits to produce tables of component voltage & current levels for agiven set of time instants. 6. Convert Y-connected resistor networks to delta-connected circuits.	1) Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1 kHz with and without negative feedback. 2) Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor. 3) Plot and study the characteristics of small signal amplifier using FET. 4) Study of push pull amplifier. Measure variation of output power & distortion with load. 5) Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency. 6) Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value. 7) Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts. 8) To plot the characteristics of UJT and UJT as relaxation.	

33	**BTEE309**	**Electronics Engineering Design Lab** To design the following circuits, assemble these on bread board and test them. Simulation of these circuits with the help of appropriate software. 1 .Op-Amp characteristics and get data for input bias current measure the output-offset voltage and reduce it to zero and calculate slew rate. 2 .Op-Amp in inverting and non-inverting modes. 3 .Op-Amp as scalar, summer and voltage follower. 4 .Op-Amp as differentiator and integrator. 5 .Design LPF and HPF using Op-Amp 741 6 .Design Band Pass and Band reject Active filters using Op-Amp 741. 7 .Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts 8 .Design (i) Astable (ii) Monostable multivibrators using IC-555 timer 9 .Design Triangular & square wave generator using 555 timer. 10 .Design Amplifier (for given gain) using Bipolar Junction Transistor.	**Electrical Machine-I Lab** 1) To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency. 2) To perform sumpner's test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit. 3) To determine the efficiency and voltage regulation of a single-phase transformer by direct loading. 4) To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit. 5) To perform the parallel operation of the transformer to obtain data to study the load sharing. 6) Separation of no load losses in single phase transformer. 7) To study conversion of three-phase supply to two-phase supply using Scott- Connection. 8) Speed control of D.C. shunt motor by field current control method & plot the curve for speed verses field current. 9) Speed control of D.C. shunt motor by armature voltage control method &plot the curve for speed verses armature voltage. 10) To determine the efficiency at full load of a D.C shunt machine considering it as a motor by performing Swinburne's test. 11) To perform Hopkinson's test on two similar DC shunt machines and hence obtain their efficiencies at various loads.	
34	**BTEE310**	**C++ Programming Lab** . To write a simple program for understanding of C++ program structure without any CLASS declaration.	**Electrical Circuit Design Lab** 1) Introduction to Datasheet Reading. 2) Introduction to Soldering - Desoldering process and	**New Course**

		Program may be based on simple input output, understanding of keyword using. 2. Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object's data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other. 3. Program involving multiple classes (without inheritance) to accomplish a task. Demonstrate composition of class. 4. Demonstration Friend function friend classes and this pointer. 5. Demonstration dynamic memory management using new & delete & static class members. 6. Demonstration of restrictions an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc. 7. Demonstrator use of protected members, public & private protected classes, multi-level inheritance etc. 8. Demonstrating multiple inheritance, virtual functions, virtual base classes, abstract classes.	tools. 3) Simulate characteristic of BJT and UJT. Validate on Bread Board or PCB. 4) Simulate Bridge Rectifier Circuit and validate on Bread Board or PCB. a) Half Bridge.b) Full Bridge. 5) Simulate Regulated Power Supply and validate on Bread Board or PCB. a) Positive Regulation (03 Volt to 15 Volt). b) Negative Regulation (03 Volt to 15 Volt). c) 25 Volt, 1–10 A Power Supply. 6) Simulate Multivibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB. a) Astable Mode. b) Bistable Mode. c) Monostable Mode. 7) Introduction to Sensors to measure real time quantities and their implementation in different processes. (Proximity, Accelerometer, Pressure, Photo-detector, Ultrasonic Transducer, Smoke, Temperature, IR, Color, Humidity, etc.). 8) Hardware implementation of temperature control circuit using Thermistor. 9) Simulate Frequency divider circuit and validate it on Bread Board or PCB. 10) Hardware implementation of 6/12 V DC Motor Speed Control (Bidirectional) 11) Simulate Buck, Boost, Buck-Boost circuit and validate on Bread Board or PCB. 12) Simulate Battery Voltage Level Indicator Circuit and validate on Bread Board or PCB.	
35	**BTEE311**	**HUMANITIES & SOCIAL SCIENCE** Unit 1 India: Brief history of Indian Constitution, farming features, fundamental rights, duties, directive principles ofstate. History of Indian National Movement, socio economic growth after independence.	Seminar	

		Unit 2 Society: Social groups- concept and types, socialization- concept and theory, social control: concept, socialproblem in contemporary India, status and role. Unit 3 The Fundamentals of Economics: meaning, definition and importance of economics, Logic of choice, central economic problems, positive and normative approaches, economic systems-socialism and capitalism. Unit 4 Microeconomics: Law of demand supply, utility approach, indifference curves, elasticity of demand and supply and applications, consumer surplus, Law of returns to factors and returns to scale. Unit 5 Macroeconomics: concepts relating to National product–National income and its measurement, Simple Keynesian theory, simple multiplier, money and banking. Meaning, concept of international trade, determinationof exchange rate, Balance of payments.		
36	**BTEE312**		**Mini project**	**Code Change**
37	**BTEE401**	**Analog Electronics** **UNIT-I** **Feedback Amplifiers:** Classification, Feedback concept, Feedback Topologies, Transfer gain with feedback, General characteristics of negative feedback amplifiers Analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier. Stabilitycriterion. Compensation techniques, miller compensation. **UNIT-II** **Oscillators &Multivibrators:** Classification. Criterion for oscillation.Tuned collector, Hartley, Colpitts, RC Phase shift, Wien Bridge and crystal oscillators	**Biology** **UNIT-1** Introduction:Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out thefundamental differences between science and engineering by drawing acomparison between eye and camera, Bird flying and aircraft. Mention themost exciting aspect of biology as an independent scientific discipline. Whywe need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. **UNIT-2.** Classification:Purpose: To convey that classification*per se*is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at	**New Course**

		Astable, monostable and bistablemultivibrators. Schmitt trigger. Blocking Oscillators **UNIT-III** **High Frequency Amplifiers:** Hybrid Pi model, conductances and capacitances of hybrid Pi model, high frequency analysis of CE amplifier Gain bandwidth product, unity gain frequency fT.Emitter follower at high frequencies. **UNIT-IV** **Tuned Amplifier**: Band pass amplifier, Parallel resonant circuits, Band Width of Parallel resonant circuit. Analysis of Single Tuned Amplifier, Primary & Secondary Tuned Amplifier with BJT & FET Double Tuned Transformer Coupled Amplifier. Stagger Tuned Amplifier. Pulse Response of such Amplifier. Class C tuned amplifiers, Shunt Peaked Circuits for Increased Bandwidth. **UNIT-V** **Power Amplifiers:** Classification, Power transistors & power MOSFET (DMOS, VMOS). Output power, power dissipation and efficiency analysis of Class A, class B, class AB, class C, class D and class E amplifiers as output stages. Pushpull amplifiers with and without transformers. Complementary symmetry & quasi complimentary symmetry amplifiers	phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructureprokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion- aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus **UNIT-3** Genetics:Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws, Concept of segregation andindependent assortment. Concept of allele.Gene mapping, Geneinteraction, Epistasis. Meiosis and Mitosis be taught as a part ofgenetics. Emphasis to be give not to the mechanics of cell division nor thephases but how genetic material passes from parent to offspring. Conceptsof recessiveness and dominance. Concept of mapping of phenotype togenes. Discuss about the single gene disorders in humans. Discuss theconcept of complementation using human genetics. Biomolecules:Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. **UNIT-4** Enzymes:Purpose: To convey that without catalysis life would not haveexisted on earth. Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme class least two examples. Enzyme kinetics and kinetic Information Transfer:Purpose: The molecular basis of coding anddecoding genetic information is universal. Molecular basis of information transfer.DNA as a genetic material. Hierarchy of DNA structure- fromsingle stranded to double helix to nucleosomes. Concept of genetic code.Universality and degeneracy of genetic code. Define gene in terms of complementation andrecombination. Macromolecular analysis:Purpose: To analyse biological processes at the	

			reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. **UNIT-5** Metabolism:Purpose: The fundamental principles of energy transactionsare the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relatic energy. Spontaneity. ATP as an energy currency. This breakdown of glucose to CO2 + H2O (Glycolysis and synthesis of glucose from CO2 and H2O (Photosynthe and energy consuming reactions. Concept of Energy ch Microbiology:Concept of single celled organisms. Concept of species andstrains.Identification and classification of microorganisms.Microscopy.Ecological aspects of single celled organisms.Sterilization and media compositions.Growth kinetics.	
38	**BTEE402**	**Circuit Analysis-II** **UNIT-I** **Impedance and Admittance Functions:** The concept of complex frequency, transform impedance and admittance,series and parallel combinations **UNIT-II** **Network Functions:** Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Restrictions on pole and zero location in splane. Time domain behavior from pole and zero plot. Procedure for finding network functions for general two terminal pair networks **UNIT-III**	**Technical Communication** **UNIT-1** Introduction to Technical Communication-Definition of technicalcommunication, Aspects of technical communication, forms oftechnical communication, importance of technical communication,technical communication skills (Listening, speaking, writing, readingwriting), linguistic ability, style in technical communication. **UNIT-2** Comprehension of Technical Materials/Texts and Information Design & development-Reading of technical texts, Reading andcomprehending instructions and technical manuals, Interpreting andsummarizing technical texts, Note-making. Introduction of differentkinds of technical documents, **UNIT-3** Information collection, factors affectinginformation and document design, Strategies for organization,Information design and writing for print and online media.Planning, draftingand writing Official Notes, Letters, E-mail, Resume, Job Application,Minutes of Meetings.	**New Course**

		Network Synthesis: Hurwitz polynomial, positive real functions, reactive networks. Separation property for reactive networks. The four-reactance function forms, specification for reactance function. Foster form of reactance networks. Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms. **UNIT-IV** **Two Port General Networks:** Two port parameters (impedance, admittance, hybrid, ABCD parameters) and their inter relations. Equivalence of two ports. Transformer equivalent, inter connection of two port networks. The ladder network, image impedance, image transfer function, application to L-C network, attenuation and phase shift in symmetrical T and pi networks. **UNIT-V** **Two Port Reactive Network (Filters):** Constant K filters. The m-derived filter. Image impedance of m-derived half (or L) sections, composite filters. Bands pass and band elimination filters. The problem of termination, lattice filters, Barlett's bisection theorem. Introduction to active filters.	**UNIT-4** Technical Writing, Grammar and Editing- Technical writing process,forms of technical discourse, Writing, drafts and revising, Basics ofgrammar, common error in writing and speaking, Study of advancedgrammar, Editing strategies to achieve appropriate technical style,Introduction to advanced technical communication. **UNIT-5** Advanced Technical Writing- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	
39	**BTEE403**	**Electrical Measurements** **UNIT-I** **Measuring Instruments:** Moving coil, moving iron, electrodynamic and induction instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, single-phase power and singlephase energy. Errors in wattmeter and energy meter and their compensation and	**Electronic Measurement & Instrumentation** **UNIT-1.** Measuring Instruments: Moving coil, moving iron, electrodynamic and induction instruments-construction, operation, torque equation anderrors. Applications of instruments for measurement of current, voltage,single-phase power and single-phase energy. Errors in wattmeter andenergy meter and their compensation and adjustment. Testing andcalibration of single-phase energy meter by phantom loading. **UNIT-2** Polyphase Metering:Blondel's Theorem for n-phase, p-wire system. Measurement of power and	**Title Change** **Code Change**

		adjustment. Testing and calibration of single-phase energy meter by phantom loading. **UNIT-II** **Polyphase Metering:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: Onewattmeter, two-wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers. Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy. **UNIT-III** **Potentiometers:** Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. Volt ratio boxes. Construction, operation and standardization of AC potentiometer – in-phase and quadrature potentiometers. Applications of AC potentiometers. **UNIT-IV** **Measurement of Resistances:** Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard-wire method. Measurement of earth resistance.	reactive kVA in 3-phase balanced andunbalanced systems: One-wattmeter, two- wattmeter and three-wattmetermethods. 3-phase induction type energy meter. Instrument Transformers:Construction and operation of current and potential transformers.Ratio and phase angle errors and their minimization. Effect of variation ofpower factor, secondary burden and frequency on errors.Testing of CTsand PTs. Applications of CTs and PTs for the measurement of current,voltage, power and energy. **UNIT-3** Potentiometers:Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use ofpotentiometer for measurement of resistance and voltmeter and ammetercalibrations. Volt ratio boxes.Construction, operation andstandardization of AC potentiometer in-phase and quadraturepotentiometers.Applications of AC potentiometers. **UNIT-4** Measurement of Resistances:Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitutionmethod, Wheatstone bridge method.Measurement of low resistances – Potentiometer method and Kelvin'sdouble bridge method. Measurement of high resistance: Price's Guard-wire method. Measurement of earth resistance. **UNIT-5** AC Bridges:Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductancemeasurement. De Sauty Bridge for capacitance measurement. Wien'sbridge for capacitance and frequency measurements.Sources of error inbridge measurements and precautions. Screening of bridge components.Wagner earth device	

		UNIT-V **AC Bridges:** Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge for capacitance measurement. Wien's bridge for capacitance and frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device.		
40	**BTEE404**	**Generation of Electrical Power** **UNIT-I** **Conventional Energy Generation Methods :**(i) Thermal Power plants: Basic schemes and working principle. (ii) Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. (iii) Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. (iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants **UNIT-II** **New Energy Sources:** Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming).Renewable and nonrenewable energy sources Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.	**Electrical Machine – II** **UNIT-1.** Fundamentals of AC machine windings:-Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor. **UNIT-2.** Pulsating and revolving magnetic fields:-Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field. **UNIT-3.** Induction Machines:-Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit.Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation.Self- excitation.Doubly-Fed Induction Machines. **UNIT-4.** Single-phase induction motors :-Constructional features,double revolving field theory, equivalentcircuit, determination of parameters. Split-phase starting methodsand applications. **UNIT-5.**	**Code Change**

		UNIT-III **Loads and Load Curves:** Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization. **Power Factor Improvement:** Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers. **UNIT-IV** **Power Plant Economics:** (i) Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. (ii) Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation. **UNIT-V** **(i) Tariffs:** Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, threepart tariff. Spot (time differentiated) pricing. **(ii) Selection of Power Plants:** Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.	Synchronous machines:-Constructional features, cylindrical rotor synchronous machine -generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division	

41	**BTEE405**	**Electrical Machines-II** **UNIT-I** **AC Machines Fundamentals:** Introduction, emf equation, mmf of three phase AC winding, production of rotating magnetic field, types of AC windings Concentric, distributed and chorded windings, pitch factor, distribution factor, effect of these factors on induced emf, effect of harmonics. **UNIT-II** **Polyphase Induction Motor**: Introduction. Construction, cage and wound rotors, principal, starting and running torque, condition for maximum torque, equivalent circuits, no load and block rotor test. Torque-slip characteristics, losses and efficiency, circle diagram, starting of cage and wound motors, speed control, cogging and crawling, double cage rotor, induction generator, application. **UNIT-III** (i) **Single Phase Induction Motor:** Introduction, construction, principal, double revolving field theory, equivalent circuit, performance calculations, starting methods, and their types, torque slip characteristics of various types. ii) **Special Machines:** Single phase synchronous motor, series motor, universal motor, Stepper motors variable reluctance, permanent magnet and hybrid stepper motors. **UNIT-IV** **Synchronous Generators (Alternators):** Introduction, Construction, advantages of rotating field, types of rotors, emf equation, excitation systems, equivalent circuit and their phasor diagrams, voltage regulation, synchronous impedance method, mmf method.	**Power Electronics** **UNIT-1.** Power switching devices:-Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT. **UNIT-2.** Thyristor rectifiers:-Single-phase half-wave and full-wave rectifiers, Single-phase full- bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor. **UNIT-3.** DC-DC buck converter:-Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. DC-DC boost converter:-Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage. **UNIT-4.** Single-phase voltage source inverter:-Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage. **UNIT-5.** Three-phase voltage source inverter:-Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation	**Code Change**

		Zero power factor method, two reaction theory of salient pole rotor, phasor diagram, power developed and power angle characteristics of salient pole machine, determination of Xd and Xq, synchronization, synchronizing power and torque, parallel operation application. **UNIT-V** **Synchronous Motors:** Introduction, construction, principal of operation, starting of synchronous motor, equivalent circuit and phasor diagrams, power and torque, performance calculation, speed torque characteristics, power factor control-effect of change of excitation. V curve and inverted V curve, synchronous condenser and reactors, synchronous phase modifiers, hunting-causes and remedies, applications, synchronous induction motor application.		
42	**BTEE406**	**Advanced Engineering Mathematics-II** **UNIT-I** **Numerical Analysis:** Finite differences - Forward backward and central difference. Newton's forward and backward differences interpolation formulae. Sterling's formulae, Lagrange's interpolation formula. Solution of non-linear equations in one variable by Newton Raphson and Simultaneous algebraic equation by Gauss and Regula Falsi method. Solution of simultaneous equations by Gauss elimination and Gauss Seidel methods. Fitting of curves (straight line and parabola of second degree) by method of least squares. **UNIT-II** **Numerical Analysis:** Numerical differentiation, numerical integration trapezoidal rule, Simpson's one-third and one	**Signals & Systems** **UNIT-1** Introduction to Signals and Systems:Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples. **UNIT-2** Behavior of continuous and discrete-time LTI systems:Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi- input, multi-output representation. State	**Syllabus Change** **Title Change** **Code Change**

		eighth rule. Numerical Integration of ordinary differential equations of first order Picard's method, Euler's & modified Euler's methods. Miline's method and Runga Kutta fourth order method. Simple linear difference equations with constant coefficients. **UNIT-III** **Special Functions:** Bessel's function of first and second kind, simple recurrence relations, orthogonal property of Bessel functions, Transformation, Generating functions Legendre's function of first kind, simple recurrence relations, orthogonal property, Generating functions. **UNIT-IV** **Statistics & Probability:** Elementary theory of probability, Baye's theorem with simple applications, Expected value. Theoretical probability distributions – Binomial, Poisson and Normal distributions. **UNIT-V** **Statistics & Probability:** Lines of regression, co-relation and rank correlation. 4 **Transforms**: Z-transforms, its inverse, simple properties and application to difference equations.	Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response. **UNIT-3** Fourier, Laplace and z- Transforms:Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). **UNIT-4** Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis. **UNIT-5** Sampling and Reconstruction:The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems	
43	**BTEE407**	**Analog Electronics Lab** 1. Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback. 2. Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor. 3. Plot and study the characteristics of small signal amplifier using FET. 4. Study of push pull amplifier.	**Digital Electronics** **UNIT-1.** Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary,signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic. **UNIT-2.** Combinational DigitalCircuits:Standard	**Code Change**

		Measure variation of output power & distortion with load. 5. Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency. 6. Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value. 7. Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts. 8. Design Fabrication and Testing of k-derived filters (LP/HP). 9. Study of a Digital Storage CRO and store a transient on it. 10. To plot the characteristics of UJT and UJT as relaxation. 11. To plot the characteristics of MOSFET and CMOS.	representation for logic functions, K- map representation, simplification of logic functions using K-map, minimization Of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization. **UNIT-3.** Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters. **UNIT-4.** A/D And D/A Converters:Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs **UNIT-5.** Semiconductor memories and Programmable logic devices:-Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Arra	
44	**BTEE408**	**Electrical Measurement Lab** Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes. 2. Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter. 3. Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method. 4. Calibrate an ammeter using DC slide wire potentiometer.	**Electrical Machine - II Lab** 1) To study various types of starters used for 3 phase induction motor. 2) To connect two 3-phase induction motor in cascade and study their speed control. 3) To perform load test on 3-phase induction motor and calculate torque,	**Syllabus Change** **Title Change** **Code Change**

		5. Calibrate a voltmeter using Crompton potentiometer. 6. Measure low resistance by Crompton potentiometer. 7. Measure Low resistance by Kelvin's double bridge. 8. Measure earth resistance using fall of potential method. 9. Calibrate a single-phase energy meter by phantom loading at different power factors. 10. Measure self-inductance using Anderson's bridge. 11. Measure capacitance using De Sauty Bridge.	output power, input power, efficiency, input power factor and slip for various load settings. 4) To perform no load and blocked rotor test on a 3-phase induction motor and determine the parameters of its equivalent circuits. 5) Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p. f. (v) Efficiency. 6) Speed control of 3- Φ Induction Motor 7) To plot the O.C.C. & S.C.C. of an alternator. 8) To determine Zs ,Xd and Xq by slip test, Zero power factor (ZPF)/ Potier reactance method. 9) To determine the voltage regulation of a 3-phase alternator by direct loading. 10) To determine the voltage regulation of a 3-phase alternator by synchronous impedance method. 11) To study effect of variation of field current upon the stator current and power factor of synchronous motor andPlot V-Curve and inverted V-Curve of synchronous motor for different values of loads. 12) To synchronize an alternator across the infinite bus and control load sharing.	

45	**BTEE409**	**Power System Design Lab** . Generating station design: Design considerations and basic schemes of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations. 2. Auxiliary power supply scheme for thermal power plant. 3. Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law. 4. Methods of short term, medium term and long term load forecasting. 5. Sending end and receiving end power circle diagrams. 6. Instrument Transformers: Design considerations of CTs & PTs for measurement and protection. 7. Substations: Types of substations, various bus–bar arrangements**.** Electricalequipment for substations.	**Power Electronics Lab** 1) Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT. 2) Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents. 3) Find V-I characteristics of TRIAC and DIAC. 4) Find output characteristics of MOSFET and IGBT. 5) Find transfer characteristics of MOSFET and IGBT. 6) Find UJT static emitter characteristics and study the variation in peak point and valley point. 7) Study and test firing circuits for SCR-R, RC and UJT firing 8) Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters. 9) Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle. 10) Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode. 11) Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode. 12) Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature	**Syllabus Change** **Code Change**

			voltage versus speed characteristics.	
46	**BTEE410**	**Electrical Machines Lab** 1. Speed control of D.C. shunt motor by (a) Field current control method & plot the curve for speed verses field current. (b) Armature voltage control method & plot the curve for speed verses armature voltage. 2. To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency. 3. To perform back-to-back test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit. 4. To determine the efficiency and voltage regulation of a single-phase transformer by direct loading. 5. To plot the O.C.C. & S.C.C. of an alternator and to determine its Zs, Xd andregulation by synchronous impedance method. 6. To plot the V-curve for a synchronous motor for different values of loads. 7. To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit. 8. To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of its equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p.f. (v) Efficiency. 9. To Plot V-Curve and inverted V-Curve of synchronous motor. 10. To synchronize an alternator across the infinite bus (RSEB) and control load sharing.	Digital Electronics Lab 1) To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs). 2) To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates. 3) To realize an SOP and POS expression. 4) To realize Half adder/ Subtractor& Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables. 5) To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor& basic Full Adder/ Subtractor. 6) To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer. 7) Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven segment display. 8) Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table. 9) Construct a divide by 2,4& 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.	**New Course**

			Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer	
47	**BTEE411**	**Electrical Machine Design Lab** Design of transformers: output of transformer, output equation- volt per turn, core area and weight of iron&copper, optimum design–(i) minimum cost and (ii) minimum losses. Design of core and windings. Design a 3-phase transformer. 2. Design of rotating machines: General concepts. specific loading, output equations –dc machines and acmachines, factor affecting size of rotating machines, choice of specific magnetic and electric loadings. 3. Design of 3-phase induction motors: output equation, choice of air gap flux density and ampereconductors'parameter, main dimensions. Design of a 3-phase squirrel cage induction motor. 4. Design of single phase induction motors: output equation, main dimensions, relative size of single phase and 3-phase induction motors. Design of a single phase capacitor start induction motor. **5.** Design of synchronous machines**:** output equation, choice of specific magnetic and electric loadings, main dimensions, short circuit ratio. Design a 3-phase, 2-pole turbo alternator.	Measurement Lab 1) Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes. 2) Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter. 3) Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method. 4) Calibrate an ammeter using DC slide wire potentiometer. 5) Calibrate a voltmeter using Crompton potentiometer. 6) Measure low resistance by Crompton potentiometer. 7) Measure Low resistance by Kelvin's double bridge. 8) Measure earth resistance using fall of potential method. 9) Calibrate a single-phase energy meter by phantom loading at different power factors. 10) Measure self-inductance using Anderson's bridge.	**Syllabus Change** **Title Change** **Code Change**

48	**BTEE412**		Social Outreach, Discipline & Extra Curricular Activates	
50	**BTEE501**	**Power Electronics** **Unit 1** **Power Semiconductor Devices:**Construction, Principle of operation, Characteristics and applications of Power Transistor& Thyristor. Characteristics of GTO, DIAC, MCT, TRIAC, Power MOSFET and IGBT; Two-Transistor Model of Thyristor, Thyristor Commutation methods. **Unit 2** **SCR:** Construction and characteristics, specification and ratings, pulse transformer, optical isolators, methods of turn on, triggering circuits for SCR: R, RC, UJT relaxation oscillator. Rating extension by series and parallel connections, string efficiency. Protection of SCR-Protection against over voltage, over current, dv/dt, di/dt, Gate protection. **Unit 3** **Converters-I:** Single Phase half & full wave converters with RL & RLE load, Single phase dual converters, Three phase half wave converters. Three phase full converters with RL load, Three phase dual converters. **Converters-II:** Single and three-phase semi converters with RL & RLE load. **Unit 4** Power factor improvement-Extinction angle control, symmetrical angle control, pulse width modulation control and sinusoidal pulse width modulation control. Inversion operation. Effect of load and source impedances. **Unit 5** **DC-DC Converters:** Step Up/Down Copper, Control strategies, Chopper Configurations, Analysis of type A Chopper Voltage, current and load commutated chopper. Multiphase Chopper	**Electrical Materials** **UNIT-1** Elementary Materials Science Concepts:- Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect.. **UNIT-2** Dielectric Properties of Insulators in Static and Alternating field:Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, Internal field in solids and liquids, Properties of Ferro-Electric materials, Polarization, Piezoelectricity, Frequency dependence of Electronic and Ionic Polarizability, Complex dielectric constant of non-dipolar solids, dielectric losses. **UNIT-3** Magnetic Properties and Superconductivity: Magnetization of matter, Magnetic Material Classification, Ferromagnetic Origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density. **UNIT-4** Conductivity of metals: Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals. **UNIT-5** Semiconductor Materials:Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, Trends in materials used in Electrical Equipment	**New Course**

51	BTEE502	**Microprocessors & Computer Architecture** **Unit 1** Introduction to 8085 Microprocessor Architecture: CPU, address bus, data bus and control bus. Input/Output devices, buffers,encoders, latches and memories. Internal Data Operations and Registers, Pins and Signals, Peripheral Devices and Memory Organization, Interrupts. **Unit2** 8085 Microprocessor Instructions: Classification, Format and Timing. Instruction Set: 8 Bit and 16 Bit Instructions, Programming and Debugging, Subroutines. **Unit 3** 8085 Microprocessor Interfacing: 8259, 8257, 8255, 8253, 8155 chips and their applications. A/D conversion, memory, keyboard and display interface (8279). **Unit 4** 8086 Microprocessor: Architecture: Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes Instruction Set of 8086: Addressing Modes: Instruction format: Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control. Interrupts: Hardware and software interrupts, responses and types. **Unit 5** Basic Computer Architecture: Central Processing Unit, memory and input/output interfacing. Memory Classification Volatile and non-volatile memory, Primary and secondary memory, Static and Dynamic memory, Logical, Virtual and Physical memory. Types Of Memory: Magnetic core memory, binary cell, Rom architecture and different types of ROM, RAM architecture, PROM, PAL, PLA, Flash and Cachememory, SDRAM, RDRAM and DDRAM. Memory latency, memory bandwidth, memory seek time.	**Power System – I** **UNIT-1.** Basic Concepts:-Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources.Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis ofsimple three-phase circuits. Power Transfer in AC circuits and Reactive Power. **UNIT-2.** Power System Components:-Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables.Capacitance and Inductance calculations for simple configurations.Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power.Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Transformers: Three-phase connections and Phase-shifts. Threewinding transformers, autotransformers, Neutral Grounding transformers.Tap-Changing in transformers.Transformer Parameters.Single phase equivalent of three-phase transformers. Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and subtransient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations. **UNIT-3.** Over-voltages and Insulation Requirements:-Generation of Over-voltages: Lightning and Switching Surges. Protection against Overvoltages, Insulation Coordination.Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams. **UNIT-4.** Fault Analysis and Protection Systems:-Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults.Representation of generators, lines and transformers in sequence networks.Computation of Fault Currents.Neutral Grounding. Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application. **UNIT-5.** Introduction to DC Transmission & Renewable Energy Systems DC Transmission Systems:Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real	**New Course**

			Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid	
52	**BTEE503**	**Control System** Unit 1 Introduction: Elements of control systems, concept of open loop and closed loop systems, Examples and application of open loop and closed loop systems, brief idea of multivariable control systems. Mathematical Modeling of Physical Systems: Representation	**Control System** **UNIT-1.** Introduction to control problem:-Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra **UNIT-2.** Time Response Analysis: Standard test signals. Time response of first and second order systems for	**No Change**

		of physical system (Electro Mechanical) by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation. **Unit 2** Time Response Analysis of First Order and Second Order System:Characteristic equations, response to step, ramp and parabolic inputs. Transient response analysis, steady state errors and error constants, Transient & steady state analysis of LTI systems **Unit 3** Control System Components: Constructional and working concept of ac servomotor, synchronous and stepper motor Stability and Algebraic Criteria: concept of stability and necessary conditions,Routh-Hurwitz criteria and limitations.Root Locus Technique: The root locusconcepts, construction of root loci **Unit 4**. Frequency Response Analysis: Frequency response, correlation between time and frequency responses,polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, M and N Loci, Nichols chart. **Unit 5** The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain. Brief idea of proportional, derivative and integral controllers.	standard test inputs.Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability.Routh-Hurwitz Criteria.Relative Stability analysis.Root-Locus technique.Construction of Root-loci. **UNIT-3.** Frequency-response analysis :-Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. **UNIT-4.** Introduction to Controller Design:-Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design.Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers **UNIT-5.** State variable Analysis:-Concepts of state variables. State space model.Diagonalization of State Matrix.Solution of state equations.Eigenvalues and Stability Analysis.Concept of controllability and observability.Pole-placement by state feedback.Discrete-time systems.Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems Introduction to Optimal Control and Nonlinear Control:-Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis	
53	**BTEE504**	**Data Base Management System** **Unit 1** Introduction, need, purpose and goals of DBMS. DBMS Architecture, Concept of keys, Generalization and specialization, Introduction to relational data model, ER modeling, concept of ER diagram	**Microprocessor** **UNIT-1** Fundamentals of Microprocessors: Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics,	**New Course**

		Unit 2 Database Design: Conceptual Data Base design. Theory of normalization, Primitive and composite data types, concept of physical and logical Data abstraction and data independence, relational algebra and relational calculus. **Unit 3** SQL, DDL and DML. Constraints assertions, views database security. Application Development using SQL: Host Language interface embedded SQL programming. GL's, Forms management and report writers. Stored procedures and triggers. Dynamic SQL, JDBC. **Unit 4** Internal of RDBMS: Physical data organization in sequential, indexed, random and hashed files. Inverted and multi-list structures **Unit 5** (i) Transaction Management: Transaction concept, transaction state, serializability, conflict serializability, views serializability. (ii) Concurrency Control: Lock based protocol. (iii) Deadlock Handling: Prevention detection, recovery. (iv) Recovery System: Log based recovery.	Role of microcontrollers in embedded Systems. Overview of the 8051 family. **UNIT-2** The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles**.** **UNIT-3** Instruction Set and Programming: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.. **UNIT-4** Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices. **UNIT-5** External Communication Interface: Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee**.** Applications:LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing	
54	**BTEE505**	**TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER Supply** **Unit 1** systems:Basic network of power system. Transmission and distribution voltage, effect of system voltage on size of conductor and losses. Comparison of DC 2- wire, DC 3-wire, 1-phase AC and 3-phase AC (3-wire and 4-wire) systems. Distribution Systems: Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems. Kelvin's law for conductor size. **Unit 2**	**Electrical Machine Design** **UNIT-1.** Major Consideration for Design:Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines. **UNIT-2.** Transformers:Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers **UNIT-3.** Induction Motors:Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of	**Syllabus Change**

		Mechanical Features of Overhead Lines:Conductor material and types of conductor. Conductor arrangements and spacing. Calculation of sag and tension, supports at ice loading, stringing chart and sag template. dampers. **Unit 3** Parameters of Transmission Lines:Resistance inductance and capacitance of overheadlines, effect of earth, line transposition. Geometric mean radius and distance. Inductance and capacitance of line with symmetrical and unsymmetrical spacing Inductance and capacitance of double circuit lines. Skin and proximity effects.Equivalent circuits and performance of short and medium transmission lines. **Unit 4** Generalized ABCD Line Constants:equivalent circuit and performance of long transmission line. Ferranti effect. Interference with communication circuits. Power flow through atransmission line Corona:Electric stress between parallel conductors. Disruptive critical voltage and visual critical voltage, Factors affecting corona. Corona power loss. Effects of corona. **Unit 5** Insulators: Pin, shackle, suspension, post and strain insulators. Voltage distribution acrossan insulator string, grading and methods of improving string efficiency. Underground Cables: Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses. Causes of breakdown. Thermal rating of cable.	polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics. **UNIT-4.** Synchronous Machines:Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design. **UNIT-5.** Computer aided Design (CAD):Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.	

		Introduction to oil filled and gas filled cables.		
55	**BTEE506 A**	**Optimization Techniques** **Unit1** Introduction: Engineering application of Optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems. **Unit2** Optimization Techniques: Classical optimization, multivariable with no constraints, unconstrained minimization techniques, Penalty function techniques, Lagrange multipliers and feasibility techniques. **Unit3** Linear Programming: Graphical method, Simplex method, Duality in linear programming (LP), Sensitivity analysis Applications in civil engineering. **Unit 4** Non Linear Programming Techniques/Method: Unconstrained optimization, one dimensional minimization, golden section, elimination, quadratic and Fibonacci, interpolation Direct search, Descent, Constrained optimization, Direct and indirect, Optimization with calculus, Khun-Tucker conditions. **Unit5** Constrained Optimization Techniques: Direct, complex, cutting plane, exterior penalty function methods for structural engineering problems.	**Restructured Power System.** **UNIT-1.** Introduction to restructuring of power industry: Reasons for restructuring of power industry; Understanding the restructuring process, Entities involved, The levels of competition, The market place mechanisms, Sector-wise major changes required; Reasons and objectives of deregulation of various power systems across the world **UNIT-2.** Fundamentals of Economics: Consumer and suppliers behavior, Total utility and marginal utility, Law of diminishing marginal utility, Elasticity of demand and supply curve, Market equilibrium, Consumer and supplier surplus, Global welfare, Deadweight loss **UNIT-3.** The Philosophy of Market Models: Monopoly model, Single buyer model, Wholesale competition model, Retail competition model, distinguishing features of electricity as a commodity, Four pillars of market design, Cournot, Bertrand and Stackelberg competition model **UNIT-4.** Transmission Congestion Management: Transfer capability, Importance of congestion management, Effects of congestion, Classification of congestion management methods, ATC, TTC, TRM, CBM, ATC calculation using DC and AC model, Nodal pricing, Locational Marginal Prices (LMPs), Implications of nodal pricing, Price area congestion management Capacity alleviation methods, Re-dispatching, Counter-trade, Curtailment **UNIT-5.** Ancillary Service Management: Type and start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of ancillary services. Pricing of transmission network usage and Market power: Introduction to transmission pricing, Principles of transmission pricing, Classification of transmission pricing, Rolled-in transmission pricing paradigm. Attributes of a perfectly competitive market, The firm's supply decision under perfect competition, Imperfect competition, Monopoly, Oligopoly. Effect of market power, Identifying market power, HHI Index, Entropy coefficient, Lerner index	**New Course**

56	**BTEE506 B**	**Principle of Communication Systems** **Unit1** Noise Effects in Communication Systems: Resistor noise, Networks with reactive elements, Noise temperature, Noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits. **Unit2** Amplitude Modulation: Frequency translation, Recovery of base band signal, Spectrum & power relations in AM systems. Methods of generation & demodulation of AM-DSB, AMDSB/SC and AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers. **Unit 3** Frequency Modulation: Phase & freq. modulation & their relationship, Spectrum & bandwidth of a sinusoidally modulated FM signal, band & wide band FM. Generation & demodulation of FM signals. FM transmitters & receivers, Comparison of AM, FM & PM. Pre emphasis & de-emphasis. Threshold in FM, PLL demodulator. **Unit4** Noise in AM and FM: Calculation of SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of S/N ratio in FM demodulators, Super-heterodyne receivers. **Unit5** Pulse Modulation Systems: Sampling theorem, Generation and demodulation methods of PAM, PWM, PPM.	**Electromagnetic Wave** **UNIT-1.** Transmission Lines:Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines. **UNIT-2.** Maxwell's Equations:Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surfacecharge and surface current, Boundary conditions at media interface. **UNIT-3.** Uniform Plane Wave:Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector. **UNIT-4.** Plane Waves at Media Interface:Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary. **UNIT-5.** Waveguides: Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguidegeneral approach, Rectangular waveguides. Antennas:Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.	**New Course**
57	**BTEE506 C**	**Introduction to VLSI** **Unit1** Introduction to MOS Technology: Basic MOS transistors, Enhancement Mode transistoraction, Depletion Mode transistor action, NMOS and CMOS fabrication.	**Digital Control System** **UNIT-1.** Discrete Representation of Continuous Systems: Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization.Choice of sampling frequency.ZOH equivalent. **UNIT-2.**	**New Course**

		Unit 2 Basic Electrical Properties of MOS Circuits:I__ versus V__relationship, Aspects of threshold voltage, Transistor Trans conductance gm. The NMOS inverter, Pull up to Pull-down ratio for a NMOS Inverter and CMOS Inverter(B_/B), MOS transistor circuit Model, Noise Margin. **Unit 3** CMOS Logic Circuits:The inverter, Combinational Logic, NAND Gate NOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation **Unit 4** Basic Physical Design of Simple Gates and Layout Issues: Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance. **Unit 5** Introduction to VHDL, Verilog & other design tools. VHDL Code for simple Logic gates, flip-flops, shift-registers, Counters, Multiplexers, adders and subtractors.	Discrete System Analysis: Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane.Solution of Discrete time systems.Time response of discrete time system. **UNIT-3.** Stability of Discrete Time System: Stability analysis by Jury test. Stability analysis using bilinear transformation.Design of digital control system with dead beat response. Practical issues with dead beat response design. **UNIT-4.** State Space Approach for discrete time systems:State space models of discrete systems, State space analysis. Lyapunov Stability.Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability. 0 **UNIT-5.** Design of Digital Control System: Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker.Design of Discrete Observer for LTI System.Design of Discrete compensator. Discrete output feedback control: Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems	
58	**BTEE507**	**Power Electronics Lab** 1 Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT. 2 Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents. 3 Find V-I characteristics of TRIAC and DIAC. 4 Find output characteristics of MOSFET and IGBT. 5 Find transfer characteristics of MOSFET and IGBT. 6 Find UJT static emitter characteristics and study the variation in peak point and valley point. 7 Study and test firing circuits for SCR-R, RC and UJT	**Power System-I Lab** 1) Generating station design: Design considerations, basic schemes and single line diagram of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations. 2) Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law. 3) Study of short term, medium term and long term load forecasting. 4) Sending end and receiving end power circle diagrams. 5) Substations: Types of substations, various bus–bar arrangements. Electrical equipment for substations. 6) Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer. 7) Design an EHV transmission line 8) Study filtration and Treatment of transformer oil. 9) Determine dielectric strength of transformer oil. 10) Determine capacitance and dielectric loss of an	**New Course**

		firing circuits. 8 Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters. 9 Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle. 10 Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode. 11 Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode. 12 Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature voltage versus speed characteristics.	insulating material using Schering bridge. 11) Flash over voltage testing of insulators.	
59	**BTEE508**	**Microprocessor Lab** 1 Study the hardware, functions, memory structure and operation of 8085-Microprocessor kit. 2 Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit. 3 Transfer of a block of data in memory to another place in memory 4 Transfer of black to another location in reverse order. 5 Searching a number in an array. 6 Sorting of array in: (1) Ascending order (2) Descending order. 7 Finding party of a 32-bit number. 8 Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal. 9 Program to multiply two 8–bit numbers 10 Program to generate and	**Control System Lab** 1. (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and wn natural undamped frequency. (b) Plot ramp response. 2. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse 3. To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system. 4. To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies. (a) Leg Network (b) Lead Network. (c) Leg-lead Network. 5. Draw the bode plot in real time for a Non-Inverting amplifier. 6. Draw the bode plot in real time for an Inverting amplifier. 7. Draw the bode plot for second order transfer function. 8. Draw the bode plot for first order transfer function. 9. Design and analyse Tow- Thomas biquad filter. 10.Design and calculate Kp, Ki for PI controller. 11.Design PID controller and also calculate Kp, Ki, Kd for it.	**Syllabus Change** **Code Change**

		sum 15 Fibonacci numbers. 11 Program for rolling display of message “India”, “HELLO”. 12 To insert a number at correct place in a sorted array. 13 Reversing bits of an 8-bit number. 14 Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255. 15 Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware. 16 Parallel data transfer between two DYNA-85 kit using 8253 ports. 17 Generation of different waveform on 8253/8254 programmable timer.		
60	**BTEE509**	**System Programming Lab** Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets) Simulink: Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)Write a program to generate Machine Op- code table using two pass Assembler.	**Microprocessor Lab** 1. Study the hardware, functions, memory structure and operation of 8085- Microprocessor kit. 2. Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit. 3. Transfer of a block of data in memory to another place in memory 4. Transfer of black to another location in reverse order. 5. Searching a number in an array. 6. Sorting of array in: (1) Ascending order (2) Descending order. 7. Finding party of a 32-bit number. 8. Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal. 9. Program to multiply two 8–bit numbers 10. Program to generate and sum 15 Fibonacci numbers. 11. Program for rolling display of message “India”, “HELLO”. 12. To insert a number at correct place in a sorted array. 13. Reversing bits of an 8-bit number. 14. Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255. 15. Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware. 16. Parallel data transfer between two DYNA-85 kit using 8253 ports. 17. Generation of different waveform on 8253/8254 programmable timer	**Code Change**

61	**BTEE510**	**DBMS Lab** 1 Designing database and constraints using DDL statements. 2 Experiments for practicing SQL query execution on designed database. 3 Database connectivity using JDBC/ODBC. 4 Features of embedded SQL. 5 Designing front end in HLL and accessing data from backend database. 6 Designing simple projects using front end-back end programming 7 Project for generating Electricity Bills 8 Project for managing student's attendance/marks details.	**System Programming Lab** 1. Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multidimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets) 2. Write a MATLAB program for designing Rheostat. 3. Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets) 4. Write a program to generate Machine Op- code table using two pass Assembler. 5. Single Phase Full Wave Diode Bridge Rectifier With LC Filter 6. Simulate Three phase Half wave diode rectifier with RL load. 7. Starting Of A 5 HP 240V DC Motor With A Three-Step Resistance Starter. 8. Simulate OC/SC test of 1-phase transformer. 9. Simulate Torque- speed characteristics of induction motor.	**New Course**
62	**BTEE 511**	**Professional Ethics and Disaster Manage** 1 Objectives: to help the students • To appreciate the importance and values and ethics in implementing the technology and ensure sustainable development, happiness and prosperity. • To understand the co-existence with nature and to be aware of potential natural and manmade disasters.	Industrial Training	**Title Change Code Change**

		2 Human Values: Effect of Technological Growth and Sustainable Development. Profession and Human Values: Values crisis in contemporary society. Nature of values. Psychological Values, Societal Values and Aesthetic Values. Moral and Ethical values. 3 Professional Ethics: • Professional and Professionalism-Professional Accountability, Role of a professional, Ethic and image of profession. • Engineering Profession and Ethics-Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world. • Professional Responsibilities-Collegiality, Loyalty, Confidentially, Conflict of Interest, Whistle Blowing. 4 Disaster Management: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, impact and preventive measures: Natural Disasters- Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions. 5 Manmade Disasters: Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Case studies. Disaster Management Cycle and its components. In order to fulfill objectives of course, (A) The institute shall be required to organize at least 3 expert lectures by eminent social workers/professional leaders.		

		(B) Each student shall compulsorily be required to: I. Visit a social institution/NGO for at least 7 days during the semester and submit a Summary report. II. Perform a case study of a disaster that has occurred in last decade and submit a Summary report.		
63	**BTEE 512**	**Discipline & Extra Curricular Activity**	Social Outreach, Discipline & Extra Curricular Activates	**Title Change**
64	**BTEE601**	**Modern Control Theory** **Unit 1** Introduction: Concept of Linear vector space Linear Independence, Bases & Representation, domain and range. Concept of Linearity, relaxedness, time invariance, causality. State Space Approach of Control System Analysis:Modern Vs conventional control theory, concept of state, state variable state vector, state space, state space equations, Writing statespace equations of mechanical, Electrical systems, Analogous systems. **Unit 2** State Space Representation using physical and phase variables, comparison form of system representation. Block diagram representation of state model. Signal flow graph representation. State space representation using canonical variables. Diagonal matrix. Jordan canonical form, Derivation of transfer functions from state-model. **Unit 3** Solution of State Equations:Eigenvalues and Eigen vectors. Matrix.Exponential, State transition matrix, Properties of state transition matrix. Computation of State transition matrix concepts of controllability &observability, Pole placement by state feedback. **Unit4** Digital Control Systems: Introduction, sampled data control	**COMPUTER ARCHITECTURE** **UNIT-1** Introduction to computer organization: Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organisation **UNIT-2** Memory organization System: memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks **UNIT-3** Input – output Organization: Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus. **UNIT-4** 16 and 32 microprocessors: 80 x 86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86 **UNIT-5** Pipelining: Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set Different Architectures: VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming	**New Course**

		systems, signal reconstruction, difference equations. The z-transform, Z-Transfer Function. Block diagram analysis of sampled data systems, z and s domain relationship. **Unit5** Modeling of sample-hold circuit, steady state accuracy, stability in z-plane and Jury stability criterion, bilinear transformation Routh-Hurwitz criterion on s-planes,digital PID controllers, Introductionto adaptive		
65	**BTEE602**	**High Voltage Engineering** **Unit1** (i) Breakdown in Gases: Introduction to mechanism of breakdown in gases, Townsend's breakdown mechanism. Breakdown in electromagnetic gases, Application of gases in power system. (ii) Breakdown in Liquids: Introduction to mechanism of breakdown in liquids, suspended solid particle mechanism and cavity breakdown. Application of oil in power apparatus. (iii) Breakdown in solids: Introduction to mechanism of breakdown in solids, electromechanical breakdown, treeing & tracking breakdown and thermal breakdown **Unit 2** (i) High DC Voltage Generation: Generation of high dc voltage, basic voltage multiplier circuit. (ii) High AC Voltage Generation: Cascaded Transformers. (iii) Impulse Voltage generation: Impulse voltage, basic impulse circuit, Mark's multistage impulse generator. (iv) Measurement of High Voltage: Potential dividers - resistive, capacitive and	**POWER SYSTEM –II** **UNIT-1** Power Flow Analysis: Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems. **UNIT-2** Stability Constraints in synchronous grids: Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability. **UNIT-3** Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt	**Title Change Code Change**

		mixed potential dividers. Sphere gap-Construction and operation. Klydonorgraph. **Unit3** Nondestructive Insulation Tests: (i) Measurement of resistively, dielectric constant and loss factor. High Voltage Schering Bridge- measurement of capacitance and dielectric loss. (ii)Partial Discharges: Introduction to partial discharge, partial discharge equivalent circuit. Basic wide-band and narrow band PD detection circuits. **Unit 4** (i) Over voltages: Causes of over voltages, introduction to lightning phenomena, over voltages due to lighting. (ii) Travelling Waves: Travelling waves on transmission lines-open end line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction and line terminated through a capacitance. Attenuation of traveling waves. **Unit5** (i) Over Voltage Protection: Basic construction and operation of ground wires-protection angle and protective zone, ground rods, counterpoise, surge absorber, rod gap and arcing horn, lighting arresters - expulsion type, non -linear gap type and metal oxide gapless type. (ii) Insulation Coordination:Volt-time curves, basic impulse insulation levels,	Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters **UNIT-4** Monitoring and Control:Overview of Energy Control Centre Functions**:** SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control **UNIT-5** Power System Economics and Management: Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework	
66	**BTEE603**	**Switchgear & Protection** **Unit1** Static Relays:Introduction to static relays, merits and demerits. Comparators:amplitude and phase comparators, duality between amplitude and phase comparators. Introduction to (a) amplitude comparators-circulating current type, phase splitting type and sampling type, (b) phase comparators-vector product type and coincidence type.	**POWER SYSTEM PROTECTION** **UNIT-1.** Introduction and Components of a Protection System: Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers. **UNIT-2.** Faults and Over-Current Protection:Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection andovercurrent relay co-ordination. **UNIT-3.** Equipment Protection Schemes: Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar	**Title Change** **Code Change**

		Static Over Current Relays:Introduction to instantaneous, definite time, inverse time and directional overcurrent relays. **Unit2** Static Differential Relays: Brief description of static differential relay schemes- single phase and three phase schemes. Introduction to static differential protection of generator and transformer. Static Distance Relays:Introduction to static impedance, reactance and mho relays. **Unit3** Carrier Current Protection: Basic apparatus and scheme of power line carrier system. Principle of operation of directional comparison and phase comparison carrier protection and carrier assisted distance protection. Distance Protection:Effect of power swings on the performance of distance protection. Out of step tripping and blocking relays, mho relay with blinders. Introduction to quadrilateral and elliptical relays. **Unit 4** Circuit Breakers-I:Electric arc and its characteristics, arc interruption-high resistance interruption and current zero interruption. Arc interruption theories– recovery rate theory and energy balance theory. Restriking voltage and recovery voltage, develop expressions for restriking voltage and RRRV. Resistance switching, current chopping and interruption of capacitive current. Oil circuit breakers-bulk oil and minimum oil circuit breakers. Air circuit breakers. Miniature Circuit breaker (MCB). **Unit 5** Circuit Breakers-II: Air blast, SF6 and vacuum circuit breakers. Selection of circuit breakers, rating of circuit breakers. Digital Protection:Introduction to	arrangement schemes. **UNIT-4.** Digital Protection: Computer-aided protection, Fourier analysis and estimation of Phasor from DFT. Sampling, aliasing issues. **UNIT-5.** Modeling and Simulation of Protection Schemes: CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing. System Protection**:** Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of- step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.	

		digital protection. Brief description of block diagram of digital relay. Introduction to digital overcurrent, transformer differential and transmission line distance protection.		
67	**BTEE604**	**Advanced Power Electronics** **Unit1** AC Voltage Controllers: Principle of On-Off Control, Principle of Phase control, SinglePhase Bi-directional Controllers with Resistive Loads, Single Phase Controllers with Inductive Loads, Three Phase full wave AC controllers, AC Voltage **Unit 2** Controller with PWM Control. Cyclo-converters: Basic principle of operation, single phase to single phase, three-phase to three-phase and three-phase to single phase cyclo-converters. Output equation, Control circuit. **Unit 3** Inverters:Principle of Operation, Single-phase bridge inverters. Three phase bridge Inverters: 180 and 120 degree of conduction. VSI and CSI. Voltage control of Single Phase and Three Phase Inverters, Harmonic analysis,harmonic reduction techniques,Pulse width modulation techniques. **Unit 4** Resonant Pulse Inverter:Series resonant inverter with unidirectional switches, parallel resonant inverter, class E resonant inverter, L-type and M-type ZCS resonant converter, ZVS resonant converter. **Unit 5** Power Supplies: Switched Mode DC Power Supplies, fly-back converter, forward converter, half and full bridge converter, resonant DC power supplies, bi-directional power supplies. Resonant AC power supplies, bidirectional AC power supplies. Multistage conversions, Control Circuits: Voltage Mode Control, Current Mode Control	**ELECTRICAL ENERGY CONSERVATION AND AUDITING** **UNIT-1** Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. **UNIT-2** Basics of Energy and its Various Forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion. **UNIT-3** Energy Management & 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 & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams. **UNIT-4** Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities	**New Course**

			with energy efficient motors. **UNIT-5** Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems. Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology	
68	**BTEE605**	**Smart Grid Technology** **Unit 1** Introduction to Smart Grid: Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives. **Unit 2** Smart Grid Technologies: Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and Control, Distribution Systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV). **Unit 3** Smart Meters and Advanced Metering Infrastructure: Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and	**ELECTRICAL DRIVES** **UNIT-1.** DC motor characteristics: Review of emf and torque equations of DC machine, review of torque- speed characteristics of separately excited dc motor, change in torque- speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation **UNIT-2.** Chopper fed DC drive: Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.Multi-quadrant DC drive: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single- quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking **UNIT-3.** Closed-loop control of DC Drive: Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design **UNIT-4.** Induction motor characteristics:Review of induction	**New Course**

		benefits,AMIprotocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement, Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection. **Unit 4** Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected RenewableEnergy Sources, Power Quality Conditioners for Smart Grid, Web based Power Qualitymonitoring, Power Quality Audit. **Unit5** High Performance Computing for Smart Grid Applications: Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadbandover Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing tomake Smart Grids smarter, Cyber Security for Smart Grid	motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation, vector control of IM, Direct torque control of IM. **UNIT-5.** Scalar control or constant V/f control of induction motor:Review of three-phase voltage source inverter, generation of three- phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation Control of slip ring induction motor:Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery	
69	**BTEE606 A**	**Advanced Microprocessors** **Unit 1** 8086 Microprocessor: Hardware specifications, architecture, address spaces, clock generator, bus controller and arbiter, Minimum and maximum mode, System Bus Timing. Software & Instruction Set: Assembly language programming: addressing mode and instructions of 8086, linking and execution of programs, MACRO programming, assembler directives and operators. I/O Interfaces: Programmable peripheral interfacing (8255, 8155), Programmable Timer interfacing (8253, 8254), Programmable interrupt controller (8259), Serial CommunicationInterfaces. Data & Memory Interfacing: A/D, D/A converter interfacing, Memory interfacing and Decoding, DMA controller. Multiprocessor Configurations: 8086 based Multiprocessor systems. 8087 Numeric data processor. Introduction to 8-bit and 16-bit microcontrollers.	**POWER SYSTEM PLANNING** **UNIT-1.** Introduction of power planning:National and Regional Planning, structure of Power System, planning tools. Electricity Regulation, Electrical Forecasting, forecasting techniques modeling. **UNIT-2.** Power system Reliability: System Reliability, Reliability Planning Criteria for Generation, Transmission and Distribution, Grid Reliability, Reliability Target, Security Requirement, Disaster Management, Roadmap for Reliability and Quality. **UNIT- 3.** Generation Planning:Objectives & Factors affecting Generation Planning, Generation Sources, Integrated Resource Planning, Generation System Model, Loss of Load (Calculation and Approaches), Outage Rate, Capacity Expansion, Scheduled Outage, Loss of Energy, Evaluation Methods. Interconnected System, Factors affecting interconnection under Emergency Assistance. **UNIT-4.** Transmission & Distribution Planning:Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability. Radial Networks – Introduction, Network Reconfiguration, Evaluation Techniques, Interruption Indices, Effects of Lateral Distribution Protection, Effects of	

			Disconnects, Effects of Protection Failure, Effects of Transferring Loads, Distribution Reliability Indices **UNIT-5.** Demand Side Planning: Computer aided planning, wheeling. Environmental effects, the greenhouse effect. Technological impacts.Insulation coordination. Reactive compensation	
70	**BTEE606 B**	**Power System Instrumentation** **Unit 1** Theory of Errors: Accuracy and precision, systematic and random errors, limits of error, probable error and standard deviation. Gaussian error curves, combination of errors. **Unit 2** Transducers: Construction & Operating Characteristics of active and digital transducers, Measurement of temperature, pressure, displacement, acceleration, noise level. Instrumentation for strain, displacement, velocity, acceleration, force, torque and temperature. **Unit 3** Signal Conditioning: Instrumentation amplifiers, isolation amplifiers, analog multipliers, analog dividers, function generators, timers, sample and hold, optical and magnetic isolators. Frequency to voltage converters, temperature to current converters. Shielding and grounding. **Unit 4** Power System Instrumentation-I:Measurement of voltage, current, phase angle, frequency, active power and reactive power in power plants. Energy meters and multipart tariff meters. Basic idea of LT & HT panel's. **Unit 5** Power System Instrumentation-II:Capacitive voltage transformers and their transient behavior, Current Transformers for measurement and protection,composite errors and transient response.	**DIGITAL SIGNAL PROCESSING** **UNIT-1.** Discrete-time signals and systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate **UNIT-2.** Z-transform: z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using ztransform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms. **UNIT-3.** Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems **UNIT-4.** Design of Digital filters:Design of FIR Digital filters: Windowmethod, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design.Parametric and non- parametric spectral estimation. Introduction to multi-rate signal processing **UNIT-5.** Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	**New Course**
71	**BTEE606 C**	**Digital Communication and Information Theory** **Unit 1** PCM & Delta Modulation Systems: PCM and delta modulation, quantization noise	**ELECTRICAL AND HYBRID VEHICLES**	**New Course**

		in PCM and delta modulation. Signal-to-noise ratio in PCM and delta modulation, T1 Carrier System, Comparison of PCM and DM. Adaptive delta Modulation. Bit, word and frame synchronization, Matched filter detection. **Unit 2** Digital Modulation Techniques: Various techniques of phase shift, amplitude shift and frequency shift keying. Minimum shift keying. Modulation & Demodulation. **Unit 3** Error Probability in Digital Modulation: Calculation of error probabilities for PSK, ASK, FSK & MSK techniques. **Unit 4** Information Theory:Amount of Information, Average Information, Entropy, Information rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound Capacity of a Gaussian Channel, BW-S/N trade off, Orthogonal signal transmission. **Unit 5** Coding: Coding of Information, Hamming code, Single Parity-Bit Code, Linear Block code, cyclic code &convolution code.	**UNIT-1.** Conventional Vehicles:Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. **UNIT-2.** Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drivetrains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. **UNIT-3.** Electric Trains Electric Drive-trains:Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. **UNIT-4.** Energy Storage:Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems **UNIT-5.** Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	
72	**BTEE607**	**Control System Lab** 1 Introduction to MATLAB Computing Control Software. 2 Defining Systems in TF, ZPK form.	**POWER SYSTEM - II LAB** 1. Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault. 2. Load flow analysis for a given system (for 3 to 6	**New Course**

		3 (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and wn natural undamped frequency. (b) Plot ramp response. 4 For a given 2ndorder system plot step response and obtain time response specification. 5 To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse 6 To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system. 7 To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies. (a) Log Network (b) Lead Network (c) Log-lead Network. 8 To draw characteristics of ac servomotor 9 To perform experiment on Potentiometer error detector. 10 Check for the stability of a given closed loop system. 11 Plot bode plot for a 2ndorder system and find GM and PM.	bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software. 3. Three phase short circuit analysis in a synchronous machine(symmetrical fault analysis) 4. Study of voltage security analysis. 5. Study of overload security analysis and obtain results for the given problem using MATLAB or any software. 6. Study of economic load dispatch problem with different methods. 7. Study of transient stability analysis using MATLAB/ETAP Software. 8. Power flow analysis of a slack bus connected to different loads.	
73	**BTEE608**	**Power System Lab** 1 Study the burden effect on the performance of CT and measure ratio error. 2 Find out the sequence components of currents in three 1-Phase transformers and 3-Phase transformer and compare their results. 3 (i) Study over current relay.	**ELECTRIC DRIVE LAB** 1Study and test the firing circuit of three phase half controlled bridge converter. 2. Power quality analysis of 3 phase half controlled bridge converter with R and RL loads. 3. Power Quality analysis of 3-phase full controlled bridge converter feeding R and RL load. 4. Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads. 5. Experimental analysis of 3-phase AC voltage	**Title Change** **Code Change**

		(ii) Draw the current-time characteristic of an over current relay for TMS=1 & 0.5 and PSM=1.25 & 1.0. 4 (i) Study percentage bias differential relay. (ii) Plot the characteristics of a percentage bias differential relay for 20%, 30% and 40% biasing. 5 Study gas actuated Buchholz relay. 6 Study under frequency relay and check it's setting experimentally. 7 Design a HV transmission line. 8 Study a typical grid substation. 9 Study earthing of power station, substation and building	regulator with delta connected, star connected (with floating load), R& RL load 6. Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic. 7. Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic. 8. Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator. 9. Control speed of a 3-phase BLDC motor. 10. Control speed of a 3-phase PMSM motor using frequency and voltage control 11. Control speed of universal motor using AC voltage regulator. 12. Study 3-phase dual converter. 13. Study speed control of dc motor using 3-phase dual converter. 14. Study three-phase cyclo-converter and speed control of synchronous motor using cyclo-converter. 15. Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter.	
74	**BTEE609**	**Advanced Power Electronics Lab** 1 Study and test AC voltage regulators using triac, antiparallel thyristors and triac&diac. 2 Study and test single phase PWM inverter. 3 Study and test buck, boost and buck- boost regulators. 4 Study and test MOSFET chopper. 5 Study and test Zero voltage switching. 6 Study and test SCR DC circuit breaker. 7 Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic. 8 Control speed of a single-phase induction motor using single phase AC voltage regulator. 9 (i) Study single-phase dual converter. (ii) Study speed control of dc motor using single-phase dual converter. 10 Study one, two and four quadrant choppers (DC-DC converters). 11 Study speed control of dc motor	**POWER SYSTEM PROTECTION LAB** 1. To determine fault type, fault impedance and fault location during single line to ground fault. 2. To determine fault type, fault impedance and fault location during single line-toline fault. 3. To determine fault type, fault impedance and fault location during double line to ground fault. 4. To study the operation of micro-controller based over current relay in DMT type and IDMT type. 5. To analyse the operation of micro-controller based directional over current relay in DMT type and IDMT type. 6. To study the micro-controller based under voltage relay. 7. To study the micro-controller based over voltage relay. 8. To study the operation of micro-controller based un-biased single-phase differential relay. 9. To study the operation of micro-controller based biased single-phase differential relay. 10. To study the operation of micro-controller un-based biased three phase differential relay. 11. To study the operation of micro-controller based biased three phase differential relay.	**Title Change Code Change**

		using one, two and four quadrant choppers. 12 Study single-phase cycloconverter.		
75	**BTEE610**	**Smart Grid Lab** 1. Study different components of smart grid 2. To visit thermal/nuclear power plant 3. To design and simulate hybrid wind-solar power generation system using simulating software 4. Study Different terminology used in power quality assessment 5. Study and measure certain parameters of power quality in laboratory with and without power quality improvement devices.	**MODELLING AND SIMULATION LAB** Simulate Swing Equation in Simulink (MATLAB) 2. Modeling of Synchronous Machine. 3. Modeling of Induction Machine. 4. Modeling of DC Machine. 5. Simulate simple circuits. 6. (a) Modeling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device. 7. (a) Modeling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices. 8. FACTS Controller designs with FACT devices for SMIB system.	**New Course**
76	**BTEE611**	**Entrepreneurship Development** 1 Definition of entrepreneur, qualities of a successful entrepreneur, Charms of being an entrepreneur, achievement- motivation, leadership and entrepreneurial competencies. 2 Decision-making, procedures and f 3 Identification and selection of Implementation and customer satisf 4 Business crises, problem-solving at 5 Knowledge based enterprises, S entrepreneurship. 6 Marketing & Sales Promotion, Techno-Economic Feasibility Assessment by Preparation of Preliminary & Detailed project report.		
77	**BTEE612**	**Discipline & Extra Curricular Activity**		

78	BTEE701	**Power System Planning** **Unit1** Introduction of power planning, National and Regional Planning, structure of P.S., planning tools Electricity Regulation, Electrical Forecasting, forecasting techniques modeling. **Unit2** Generation planning, Integrated power generation cogeneration/captive power, Power pooling and power trading. Transmission and distribution planning. Power system Economics. Power sector finance, financial planning, private participation Rural Electrification investment, concept of Rational tariffs. **Unit 3** Power supply Reliability, Reliability planning. System operation planning, load management, load prediction, reactive power balance Online power flow studies, state estimation, computerized management, power system simulator. **Unit4** Computer aided planning, wheeling. Environmental effects, the greenhouse effect Technological impacts. Insulation coordination. Reactive compensation. **Unit 5** Optimal power system expansion planning: Formulation of least cost optimization problem incorporating the capital, Operating and maintenance cost of candidate plants of different types (Thermal, Hydro, Nuclear, Non-conventional etc.) and minimum assured reliability	**BTEE701A** **Wind and Solar Energy Systems.** **Unit-1** **Physics of Wind Power** History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics- probability distributions, Wind speed and power-cumulative distribution functions. **Unit-2** **Wind Generator Topologies** Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. **Unit-3** **Solar Photovoltaic** Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control. **Unit-4** **Network Integration Issues** Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems	**New Course**

		constraint – optimization techniques for solution by programming.	**Unit-5** **Solar Thermal Power Generation** Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.	
79	**BTEE701 B**		**BTEE701B** **POWER QUALITY AND FACTS** **Unit-1** **Transmission Lines and Series/Shunt Reactive Power Compensation** Basics of AC Transmission.Analysis of uncompensated AC transmission lines.Passive Reactive Power Compensation.Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation **Unit-2** **Thyristor-based Flexible AC Transmission Controllers (FACTS)** Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter. **Unit-3** **Voltage Source Converter based (FACTS) controllers** Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective	**Title Change Code Change**

			Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter **Unit-4** **Application of FACTS** Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Waveform Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.. **Unit-5** **DSTATCOM** Reactive Power Compensation, Harmonics and Unbalance mitigationin Distribution Systems using DSTATCOM and Shunt Active Filters.Synchronous Reference Frame Extraction of Reference Currents.Current Control Techniques in for DSTATCOM**.** **Dynamic Voltage Restorer and Unified Power Quality Conditioner**- Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering.Unified Power Quality Conditioner (UPQC): Working Principle.Capabilities and	

			Control Strategies.	
80	**BTEE701 C**		**BTEE701C** **CONTROL SYSTEM DESIGN** **Unit-1** **Design Specifications** Introduction to design problem and philosophy.Introduction to time domain and frequency domain design specification and its physical relevance.Effect of gain on transient and steady state response.Effect of addition of pole on system performance. Effect of addition of zero on system response.. **Unit-2** **Design of Classical Control System in the time domain**: Introduction to compensator.Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation.Realization of compensators. **Design of Classical Control System in frequency domain** Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram. **Unit-3** **Design of PID controllers:** Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control **Unit-4** **Control System Design in state space**:	**Title Change Code Change**

			Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle. **Unit-5** **Nonlinearities and its effect on system performance**: Various types of non-linearities.Effect of various non-linearities on system performance.Singular points. Phase plot analysis	
81	**BTEE702**	**Power System Analysis** **Unit 1** Percent and per unit quantities. Single line diagram for a balanced 3-phase system Admittance Model: Branch and node admittances Equivalent admittance network and calculation of Y bus. Modification of an existing Y bus. **Unit 2** Impendence Model: Bus admittance and impedance matrices. Thevenin's theorem and Z bus. Direct determination of Z bus. Modification of an existing bus. Symmetrical fault Analysis: Transient on a Transmission line, short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions. Selection of circuit breakers, Algorithm for short circuit studies. Analysis of three-phase faults. **Unit 3**	**BTEE702A** **Principle of Electronic Communication (OPEN ELECTIVE)** **Unit-1** **Introduction:** Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels. **Unit-2** **Simple description on Modulation:** Analog Modulation-AM, Frequency modulation-FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes. **Unit-3**	**New Course**

		SymmetricalComponents:Fortescue theorem, symmetrical component transformation. Phase shift in star-delta transformers. Sequence Impedances of transmission lines, Synchronous Machineand Transformers, zero sequence network of transformers and transmission lines. Construction of sequence networks of power system. Fault Analysis: Analysis of single line to ground faults using symmetrical components, connection of sequence networks under the fault condition. **Unit 4** Unsymmetrical Fault Analysis: (i) Analysis of line-to-line and double line to ground faults using symmetrical components, connection of sequence networks under fault conditions. Analysis of unsymmetrical shunt faults using bus impedance matrix method. **Unit 5** Load Flow Analysis:Load flow problem, development of load flow equations, bus classification Gauss Seidel, Newton Raphosn, decoupled and fast decoupled methods for load flow analysis. Comparison of load flow methods.	**Telecommunication Systems:** Telephones Telephone system, Paging systems, Internet, Telephony. **Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN. **Unit-4** **Satellite Communication:** Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems. **Optical Communication:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing. **Unit-5** **Cellular and Mobile Communications:** Cellular telephone systems, AMPS, GSM, CDMA and WCDMA. **Wireless Technologies:** Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.	

82	**BTEE702B**		**BTEE702B** **Water Pollution control Engineering** **Unit-1** **Introduction:** Characterisation and monitoring of industrial and municipal waste water, recycling and reuse of wastewater. Basic philosophy and selection of water pollution treatment plants; Design criteria: hydraulic loading rate, organic loading rate, residence time, dilution rate. **Unit-2** **Physico-Chemical Treatment Methods:** Sedimentation, coagulation, flocculation, thickening, floatation. Biological Treatment Fundamentals: Microbial metabolism, bacterial growth kinetics; Biological nitrification, denitrification and phosphorus removal; Anerobic fermentation and aerobic treatment. **Unit-3** **Aerobic Suspended and Attached Growth Biological Treatment Processes:** Aerated lagoon, activated sludge systems, trickling filter, sequential batch reactor, fluidized bed bioreactors. Anaerobic Suspended and Attached Growth Biological Treatment Processes: UASB and hybrid UASB reactors, bio-towers. **Unit-4** **Advanced Treatment Processes:** Membrane processes- reverse osmosis, ultrafiltration, nanofiltration and electrodialysis; Wet air oxidation, adsorption and ion-exchange; Wet-land and root-zone treatment of industrial and municipal wastes; Design of sludge drying	**Title Change Code Change**

			beds, thermal and biological processes for sludge and land fillings. **Unit-5** Case Studies: Waste water treatment and disposal strategies in petroleum, petrochemical, fertilizer, distillery, pulp and paper industries.	
83	**BTEE702C**		**BTEE702C** **Micro and Smart System Technology** **Course objective(s):-**Gain knowledge of Smart Materials, Sensors & Actuators, Microsystems. Understand the Operation of Smart Devices & Systems, Electronic Circuits & Control for MEMS, Methodology of Micro-manufacturing. **Syllabus** **Unit-1** **Introduction**: INTRODUCTION TO MICRO AND SMART SYSTEMS: (a) Smart-material systems- History, Introduction and evolution of smart materials, structures and systems. Components of a smart system.Application areas.Commercial products. (b) Microsystems-Introduction, History and their evolution, Feynman's vision. Micromachined transducers.Evolution of micro-manufacturing.Multi-disciplinary aspects.Applications areas. Commercial products **Unit-2** **MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:** a) Definitions and salient features of sensors, actuators, and systems. b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conduct metric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor. c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print head,	**Title Change Code Change**

			electrostatic comb-drive and micro motor, magnetic micro relay, shape memory-alloy based actuator, electro-thermal actuator. d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin. **Unit-3** **MICROMANUFACTURING AND MATERIAL PROCESSING:** a. Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization. b. Silicon micromachining: surface, bulk, moulding, bonding based process flows. c. Thick-film processing: d. Smart material processing: e. Processing of other materials: ceramics, polymers and metals f. Emerging trends **Unit-4** **MODELING:** a. Scaling issues. b. Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading.Heat transfer issues.Basic fluids issues. c. Electrostatics. Coupled electromechanics.Electromagnetic actuation.Capillary electro-phoresis.Piezoresistive modeling.Piezoelectric modeling.Magnetostrictive actuators. **Unit-5** **INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:** Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low temperature-cofired-ceramic (LTCC) multi-chip-module technology.Microsystem packaging examples. Examples from smart systems and micromachined accelerometer or a thermal cycler BEL pressure sensor, thermal cycler for DNA amplification, and	

			active vibration control of a beam	
84	**BTEE703**	**Artificial Intelligence Techniques** **Unit 1** Artificial Intelligence: Introduction to AI and knowledge based Expert systems, Introduction, Importance and Definition of AI, ES, ES building tools and shells. **Unit 2** Knowledge Representation: Concept of knowledge, Representation of knowledge using logics rules, frames. Procedural versus. Declarative knowledge, forward versus backward chaining Control Strategies: Concept of heuristic search, search techniques depth first search, Breath first search, Generate & test hill climbing, best first search. Artificial Neural Network: Biological Neurons and synapses, characteristics **Unit 3** Artificial Neural Networks, types of activation functions. Perceptions: Perception representation, limitations of perceptrons. Single layer and multiplayer perceptrons. Perceptron learning algorithms. **Unit 4** Basic Concepts in Learning ANN: Supervised learning, Back propagation algorithm, unsupervised learning, Kohonen's top field network & Algorithm. **Unit 5** Fuzzy Logic: Fuzzy logic concepts, Fuzzy relation and membership functions, Defuzzification, Fuzzy controllers, Genetic Algorithm: concepts, coding, reproduction, crossover, mutation, scaling and fitness.	**EMBEDDED SYSTEM LAB** 1 Introduction to Embedded Systems and their working. 2 Data transfer instructions using different addressing modes and block transfer. 3 Write a program for Arithmetic operations in binary and BCD-addition, subtraction, multiplication and division and display. 4 Interfacing D/A converter & Write a program for generation of simple waveforms such as triangular, ramp, Square etc. 5 Write a program to interfacing IR sensor to realize obstacle detector. 6 Write a program to implement temperature measurement and displaying the same on an LCD display. 7 Write a program for interfacing GAS sensor and perform GAS leakage detection. 8 Write a program to design the Traffic Light System and implement the same using suitable hardware. 9 Write a program for interfacing finger print sensor. 10 Write a program for Master Slave Communication between using suitable hardware and using SPI 11 Write a program for variable frequency square wave generation using with suitable hardware. 12 Write a program to implement a PWM based speed controller for 12 V/24V DC Motor incorporating a suitable potentiometer to provide the set point.	**New Course**

85	**BTEE704**	**Non Conventional Energy Sources** **Unit 1** Introduction: World energy situation, conventional and non-conventional energy sources, Indian energy scene. Tidal Energy: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India. **Unit 2** Solar Energy: Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector - parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system. **Unit 3** Wind Energy: Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes-constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy. Geothermal Energy: Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. **Unit 4** Nuclear Fusion Energy: Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion.	**Advanced Control System Lab** 1 Determination of transfer functions of DC servomotor and AC servomotor. 2 Time domain response of rotary servo and Linear servo (first order and second order) systems using MATLAB/Simulink. 3 Simulate Speed and position control of DC Motor 4 Frequency response of small-motion, linearized model of industrial robot (first and second order) system using MATLAB. 5 Characteristics of PID controllers using MATLAB. Design and implementation of P, PI and PID Controllers for temperature and level control systems; 6 Design and implement closed loop control of DC Motor using MATLAB/Simulink and suitable hardware platform. 7 Implementation of digital controller using microcontroller; 8 Design and implementation of controller for practical systems - inverted pendulum system. 9 To design and implement control action for maintaining a pendulum in the upright position (even when subjected to external disturbances) through LQR technique in an Arduino Mega. 10 The fourth order, nonlinear and unstable real-time control system (Pendulum & Cart Control System) 11 Mini project on real life motion control system	**New Course**

		Plasma confinement – magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybridand cold fusion. **Unit 5** Biomass Energy: Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production.		
86	**BTEE705**	**Power System Engineering** **Unit 1** Economic Operation of Power Systems: Introduction, system constraints, optimal operation of power systems. Input output, heat rate and incremental rate curves of thermal generating units. Economic distribution of load between generating units within a plant. Economic distribution of load between power stations, transmission loss equation. Introduction to unit commitment and dynamic programming. **Unit 2** Power System Stability-I: Power angle equations and power angle curves under steady state and transient conditions. Rotor dynamics and swing equation (solution of swing equation not included). Synchronizing power coefficient. Introduction to steady state and dynamic stabilities, steady state stability limit. **Unit 3** Power System Stability-II: Introduction to transient stability. Equal area criterion and its application to transient stability studies under basic disturbances. Critical clearing angle and critical clearing time. Factors affecting		**Title Change** **Code Change**

		stability and methods to improve stability. **Unit 4** Excitation Systems: Introduction of excitation systems of synchronous machines, types of excitation systems, Elements of various excitation systems and their control (functional block diagrams and their brief description)-DC excitation systems, AC excitation systems, brushless excitation system. Interconnected Power Systems: Introduction to isolated and interconnected powers systems. Reserve capacity of power stations, spinning and maintenance resaves. Advantages and problems of interconnected power systems. Power systems inter connection in India. **Unit 5** Tap Changing transformer, phase angle control and phase shifting transformer. Series compensation of transmission lines, location and protection of series capacitors, advantages and problems Introduction to power system security. Introduction to voltage stability.		
87	**BTEE706 A**	**Electromagnetic Field Theory** **Unit 1** Introduction: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholz theorems **Unit 2** Electrostatics: Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. The potential functions and displacement vector. Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field		**Code Change**

		mappings and concept of field cells. **Unit 3** Magnetostatics: Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance. Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells. **Unit 4** Time Varying Fields: Faraday's law, Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction & polarization of UPW, standing wave ratio. Pointing vector and power considerations. **Unit 5** Transmission Lines: The high-frequency circuit. LCR ladder model. The transmission Lin equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR.		
88	**BTEE706 B**	**Computer Aided Design of Electrical Machines** **Unit 1** Basic Principles of Electrical MachineDesign: Specifications, Factors affecting the design, Limitations, main dimension, loadings, output equation, factor affecting the size and rating, Electrical Engineering Materials: conducting, magnetic and insulating materials. Magnetic Circuit Calculation: Ohm's law for magnetic circuit, mmf required for air gap and iron parts, tapered teeth, real and apparent flux density, magnetizing current **Unit 2** Heating and Cooling of Electrical Machines: heat dissipation and heat flow equations, Newton's law of cooling,		**Title Change Code Change**

		equations for temperature rise, Rating of Machines: Continuous, short and intermittent ratings, mean temperature rise, hydrogen cooling of turbo alternators, quantity of cooling medium. **Unit 3** ComputerAidedDesignofTransformers: Powerand Distribution Transformers, core and yoke cross sections, square and stepped core, output equations, main dimensions, types & design of windings, optimization concepts. **Unit 4** Computer Aided Design of Synchronous Machines: Turbo and Hydro alternators, choice of specificmagnetic & electric loading, short circuit ratio and its effects air gap length, output equation, main dimensions, flow charts for design of synchronous machine, design of stator core & winding. **Unit 5** Computer Aided Design of Induction Machines: Output equation, main dimensions, design criteria, flow charts for design of induction motor, air gap length, design of stator core and winding, rotor design.		
89	**BTEE706 C**	**Economic Operation of Power Systems** **Unit 1** Economics of Power Generation: Introduction, cost of electrical energy, expression for cost of electrical energy, depreciation, power plant cost analysis, economics in plant selection, selection of types of generation and types of equipments, factors effecting economic generations and distributions, generating cost, economics of different types of generating plants **Unit 2** Economical Operations of Thermal Power Plants: Methods of loading turbo generators, input, output and heat rate characteristics, incremental cost, two generations units,		**Title Change Code Change**

		large no of units, sequence of adding units, effects of transmission losses, economic scheduling considering transmission losses, coordination equations, penalty factors **Unit 3** Hydro Thermal coordination: Advantages of combined operation, base load peak load operation requirement, combined working of run-off river and steam plant Reservoirs hydroplants and thermal plants (long term operational aspects), short term hydro thermal coordination, coordination equations, scheduling methods and applications. **Unit 4** Parallel Operations of Generators: Conditions, synchronizingcurrent and power, two alternators in parallel (effect of change in excitation, load sharing, sharing of load currents), Infinite bus bars, active and reactive power control, synchronizing power, torque, operating limits of alternators, operating characteristics of cylindrical alternator rotor. **Unit 5** Economics for Electrical Engineers: Concepts of physical and financial efficiencies of electrical goods and services, supply and demand, break even and minimum cost analysis, linear and nonlinear break even, min cist analysis		
90	**BTEE707**	**Power System Planning Lab** 1. Status of National and Regional Planning, for power system 2. Write components of Structure of power system 3. Explain in detail various planning tools. 4. Write short note on Electricity Regulation 5. Modeling of Electrical		**Subject Removed**

		Forecasting techniques 6. Transmission and distribution planning 7. concept of Rational tariffs 8. Rural Electrification		
91	**BTEE708**	**Power System Modelling & Simulation lab** 1. Simulate Swing Equation in Simulink (MATLAB) 2. Modeling of Synchronous Machine. 3. Modeling of Induction Machine. 4. Simulate simple circuits using Circuit Maker. 5. (a) Modeling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device. 6. (a) Modeling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices. 7. FACTS Controller designs with FACT devices for SMIB system.		**Title Change Code Change**
92	**BTEE709**	**Industrial Economics & Management** 1 Money Banking and Trade: Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences. Functions of Commercial banks, banking system in India, shortcomings and improvements. Function of RBI, monetary policy-making, objectives and features. Sources of public revenue, principles of taxation, direct and indirect taxes, Theory of international trade, balance of trade and payment, Foreign exchange control, devaluation New economic policy: Liberalization, extending privatization,		**Subject Removed**

		globalization. 2 Management Principles: Management functions, responsibilities of management to society, development of management thought. Nature of planning, decision making, management by objectives, Line and staff authority relationships, decentralization and delegation of authority, span of management. 3 Production Management: Production planning and control, inventory control, quality control and Total quality management. ISO standards Related to quality/Environment/safety etc. Tools of Project Management: CPM, PERT, project information systems. Marketing functions, management of sales and advertising marketing research. 4 Human Resource Management: Function, application of industrial psychology for selection, training and recruitment. Communication process, media channels and barriers to effective communication, theories of motivation, leadership. 5 Finance and Account Management: Engineering Economics: Investment decision, present worth, annual worth and rate of return methods. Payback time. Need for good cost accounting system, cost control techniques of financial control, financial statements, financial ratios, breakeven analysis, budgeting and budgetary control.		
93	**BTEE710**	**Practical Training & Industrial Visit**		**Title Change Code Change**

94	**BTEE711**	**Project-I**		**Title Change Code Change**
95	**BTEE712**	**Discipline & Extra Curricular Activity**		**Title Change Code Change**
96	**BTEE 801**	**EHV AC/DC Transmission** **Unit 1** EHV AC Transmission: Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, Bundled Conductors: geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise. **Unit 2** Load Frequency Control: Introduction to control of active and reactive power flow, turbine speed governing system. Speed governing characteristic of generating unit and load sharing between parallel operating generators Method of Load Frequency Control: Flat frequency, flat tie line and tie line load bias control. Automatic generation control (description of block diagram only). **Unit 3** Voltage Control: No load receiving end voltage and reactive power generation. Methods of voltage control. Synchronous phase modifier Shunt capacitors and reactors, saturable reactors, Thyristorised static VAR compensators- TCR, FC-TCR and TSC- TCR. **Unit 4** FACTS: Introduction to FACTS controllers, types of FACTS	**BTEE801A: HVDC TRANSMISSION SYSTEM** **Syllabus** **Unit-1** **DC Transmission Technology:** Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVdc Systems. Components of a HVdc system. Line Commutated Converter and Voltage Source Converter based systems. **Unit-2** **Analysis of Line Commutated and Voltage Source Converters:** Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links. Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC. **Unit-3** **Control of HVDC Converters:** Principles of Link Control in a LCCHVdc system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation **Unit-4** **Components of HVdc systems:** Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar	**New Course**

		controllers, Brief description of STATCOM, Thyristor controlled series capacitors and unified power flow controller. **Unit 5** HVDC Transmission: Types of D.C. links, advantages and disadvantages of HVDC transmission. Basic scheme and equipment of converter station. Ground return. Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission.	Operation. Ground Electrodes **Unit-5** **Stability Enhancement using HVDC Control:** Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems **MTdc Links:** Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Introduction to Modular Multi-level Converters	
97	**BTEE801 B**		**BTEE801B Line-Commutated and Active PWM Rectifiers** **Syllabus** **Unit-1** **Diode rectifiers with passive filtering:** Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap. **Unit-2** **Thyristor rectifiers with passive filtering:** Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape **Unit-3** **Multi-Pulse converter**: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation. **Unit-4**	**Title Change Code Change**

			Single-phase ac-dc single-switch boost converter: Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closedloop control structure. **Ac-dc bidirectional boost converter:** Review of 1-phase inverter and 3-phase inverter, power circuits of 1- phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure. **Unit-5** **Isolated single-phase ac-dc flyback converter**: Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop control structure.	
98	**BTEE801 C**		**BTEE801C** **ADVANCED ELECTRIC DRIVES** **Course objective(s):-** Electrical drives play an important part as electromechanical energy converters in transportation, materials handling and most production processes. The course tries to give unified treatment of complete electrical drive systems, including the mechanical parts, electrical machines, and power converters and control. **Syllabus** **Unit-1** **Power Converters for AC drives:** PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as	**Title Change Code Change**

			line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive. **Unit-2** **Induction motor drives:** Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC). **Unit-3** **Synchronous motor drives:** Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives. **Unit-4** **Permanent magnet motor drives**: Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM **Unit-5** **Switched reluctance motor drives**: Evolution of switched reluctance motors, various topologies for SRM drives, comparison. Closed loop speed and torque control of SRM. **DSP based motion control:** Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control	

99	**BTEE 802**	**Electric Drives and Their Control** **Unit 1** Dynamics of Electric Drives: Fundamental torque equations, speed-torque conventions and multi-quadrant operation, Nature and classification of load torques, steady state stability, load equalization, close loop configurations of drives. **Unit 2** DC Drives: Speed torque curves, torque and power limitation in armature voltage and field control, Starting, Braking: Regenerative Braking, dynamic braking and plugging. Speed Control-Controlled Rectifier fed DC drives, Chopper Controlled DC drives. **Unit 3** Induction Motor Drives-I: Starting, Braking-Regenerative braking, plugging and dynamic braking. Speed Control: Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control. **Unit 4** Induction Motor Drives-II: Variable frequency control from current source, Current Source Inverter (CSI) Control, Cycloconverter Control, Static rotor resistance control, Slip Power Recovery- Stator Scherbius drive, Static Kramer drive. **Unit 5** Synchronous Motor Drive: Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives. Dynamic and Regenerative Braking of Synchronous Motor with VSI. Control of Synchronous Motor Using Current Source Inverter (CSI).	**BTEE802A** **Electrical and Electronic Ceramics** **Syllabus** **Unit-1** **Ferroelectric and Piezoelectric Ceramics:** Symmetry and other criteria of ferro electricity, ferroelectric phase transitions.Effect of compositional modifications on properties of ferroelectric and piezoelectric ceramics.Piezoelectric transducers, Motors, Piezoelectric positioners, loudspeakers and gas igniters.Pyroelectric and electro-optic ceramics and their applications. **Unit-2** **Ceramic Capacitors:** Performance categories of ceramic capacitors with typical compositions. Multilayer and barrier layer capacitors. **Unit-3** **Thermistors and Varistors:** NTC and PTC thermistors, ZnOvaristors and their applications **Unit-4** **Magnetic Ceramics:** Soft and hard magnetic materials.Spinels: crystal structure, magnetic structure and their properties, Hexaferrite: crystal structure, magnetic structure and their properties. Basic principle of magnetic recording, GMR materials. **Unit-5** **Superionic Solids:** Classification and structural features of superionic solids.Applications in oxygen sensors, fuel cells, high density energy storage batteries.	**Title Change Code Change**

100	**BTEE802B**		**BTEE802B Robotics and Control** **Syllabus** **Unit-1** **Introduction to control problem-** Industrial Control examples. Transfer function. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho- generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness.proportional, integral and derivative systems. Feedforward and multiloop control configurations, stability concept, relative stability, Routh stability criterion **Unit-2** **Time response of second-order systems-** steady-state errors and error constants. Performance specifications in time-domain. Lead and lag compensation**.** **Frequency-response analysis-** Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain.. Lead and Lag compensation. **Unit-3** **ROBOT ARM KINEMATICS:** Introduction, The direct Kinematics Problem, Rotation Matrices, Composite Rotation Matrix,	**Title Change** **Code Change**

			Rotation matrix about an arbitrary axis, Rotation matrix with Euler angle representation, Geometric interpretation of Homogeneous transformation matrices, composite homogeneous transformation matrix, Links joints and their parameters. The DenavitHartenberg representation. Kinematic equations for manipulators, Other specifications of the locations of the End-Effector, Classification of Manipulators, The inverse Kinematics problem, Inverse Transform Technique for Euler Angles Solution **Unit-4** **Planning of Manipulator Trajectories:** Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory. Sensing: Range sensing, Triangulation, Structured Lighting Approach, Time-of- Flight range finders Proximity sensing, Inductive sensors, Hall effect sensors, Capacitive Sensors, Ultrasonic sensors, Optical Proximity Sensors, Touch sensors, Binary sensors, Analog sensors, Force and Torque sensing, Elements of a Wrist sensor. LOW-LEVEL VISION: Image acquisition, illumination Techniques, imaging geometry, some basic transformations, perspective transformations. Higher-Level Vision: Segmentation, Edge Linking and Boundary detection **Unit-5** Camera model, camera calibration, stereo imaging, some basic relationships between pixels, Neighbours of a Pixel, connectivity, distance measures, Preprocessing, Spatial-Domain methods, Frequency- Domain methods, Smoothing, Enhancement, Edge detection, Thresholding. Thresholding.Region-oriented segmentation, the use of motion, description,	

			Boundary descriptors, Regional descriptors.	
101	**BTEE802C**		**BTEE802C Composite Materials** **Syllabus** **Unit-1** **Basics of composites:** ObjectiveDefinition, Classification, Metal matrix, polymer matrix and ceramic matrix composites.Fibres, Matrices, Properties of various type of fibres. Various types of matrix materials and their properties. Polymers, Properties of polymers like epoxy, polyester and phenolic. Applications of composites in Engineering. **Unit-2** **Elastic behaviour of composite Lamina-** Micromechanics and Macro-mechanics approach **Micromechanics:** Volume fraction, weight fraction, density of composites, Lamina, longitudinal elastic properties, Transverse elastic properties, In-Plane shear modulus, Poisson's ratio. **Unit-3** **Elastic behaviourof composite Lamina-** Macro-mechanics: Stress-Strain relations, General Anisotropic materials, Especially Orthotropic material, Transversely Isotropic material, Isotropic material, Stress-StrainrelationsforaThinLamina. Thermal and moisture expansion of a lamina. **Unit-4** **Testing of Composites:** Mechanical testing of composites, Tensile testing, Compressive testing, Intra-Laminar shear testing, Fracture testing, Experimental	**Title Change** **Code Change**

			characterization of mechanical and hygrothermal constants **Unit-5** **Failure and Maintenance of Composites:** Failure types in laminates, Damage to laminate structures, Quality control, Case Studies.	
102	**BTEE 803**	**Unit 1** Protection of Power System Causes and consequences of dangerous currents: Faults, overloads and switching over currents. Introduction to protection, trip circuit of a circuit breaker. Functional characteristics of a relay, zone of protection, primary and backup protection. CTs &PTs: Current transformer construction, measurement and protective CTs. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT (Capacitive Voltage Transformer). **Unit 2** Overcurrent Protection: HRC fuse and thermal relay. Overcurrent relays – instantaneous, definite time, inverse time and inverse definite minimum time overcurrent relays, time and current gradings. Induction disc type relay. Directional overcurrent relay, 300, 600 and 900 connections. Earth fault relay. Brief description of overcurrent protective schemes for a feeder, parallel feeders and ring mains. **Unit 3**	**BTEE803: Energy Systems Lab** **List of Experiments** 1 V-I characteristics of solar panels at various levels of insolation. 2 Experiment of solar Charge controller, PWM, MPPT with boost converter and algorithms. 3 Experiment on Shadowing effect and diode based solution in1kWpSolar PV System. 4 Study of wind turbine generators with DC generators, DFIG, PMSG etc. 5 Performance Study of Solar Flat Plate Thermal Collector Operation with Variation in Mass Flow Rate and Level of Radiation. 6 Characterization of Various PV Modules Using large area Sun Simulator. 7 Study of micro-hydel pumped storage system. 8 Experiment on Fuel Cell and its operation. 9 Study of 100 kW or higher solar PV plant. 10 Study different components of Micro Grid. 11 To design and simulate hybrid wind-solar power generation system using simulation software. 12 Experiments on Performance Assessment of Hybrid (Solar-Wind- Battery) Power System. 13 Simulation study on Intelligent Controllers for on-grid and off-grid Hybrid Power Systems.	**New Course**

		Generator Protection: Stator protection–differential and percentage differential protection, protection against stator inter-turn faults, stator overheating protection. Rotor protection-protection against excitation and prime mover failure, field earth fault and unbalanced stator currents (negative sequence current protection). **Unit 4** Transformer Protection: Percentage differential protection, magnetizing inrush current, percentage differential relay with harmonic restraint. Buchholz relay. Differential protection of generator transfer unit. Busbar Protection: Differential protection of busbars. Highimpedance relay scheme, frame leakage protection **Unit 5** Transmission Line Protection: Introduction to distance protection. Construction, operating principle and characteristics of an electromagnetic impedance relay. Effect of arc resistance.Induction cup type reactance and mho relays. Comparison between impedance, reactance and mho relays. Three stepped distance protection of transmission line. Induction Motor Protection: Introduction to various faults and abnormal operating conditions, unbalance supply voltage and single phasing. Introduction to protection of induction motors- HRC fuse and overcurrent, percentage differential, earth fault and negative sequence voltage relays		
103	**BTEE804A**	**Utilization of Electrical Power** **Unit 1** Utilization of Electrical Power Electric Heating: Different methods of electric heating. Principle of high frequency induction and dielectric heating.		**Title Change** **Code Change**

		Construction, operation, performance and applications of arc furnace and induction furnace Electric Welding: Welding process, welding transformer, Classification of Electric Welding: arc welding, resistance welding, welding of various metals. **Unit 2** Illuminations: Definitions, laws of illuminations, polar curves, luminous efficiency, photometer, incandescent lamps, filament materials, Halogen lamp, electric discharge lamps, sodium vapour lamp, mercury vapour lamp and fluorescent lamp. Light Calculations: commercial, industrial, street and flood lighting. **Unit 3** Electrolytic Process: Principles and applications of electrolysis, electro-deposition, Manufactures of chemicals, anodizing, electro-polishing , electro-cleaning, electroextraction, electro-refining, electro-stripping (parting) power supplies for electrolytic process. **Unit 4** Electric Traction & Means of Supplying Power: Systems of Electric Traction: DC & AC Systems, Power Supply for Electric Traction System: Comparison and application of different systems. Sub-station equipment and layout, conductor rail & pantograph. **Unit 5** Traction Methods: Types of services, speed time and speed distance curves, estimation of powerand energy requirements, Mechanics of train movement. Co-efficient of adhesion, Adhesive weight, effective weight. Traction Motor Controls: DC and AC traction motors, Series parallel starting. Methods of electric braking of traction motors.		

104	**BTEE804 B**	**FACTS Devices & Their Applications** **Unit 1** Problems of AC transmission systems, power flow inparallel paths and meshed system, factors limiting loading capability, Stability consideration. Power flow control of an ac transmission line. Basic types of facts controllers. Advantages of FACTS technology. **Unit 2** Voltage-Sourced Converters: Basic concept of voltage-sourced converters, single and three phase bridge converters. Introduction to power factor control. Transformer connections for 12-pulse, 24 pulse and 48 pulse operations. Static Shunt Compensators: Mid-point and end point voltage regulation of transmission line, and stability improvement. Basic operating principle of Static Synchronous Compensators (STATCOM). Comparison between STATCOM and SVC. **Unit 3** Static Series Compensators: Concept of series capacitive compensation, voltage and transient stabilities, power oscillation and sub synchronous oscillation damping. Introduction to thyristors witched series capacitor (TSSC), thyristor controlled series capacitor (TCSC), and static synchronous series compensator, - operation, characteristics and applications. **Unit 4** Static Voltage and Phase Angle Regulators: Voltage and phase angle regulation. Power flow control and improvement of stability by phase angle regulator. Introduction to thyristor controlled		**Title Change Code Change**

		voltage and phase angle regulators (TCVR and TCPAR) (ii) Introduction to thyristor controlled braking resistor and thyristor controlled voltage limiter. **Unit 5** UPFC: Unified Power Flow Controller (UPFC), basic operating principles, conventional transmission control capabilities. Comparison of UPFC to series compensators and phase angle regulator. Applications of UPFC. IPFC: Interline Power Flow Controller (IPFC), basic operating principles and characteristics. Applications of IPFC.		
105	**BTEE804C**	**Power System Transients** **Unit 1** Wave terminology, Development of wave quotations, Terminal problems, Lattice diagrams, Origin and Nature of power system transients and surges, Surge parameters of plants, Equivalent Circuit representations. Lumped and distributed circuit transients. **Unit 2** Line energisation and de-energisation transients-Earth and earthwire effects. Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. **Unit 3** Control of transients, Lightening phenomenon, influence of tower footing resistance and earth resistance, Traveling waves in distributed parameters multiconductor lines, parameters as a function of frequency. **Unit 4** Mechanism of Lightning Discharge Types of Lightning strokes, Harmful effects of		**Subject Removed**

		lighting, protections against lightning, overhead Ground wires. **Unit 5** Lightening Arresters, Types of lightening arresters, Surge Absorber simulation of surge diverters in transient analysis. Fourier integral and z transform methods in power system transient		
106	**BTEE 805**	**Computer Based Power System Lab** 1. Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault 2. Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software 3. Study of voltage security analysis 4. Study of overload security analysis and obtain results for the given problem using MATLAB or any software. 5. Study of economic load dispatch problem with different methods. 6. Study of transient stability analysis using MATLAB/ETAP Software.		**Subject Removed**
107	**BTEE806**	**Electrical Drives and Control Lab** 1. Study and test the firing circuit of three phase half controlled bridge converter. 2. Study and obtain waveforms of 3 phase half controlled bridge converter with R and RL loads. 3. Study and test the firing circuit of 3-phase full controlled bridge converter. 4. Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads.		**Title Change Code Change**

		5. Study and test 3-phase AC voltage regulator. 6. Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic. 7. Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic. 8. Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator. 9. Control speed of a 3-phase BLDC motor. 10. Control speed of a 3-phase PMSM motor using frequency and voltage control 11. Control speed of universal motor using AC voltage regulator. 12. Study 3-phase dual converter. 13. Study speed control of dc motor using 3-phase dual converter. 14. Study three-phase cycloconverter and speed control of synchronous motor using cycloconverter. 15. Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter		
108	**BTEE807**	**High Voltage Engineering Lab** 1. Study filtration and Treatment of transformer oil. 2. Determine dielectric strength of transformer oil. 3. Determine capacitance and dielectric loss of an insulating material using Schering bridge. 4. Study solid dielectrics used in power apparatus. 5. Study applications of insulating materials.		**Subject Removed**

		6. Study direct testing and indirect testing of circuit breakers. 7. Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer. Design an EHV transmission line.		
109	**BTEE808**	**Project-II**		**Title Change** **Code Change**
110	**BTEE809**	**Seminar**		**Title Change** **Code Change**
111	**BTEE810**	**Discipline & Extra Curricular Activities**		**Title Change** **Code Change**