Semester -I

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MS1	MS2	END TERM	IA	Total
Theory											
101	Engineering Mathematics-I	3	3	1	0	3	10	10	60	20	100
102	Engineering Physics	3	3	1	0	3	10	10	60	20	100
103	Communication Skills	3	3	1	0	3	10	10	60	20	100
104	Programming For Problem Solving	3	4	1	0	3	10	10	60	20	100
105	Basic Electrical Engineering	3	3	1	0	3	10	10	60	20	100

Practicals & Sessionals

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	IA (60%)		EA (40%)	Total
			L	T	P		MP1 30%	MP2 30%		
106	Engineering Physics Lab	2	0	0	2	2	30	30	40	100
106	Language Lab	2	0	0	2	2	30	30	40	100
108	Computer Programming Lab	2	0	0	2	2	30	30	40	100
109	Basic Electrical Lab	2	0	0	2	2	30	30	40	100
110	Computer Aided Engg.Graphics	2	0	0	3	3	30	30	40	100
	Grand Total	**26**	**18**	**6**	**11**					**1000**

Semester-II

Code	Subject	Cr	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MS1	MS2	ENDTERM	IA	Total
Theory											
201	Engineering Mathematics-II	3	3	1	0	3	10	10	60	20	100
202	Engineering Chemistry	3	3	1	0	3	10	10	60	20	100
203	Human Values	3	4	1	0	3	10	10	60	20	100
204	Basic Mechanical Engineering	3	3	1	0	3	10	10	60	20	100
205	Basic Civil Engineering	2	2	1	0	3	10	10	60	20	100
Practicals & Sessionals											
Code	Subject	Cr	Hrs. /Week			Exam Hrs.	IA (60%)		EA (40%)	Total	
			L	T	P		MP1 30%	MP2 30%			
206	Engineering Chemistry Lab	2	0	0	2	2	30	30	40	100	
206	Human Values Activities	2	0	0	2	2	30	30	40	100	
208	Manufacturing Practice Workshop	2	0	0	2	2	30	30	40	100	
209	Basic Civil Engineering Lab	2	0	0	3	3	30	30	40	100	
210	Computer Aided Machine Drawing	2	0	0	2	2	30	30	40	100	
	Grand Total	**26**	**18**	**06**	**11**					**1000**	

Semester -III

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
3BTEE01	Advance Mathematics	3	3	0	0	3	10	10	60	20	100
3BTEE02	Power generation Process	3	3	1	0	3	10	10	60	20	100
3BTEE03	Electrical Circuit Analysis	3	3	1	0	3	10	10	60	20	100
3BTEE04	Analog Electronics	3	3	1	0	3	10	10	60	20	100
3BTEE05	Electrical Machine - I	3	3	1	0	3	10	10	60	20	100
3BTEE06	Electromagnetic Field	3	3	0	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
3BTEE06	Analog Electronics Lab	2	0	0	2	3	30	30	30	10	100
3BTEE08	Electrical Machine-I Lab	2	0	0	2	3	30	30	30	10	100
3BTEE09	Electrical circuit design Lab	2	0	0	2	3	30	30	30	10	100
3BTEE10	Social Outreach, Discipline & Extra Curricular Activities	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester -IV

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
4BTEE01	Managerial Economics and Financial Accounting	3	3	0	0	3	10	10	60	20	100
4BTEE02	Electronic Measurement & Instrumentation	3	3	1	0	3	10	10	60	20	100
4BTEE03	Electrical Machine - II	3	3	0	0	3	10	10	60	20	100
4BTEE04	Power Electronics	3	3	1	0	3	10	10	60	20	100
4BTEE05	Signals & Systems	3	3	1	0	3	10	10	60	20	100
4BTEE06	Digital Electronics	3	3	1	0	3	10	10	60	20	100
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
4BTEE06	Electrical Machine - II Lab	2	0	0	2	3	30	30	30	10	100
4BTEE08	Power Electronics Lab	2	0	0	2	3	30	30	30	10	100
4BTEE09	Digital Electronics Lab	2	0	0	2	3	30	30	30	10	100
4BTEE10	Measurement Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester -V

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
5BTEE01	Electrical Material	3	3	1	0	3	10	10	60	20	100
5BTEE02	Microprocessor And Computer Architecture	3	3	1	0	3	10	10	60	20	100
5BTEE03	Control Systems	3	3	1	0	3	10	10	60	20	100
5BTEE04	Power System-I	3	3	0	0	3	10	10	60	20	100
5BTEE05	Electrical Machine Design	3	3	1	0	3	10	10	60	20	100
5BTEE06.1	Electro Magnetic Wave	3	3	1	0	3	10	10	60	20	100
5BTEE06.2	Digital Control System										
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
5BTEE06	Power System Lab	2	0	0	2	3	30	30	30	10	100
5BTEE08	Control Systems Lab	2	0	0	2	3	30	30	30	10	100
5BTEE09	Microprocessor Lab	2	0	0	2	3	30	30	30	10	100
5BTEE10	System Programming Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester -VI

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
6BTEE01	Computer Architecture	3	3	1	0	3	10	10	60	20	100
6BTEE02	Power System-II	3	3	1	0	3	10	10	60	20	100
6BTEE03	Power System Protection	3	3	1	0	3	10	10	60	20	100
6BTEE04	Electrical Energy Conservation & Auditing	3	3	0	0	3	10	10	60	20	100
6BTEE05	Electrical Drives	3	3	1	0	3	10	10	60	20	100
6BTEE06.1	Power System Planning	3	3	0	0	3	10	10	60	20	100
6BTEE06.2	Digital Signal Processing										
6BTEE06.3	Electrical & Hybrid Vehicles										
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
6BTEE06	Power System-II Lab	2	0	0	2	3	30	30	30	10	100
6BTEE08	Electric Drives System Lab	2	0	0	2	3	30	30	30	10	100
6BTEE09	Power System Protection Lab	2	0	0	2	3	30	30	30	10	100
6BTEE10	Modelling and simulation lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**26**	**18**	**4**	**8**						**1000**

Semester –VII

Code	Subject	Hrs. /Week			Exam Hrs.	Maximum Marks				
		L	T	P		MT1	MT2	End Term	TA	Total
7BTEE01	Wind And Solar Energy Systems	3	1	0	3	10	10	60	20	100
7BTEE02	Power Quality and FACTS	3	1	0	3	10	10	60	20	100
7BTEE03	Control System Design	3	1	0	3	10	10	60	20	100
7BTEE04	Environmental Engineering and Disaster Management	3	0	0	3	10	10	60	20	100
Code	**Subject**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
		L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
7BTEE05	Embedded Systems Lab	0	0	2	3	30	30	30	10	100
7BTEE06	Advance control system lab	0	0	2	3	30	30	30	10	100
7BTEE06	Industrial Training	0	0	2	3	60	60	60	20	200
7BTEE08	Seminar	0	0	2	3	60	60	60	20	200
	Grand Total	**18**	**4**	**8**						**1000**

Semester -VIII

Code	Subject	Credit	Hrs. /Week			Exam Hrs.	Maximum Marks				
			L	T	P		MT1	MT2	End Term	TA	Total
Theory subjects											
8BTEE01	HVDC Transmission System	3	3	1	0	3	20	20	80	30	150
8BTEE02	Line Commutated and active rectifiers	3	3	1	0	3	20	20	80	30	150
8BTEE03	Advanced Electric Drives	3	3	1	0	3	20	20	80	30	150
8BTEE04	Energy Management	3	3	0	0	3	20	20	80	30	150
Practical laboratory courses											
Code	**Subject**	**Credit**	**Hrs. /Week**			**Exam Hrs.**	**Maximum Marks**				
			L	**T**	**P**		**MP1**	**MP2**	**End Term**	**Viva**	**Total**
8BTEE06	Energy Systems Lab	2	0	0	2	3	60	60	60	20	200
8BTEE08	Project	2	0	0	2	3	60	60	60	20	200
	Grand Total	**26**	**18**	**4**	**8**						**1000**

101 Engineering Mathematics-I

SN	CONTENTS
1	**Calculus:** Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surfa
2	**SequencesandSeries:** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.
3	**FourierSeries:** Periodic functions, Fourier series, Euler's formula, Change of intervals,Half range sine and cosine series, Parseval's th
4	**MultivariableCalculus(Differentiation):** Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxim Lagrange multipliers; Gradient, curl and divergence.
5	**MultivariableCalculus(Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variabl and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Simple applications parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

102:EngineeringPhysics

SN	CONTENTS	Hours
1	**WaveOptics:** Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.	9
2	**QuantumMechanics:** Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.	6
3	**CoherenceandOpticalFibers:** 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.	4
4	**Laser:** Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.	6
5	**MaterialScience&SemiconductorPhysics:** Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.	6
6	**IntroductiontoElectromagnetism:** Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential, Bio-Savart law, Divergence and curl of static magnetic field, Faraday's law, Displacement current and magnetic field arising from time dependent electric field, Maxwell's equations, Flow of energy and Poynting vector.	8
	TOTAL	**40**

03: Communication Skills

SN	CONTENTS	Hours
1	**Communication:** Meaning, Importance and Cycle of Communication. Media and Types of Communication. Verbal and Non-Verbal Communication. Barriers to communication. Formal and Informal Channels of Communication (Corporate Communication). Divisions of Human Communication and Methods to improve Interpersonal Communication. Qualities of good communication.	6
2	**Grammar:** Passive Voice. Reported Speech. Conditional Sentences. Modal Verbs. Linking Words (Conjunctions)	6
3	**Composition:** Job Application and Curriculum-Vitae Writing. Business Letter Writing. Paragraph Writing. Report Writing.	6
4	**ShortStories:** "Luncheon" by Somerset Maugham."How Much Land Does a Man Need?" by Count Leo Tolstoy. "The Night Train at Deoli" by Ruskin Bond.	6
5	**Poems:** "No Men are Foreign" by James Kirkup. "If" by Rudyard Kipling. "Where the Mind is without Fear" by Rabindranath Tagore.	65
	TOTAL	35

104: Programming for Problem Solving

SN	CONTENTS	Hours
1	**FundamentalsofComputer:** Stored program architecture of computers, Storage device- Primary memory, and Secondary storage, Random, Direct, Sequential access methods, Concepts of High-level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.	**12**
2	**Numbersystem:** Data representations, Concepts of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to r2, r's and (r-1)'s complement, Binary addition, Binary subtraction, Representation of alphabets.	**12**
3	**CProgramming:** Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, development of C programs using above statements, Arrays, functions, parameter passing, recursion, Programming in C using these statements, Structures, files, pointers and multi file handling.	**12**
	TOTAL	**36**

105: Basic Electrical Engineering

SN	CONTENTS	Hours
1	**DCCircuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, Thevenin's, Norton's and Maximum power transfer theorems.	8
2	**ACCircuits:** Representation of sinusoidal waveforms, peak and r.m.s values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC and RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**Transformers:** Ideal and practical transformer, EMF equation, equivalent circuit, losses in transformers, regulation and efficiency.	6
4	**ElectricalMachines:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single- phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.	6
5	**PowerConverters:** Semiconductor PN junction diode and transistor (BJT). Characteristics of SCR, power transistor and IGBT. Basic circuits of single phase rectifier with R load, Single phase Inverter, DC-DC converter.	6
6	**ElectricalInstallations:** Layout of LT switchgear: Switch fuse unit (SFU), MCB, ELCB, MCCB, Type of earthing. Power measurement, elementary calculations for energy consumption.	6
	TOTAL	**40**

106:EngineeringPhysicsLab

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 wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
6. To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the Hall Effect and determine the Hall Voltage and Hall coefficients.

106:LanguageLab

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

108:ComputerProgrammingLab

1. To learn about the C Library, Preprocessor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement
3 Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
6. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10 Programs to learn Pointer operations
11.Programs to understand File handling operations
12 Programs to input data through Command line argument

109:BasicElectricalEngineeringLab

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform
(c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

110: ComputerAidedEngineeringGraphics Lab

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

ProjectionsofPoint&Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position 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).

ProjectionofPlanes: 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 the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes.

ProjectionsofRegularSolids: frustum and truncated solids, those inclined to both the Planes-Auxiliary Views.

SectionofSolids: Theory of sectioning, section of prisms and cubes, section of pyramids and Tetrahedron section of Cylinders, section of cones, section of spheres (One drawing sheet, one assignment in sketch book)

OverviewofComputerGraphics: Covering theory of CAD software [such as: The menu System, Toolbars (standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

201: Engineering Mathematics-II

SN	CONTENTS	Hours
1	**Matrices:** Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	**10**
2	**Firstorderordinarydifferentialequations:** Linear and Bernoulli's equations, Exact equations, Equations not of first degree: equations solvable for *p*, equations solvable for *y*, equations solvable for *x* and Clairaut's type.	**6**
3	**Ordinarydifferentialequationsofhigherorders:** Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, Cauchy-Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.	**12**
4	**PartialDifferentialEquations–Firstorder:** Order and Degree, Formation; Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms.	**6**
5	**PartialDifferentialEquations–Higherorder:** Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.	**6**
	TOTAL	**40**

SunRise University.Alwar

B.tech Syllabus Session 2019-2020

202 : Engineering Chemistry

SN	CONTENTS	Hours
1	**Water:** Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process.Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.	**10**
2	**OrganicFuels:** Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann by-product oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.	**10**
3	**Corrosionanditscontrol:** Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.	**3**
4	**EngineeringMaterials:** Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point.	**10**
5	**Organicreactionmechanismandintroductionofdrugs:** Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol	**6**
	TOTAL	**40**

203: Human Values

SN	CONTENTS	Hours
1	**CourseIntroduction-Need,BasicGuidelines,ContentandProcessforValueEducation** Understanding the need, basic guidelines, Self Exploration - its content and process; 'Natural Acceptance' and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities,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	5
2	**UnderstandingHarmonyintheHumanBeing-HarmonyinMyself** 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',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, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	5
3	**UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship** Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.	5
4	**UnderstandingHarmonyintheNatureandExistence-WholeexistenceasCoexistence** Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence	5
5	**ImplicationsoftheaboveHolisticUnderstandingofHarmonyonProfessionalEthics.Naturalacceptanceofhumanvalues** Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. 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. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.	5
	TOTAL	**25**

204: Basic Mechanical Engineering

SN	CONTENTS	Hours
1	**Fundamentals:** Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.	6
2	**PumpsandICEngines:** 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.	6
3	**RefrigerationandAirConditioning:** Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.	6
4	**TransmissionofPower:** Introduction and types of Belt and Rope Drives, Gears.	6
5	**PrimaryManufacturingProcesses:** 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.	6
6	**EngineeringMaterialsandHeatTreatmentofSteel:** Introduction to various engineering materials and their properties.	5
TOTAL		**40**

205: Basic Civil Engineering

SN	CONTENTS	Hours
1	**Introductiontoobjective,scopeandoutcomethesubject**	
2	**Introduction:** Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.	8
3	**Surveying:** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of levelling, Methods of levelling in brief, Contour maps.	8
4	**Buildings:** Selection of site for Buildings, Layout of Building Plan, 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.	8
5	**Transportation:** Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.	8
6	**EnvironmentalEngineering:** Environmental Pollution, Environmental Acts and Regulations,Functional Concepts of Ecology, Basics of Species, Biodiversity,Ecosystem, Hydrological Cycle;Chemical Cycles: Carbon, Nitrogen& Phosphorus; Energy Flow in Eco-systemsWater Pollution: Water Quality standards, Introduction to Treatment& Disposal of Waste Water. Reuse and Saving of Water, Rain Water Harvesting.Solid Waste Management: Classification of Solid Waste, Collection, Transportation and Disposal of Solid. Recycling of Solid Waste: Energy Recovery,Sanitary Land fill, On-Site Sanitation. Air& Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. . Noise Pollution, Harmful Effects of noise pollution, control of noise pollution, Global warming& Climate Change, Ozone depletion, Green House effect	8
	TOTAL	40

206: Engineering Chemistry Lab

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O6 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
6. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

206: Human Values Activities Lab

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 differentiate 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, environmental 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 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 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 sensoryattractions). 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.

PS 5:
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 acceptableat 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

PS6:

1. Chalk out some programs towards ensuring your harmony with the body - in terms of nurturing, protection and right utilization of the body.

2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS6:

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.

PS8:

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 yourself or on differentiations based on body, physical facilities or belieds.

PS9:

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.

PS10:

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.

PS11:

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.

PS12:

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

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

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

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 i.e. social work at villages adopted by respective institute/ college.

208: Manufacturing Practices Workshop

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
6. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

209: Basic Civil Engineering Lab

1. Linear Measurement by Tape:

a) Ranging and Fixing of Survey Station along straight line and across obstacles.

b) Laying perpendicular offset along the survey line

2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass

3. Levelling: Using Tilting/ Dumpy/ Automatic Level

a) To determine the reduced levels in closed circuit.

b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.

4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.

5. To determine pH, hardness and turbidity of the given sample of water.

6. To study various water supply Fittings.

6. To determine the pH and total solids of the given sample of sewage.

8. To study various Sanitary Fittings.

210:Computer Aided Machine Drawing Lab

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (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.

Fasteners and other mechanical components: (Free hand sketch) 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, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, and pin type flexible coupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

Semester - III

3BTEE01 Advance Mathematics		**40hrs**
	Objective: The objective of Advanced Engineering Mathematics is for students to learn the basics of Modeling and solution of differential equations. They will study standard functions with graph, geometrical meaning of differential equations, modeling and solution of ordinary and partial differential equations also application of Fourier series, Fourier integral and Laplace transform	
Unit 1	**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. Interpolation with unequal intervals: Newton's divided difference and Lagrange'sformulae. 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..	**14**
Unit 2	**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. 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.	**20**
Unit 3	**Complex Variable:** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties	**6**

3BTEE02 Power Generation Process			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	

Unit 1	**Conventional Energy Generation Methods** 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. 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., negative and mixed logic. Logic gate conversion	**8**
Unit 2	**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..	**8**
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	**8**
Unit 4	**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.	**8**
Unit 5	**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.	**8**
Unit 6	**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.	
Unit 6	**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.	

3BTEE03 Electrical Circuit Analysis			**40**
Lecture:03	**Tutorial:01**	**Practical :00**	
	Objective:		
Unit 1	**Network Theorems** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and Voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.		**6**
Unit 2	**Solution of First and Second order networks** Solution of first and second order differential equations for Series and parallel R-L, R-C, RL- C circuits, initial and final conditions in network elements, forced and free response, time Constants, steady state and transient state response.		**6**
Unit 3	**Sinusoidal steady state analysis** Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.		**10**
Unit 4	**Electrical Circuit Analysis Using Laplace Transforms** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances		**10**
Unit 5	**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		**8**

3BTEE04 Analog Electronics			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Diode circuits** P-N junction diode, I-V characteristics of a diode; review of half- wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits		**8**
Unit 2	**BJT circuits** Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.		**8**
Unit 3	**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, trans-conductance, high frequency equivalent circuit.		**8**
Unit 4	**Differential, multi-stage and operational amplifiers** Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op- amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)		**8**
Unit 5	**Linear applications of op-amp** Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.		**8**
Unit 6	**Nonlinear applications of op-amp** Hysteretic Comparator, Zero Crossing Detector, Square-wave and Triangular-wave generators, Precision rectifier, peak detector. Mono-shot		

3BTEE06 Electrical Machine -1			**40 hrs**
Lecture:03	**Tutorial:00**	**Practical :00**	

Unit 1	**Magnetic fields and magnetic circuits** Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields 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.	**8**
Unit 2	**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 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	**8**
Unit 3	**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.	**8**
Unit 4	**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 torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines	**8**
Unit 5	**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.	**8**

3BTEE06 Electronic Magnetic Field			
Lecture:00	**Tutorial:00**	**Practical :02**	
Unit 1	**Review of Vector Calculus** Vector algebra- addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operatories, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.		
Unit 2	**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 3	**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 4	**Static Magnetic Fields** Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields producedby current carrying conductors.		
Unit 5	**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 6	**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.		
Unit 6	**Electromagnetic Waves** Derivation 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.		

3BTEE06 Analog Electronics Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	
	Objective:. The student will practically perform and analyse working DSO, Analog and digital multimeter. Also they will plot various curves of PN diode, Zener diode, transistor and FET		
	1. Study the following devices: (a) Analog & digital multimeters (b) Function/ Signal generators (c) Regulated d. c. power 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.		

3BTEE08 Electrical Machine -1 Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	
	Objective:		
	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.	

3BTEE09 Electrical Circuit Design Lab - I			
Credit:02			
Lecture:00	**Tutorial:00**	**Practical :02**	

1) **Objective:** Introduction to Datasheet Reading.
2) Introduction to Soldering - Desoldering process and 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.	

Semester - IV			
4BTEE01 Managerial Economics and Financial Accounting			**40hrs**
Lecture:03	**Tutorial:00**	**Practical :00**	
Unit 1	**Introduction**- Objective, scope and outcome of the course		**8**
Unit 2	**Basic economic concepts** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.		**8**
Unit 3	**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.		**8**
Unit 4	**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.		**8**
Unit 5	**Market structure and pricing theory** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.		**8**
Unit 6	**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		

4BTEE02: Electronic Measurement and Instrumentation			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Introduction:** Objective, scope and outcome of the course.		**8**
Unit 2	**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-phasepower and single-phase energy. Errors in wattmeter and energy meter and their compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading		**8**
Unit 3	**Polyphase Metering:** Blondel's Theorem for n-phase, p-wire system.Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two- wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operationof current and potential transformers. Ratio and phase angle errors and theirminimization. Effect of variation of power factor, secondary burden and frequencyon errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.		**8**
Unit 4	**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.		**8**
Unit 5	**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.		**8**
Unit 6	**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 andfrequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device		

4BTEE03 Electrical machine -II			**40 hrs**
Lecture:03	**Tutorial:00**	**Practical :00**	

Unit 1	**Introduction:** Objective, scope and outcome of the course.	**8**
Unit 2	**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.	**8**
Unit 3	**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	**8**
Unit 4	**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.	**8**
Unit 5	**Single-phase induction motors** Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications.	**8**

4BTEE04 Power Electronics			
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Introduction:** Objective, scope and outcome of the course.		**8**
Unit 2	**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.		**8**
Unit 3	**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.		**8**
Unit 4	**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.		**8**
Unit 5	**DC-DC boost converter** Power circuit of a boost converter, analysis and wavefors at steady state, relation between duty ratio and average output voltage		**8**
Unit 6	**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 6	**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.		

4BTEE05 Signal & Systems			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Introduction:** Objective, scope and outcome of the course.		**8**
Unit 2	**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, realizability. Examples.		**8**
Unit 3	**Behavior of continuous and discrete-time LTI systems:** Impulse response and step response, convolution, input-output behavior with aperiodic 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 Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.		**8**
Unit 4	**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). 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.		**8**
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.		**8**

4BTEE06 Digital Electronics		**40 hrs**
Credit:03		
Lecture:03	**Tutorial:01**	**Practical :00**

	Objective:	
Unit 1	**Introduction:** Objective, scope and outcome of the course.	**8**
Unit 2	**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..	**8**
Unit 3	**CombinationalDigitalCircuits:**Standard 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.	**8**
Unit 4	**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.	**8**
Unit 5	**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	**8**
Unit 6	**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 Array (FPGA).	

4BTEE06 Electrical Machine-II Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	

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, 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
6. 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.

4BTEE08 Power Electronics Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	

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.

6. Find transfer characteristics of MOSFET and IGBT.

6. Find UJT static emitter characteristics and study the variation in peak point and valley point.

8. Study and test firing circuits for SCR-R, RC and UJT firing c

9. Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters.

10. 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.

11. Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.

12 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.

13. 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.

4BTEE09 Digital Electronics Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	
•	• 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). • To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates. • To realize an SOP and POS expression. • To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables. • To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor. • 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. • Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven segment display. • Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table. • 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. • 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	•

4BTEE10 Electrical Machines Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	
	Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes. Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter. Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method. Calibrate an ammeter using DC slide wire potentiometer. Calibrate a voltmeter using Crompton potentiometer. Measure low resistance by Crompton potentiometer. Measure Low resistance by Kelvin's double bridge. Measure earth resistance using fall of potential method. Calibrate a single-phase energy meter by phantom loading at different power factors. Measure self-inductance using Anderson's bridge.		

Semester - V			
5BTEE01 Electrical Materials			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
	Objective:		
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...		**8**
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.		**8**
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.		**8**
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.		**8**
Unit 5	**Semiconductor Materials**: Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, Trends in materials used in Electrical Equipment.		**8**

5BTEE02 Microprocessor And Computer Architecture			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Fundamentals of Microprocessor:** Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microco.8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.		**8**
Unit 2	**Architecture The 8051**: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and StackPointer, Program Counter, I/O ports, Memory Structures, Data andProgram Memory, Timing diagrams and Execution Cycles.		**8**
Unit 3	**Instruction Set & 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. 8051Instructionset, 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		**8**
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. External..Communication.Interface: Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee		**8**
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 Cache memory, SDRAM, RDRAM and DDRAM. Memory latency, memory bandwidth, memory seek time.		**8**

5BTEE03 Control Systems			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	

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 of physical system (Electro Mechanical) by differential equations, Determination of transfer functionby block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation.	**8**
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	**8**
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 locus concepts, construction of root loci.	**8**
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.	**8**
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.	**8**

5BTEE04 Power System-I			**40 hrs**
Lecture:03	**Tutorial:00**	**Practical :00**	

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: Linedia- grams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of- simple three-phase circuits. Power Transfer in AC circuits and Reactive Power	**8**
Unit 2	**Power System Component**: 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.	**8**
Unit 3	**Transformers**: Three-phase connections and Phase-shifts. Three- winding 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 sub- transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.	**8**
Unit 4	**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.	**8**
Unit 5	**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. 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	**8**

	Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.	

5BTEE05 Electrical Machine Design			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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.		**8**
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		**8**
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 ro-tor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating and performance of short and medium transmission lines.		**8**
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.		**8**
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.		**8**

5BTEE06.1 Electromagnetic Wave				**40 hrs**
Lecture:03		**Tutorial:01**	**Practical :00**	
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			**8**
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, Surface charge and surface current, Boundary conditions at media interface			**8**
Unit 3	**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.			**8**
Unit 4	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 waveguide-. general approach, Rectangular waveguides			**8**
Unit 5	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.			**8**

5BTEE06.2 Digital Control System			**40 hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	**Discrete Representation of Continuous Systems** Basics of Digital Control Systems. Discrete representation of conti-nuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent		**6**
Unit 2	**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.		**6**
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		**6**
Unit 4	**Stability of Discrete Time System** Stability analysis by Jury test. Stability analysis using bilinear trans-formation. Design of digital control system with dead beat response. Practical issues with dead beat response design		**6**
Unit 5	**State Space Approach for discrete time systems** State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Re-constructability and ob- servability analysis. Effect of pole zero cancellation on the controllability & observability.		**8**
Unit 6	**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.		**04**
Unit 6	**Discrete output feedback control** Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems		**04**

5BTEE07 Power System Lab			
Lecture:00	**Tutorial:00**	**Practical :02**	
	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. 6) 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 insulating material using Schering bridge. 11) Flash over voltage testing of insulators	

5BTEE08 Control System Lab			**40 hrs**
Lecture:00	**Tutorial:00**	**Practical :02**	

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.

6. 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.

5BTEE09 Microprocessor Lab			**40 hrs**
Lecture:00	**Tutorial:00**	**Practical :02**	

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.
6. 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.

5BTEE10 System Programming Lab			**40 hrs**
Lecture:00	**Tutorial:00**	**Practical :02**	

1. Basics of MATLAB matrices and vectors, matrix and array operations, Saving and load- ing 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 inter- polation. 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.

6. 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.

Semester - VI				
6BTEE01 COMPUTER ARCHITECTURE				**40hrs**
Lecture:03		**Tutorial:01**	**Practical :00**	
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 05 representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming,System buses, Multi-bus organisation			**8**
Unit 2	Memory organization System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks			**8**
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.			**8**
Unit 4	16 and 32 microprocessors 80x86 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			**8**
Unit 5	Pipelining Introduction to pipelining, Instruction level pipelining (ILP), compiler 04techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set			**8**
Unit 6	Different Architectures VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming			8

6BTEE02 POWER SYSTEM –II			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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.		**8**
Unit 2	Stability Constraints in synchronous grids Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomenaof 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 compensationof transmission lines on stability.		**8**
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 componentsof a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters		**8**
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		**8**
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, RetailCompetition), Demand Side-managementPower System Economics and ManagementBasic 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 Transmission and Distributions charges, Ancillary Services. Regulatory framework		**8**

6BTEE03 POWER SYSTEM PROTECTION			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Introduction and Components of a Protection System Principles of Power System Protection, Relays Introduction and Components of a Protection System Principles of Power System Protection, Relays Instrument transformers, Circuit Breakers.		**8**
Unit 2	Faults and Over-Current Protection Review of Fault Analysis, Sequence Networks. Introduction to Over current Protection and over current relay co-ordination.		**8**
Unit 3	Equipment Protection Schemes Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.		**8**
Unit 4	Digital Protection Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.		**8**
Unit 5	Modeling and Simulation of Protection Schemes CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing		**4**
Unit 6	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.		**4**

6BTEE04 Electrical Energy Conservation And Auditing			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Introduction and Components of a Protection System Energy ScenarioCommercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energyneeds of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security,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		**8**
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.		**8**
Unit 3	Energy Management & AuditDefinition, energy audit, need, types of energy audit. Energy management (audit) approachunderstanding energy costs, bench marking, energy performance, matching energy use to requirement, 08maximizing system efficiencies, optimizing the input energyrequirements, 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		**8**
Unit 4	Energy Efficiency in Electrical SystemsElectrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PFcapacitors, distribution and transformer losses. Electric motors: Types, lossesin induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.		**8**
Unit 5	Energy Efficiency in Industrial SystemsOverview 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 08 disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV		**4**
Unit 6	Energy Efficient Technologies in Electrical SystemsMaximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speeddrives, energy efficient transformers, electronic ballast, occupancy energy efficient lighting controls, energy saving potential of each technology.		**4**

6BTEE05 ELECTRICAL DRIVES			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	DC motor characteristicsReview of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque- 05 speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varyingmotor speed, flux weakening for high speed operation		**8**
Unit 2	Chopper fed DC driveReview 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 andchopper, efficiency of dc drive, smooth starting..		**8**
Unit 3	Multi-quadrant DC driveReview 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		**8**
Unit 4	Closed-loop control of DC DriveControl 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		**8**
Unit 5	Induction motor characteristicsReview of induction 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.		**4**
Unit 6	Scalar control or constant V/f control of induction motorReview of three-phase voltage source inverter, generation of three- phase PWM signals,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		**4**

6BTEE06.1 POWER SYSTEM PLANNING			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Power system Reliability: System Reliability, Reliability Planning Criteria for Generation, Transmission and Distribution, Grid Reliability, Reliability Target, Security Requirement, DisasterManagement, Roadmap for Reliability and Quality		**8**
Unit 2	Chopper fed DC driveReview 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 andchopper, efficiency of dc drive, smooth starting..		**8**
Unit 3	Multi-quadrant DC driveReview 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		**8**
Unit 4	Closed-loop control of DC DriveControl 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		**8**
Unit 5	Induction motor characteristicsReview of induction 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.		**4**
Unit 6	Scalar control or constant V/f control of induction motorReview of three-phase voltage source inverter, generation of three- phase PWM signals,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		**4**

6BTEE06.2 DIGITAL SIGNAL PROCESSING			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Discrete-time signals and systems Discrete time signals and systems: Sequences; representation ofsignals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate		**8**
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.		**8**
Unit 3	Discrete Fourier Transform Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT,Connvolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems		**8**
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		**8**
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		**8**

6BTEE06.3 ELECTRICAL AND HYBRID VEHICLES			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Conventional Vehicles: Basics of vehicle performance,vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.		**8**
Unit 2	Hybrid Electric Vehicles History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains 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..		**8**
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.		**8**
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 energystorage 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		**8**
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).		**8**

6BTEE06 Power System-II Lab			**40 hrs**
Lecture:00	**Tutorial:00**	**Practical :02**	

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. 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.

6. Study of transient stability analysis using MATLAB/ETAP Software.

8. Power flow analysis of a slack bus connected to different loads

6BTEE08 Electric Drive Lab

Lecture:00	**Tutorial:00**	**Practical :02**

1. Study 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 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.

6. 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.

6BTEE09 POWER SYSTEM PROTECTION LAB		
Lecture:00	**Tutorial:00**	**Practical :02**

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-to- line 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.

6. 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.

6BTEE10 MODELLING AND SIMULATION LAB		
Lecture:00	**Tutorial:00**	**Practical :02**

1. 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.

6. (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.

Semester - VII			
7BTEE01 WIND AND SOLAR ENERGY SYSTEM			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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.		**8**
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.		**8**
Unit 3	The Solar Resource Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.		**8**
Unit 4	Solar Photovoltaic Technologies-Amorphous, monocrystalline, polycrystalline; V-I characte-ristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.		**8**
Unit 5	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.		**8**
Unit 6	Solar Thermal Power Generation Technologies, Parabolic trough, central receivers, parabolic dish, Fres- nel, solar pond, elementary analysis.		8

7BTEE02 POWER QUALITY AND FACTS			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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.		**8**
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.		**8**
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 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 Inter phase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter		**8**
Unit 4	Application of FACTS Application of FACTS devices for power-flow control and stability im- provement. 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.		**8**
Unit 5	Power Quality Problems in Distribution Systems Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave- form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve...		**8**
Unit 6	DSTATCOM Reactive Power Compensation, Harmonics and Unbalance mitigation. in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Cur- rent Control Techniques in for DSTATCOM.		8
Unit 6	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.		

7BTEE03 CONTROL SYSTEM DESIGN		
Lecture:03	**Tutorial:01**	**Practical :00**

Unit 1	Design Specifications Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical re- levance. 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.
Unit 3	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 4	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 5	Control System Design in state space Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the sys- tem, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle
Unit 6	Nonlinearities and its effect on system performance Various types of nonlinearities. Effect of various nonlinearities on sys- tem performance Singular points. Phase plot analysis

7BTEE04 EMBEDDED SYSTEM LAB		
Lecture:00	**Tutorial:00**	**Practical :02**

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 LAB/Simulink and suitable hardware platform of DC Motor using MATLAB

6. Implementation of digital controller using microcontroller;

8. Design and implementation of controller for practical systems - inverted pen- dulum 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

7BTEE05 Advanced Control System Lab		
Lecture:00	**Tutorial:00**	**Practical :02**

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 LAB/Simulink and suitable hardware platform of DC Motor using MATLAB

6. Implementation of digital controller using microcontroller;

8. Design and implementation of controller for practical systems - inverted pen- dulum 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

Semester - VIII			
8BTEE01 HVDC TRANSMISSION SYSTEM			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
Unit 1	Dc Transmission Technology: Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HV dc Systems. Components of a HV dc system. Line Commutated Converter and Voltage Source Converter based systems.		**8**
Unit 2	Analysis of Line Commutated and Voltage Source Converters: Line Commutated Converters (LCCs): Six pulse converter, Analysis neglect- ing 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..		**8**
Unit 3	Control of HV dc Converters: Principles of Link Control in a LCC HV dc 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 HV dc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation.		**8**
Unit 4	Components of HV dc systems: Smoothing Reactors, Reactive Power Sources and Filters in LCC HV dc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. Dc line faults in VSC systems. Dc breakers. Mono polar Operation. Ground Electrodes		**8**
Unit 5	Stability Enhancement using HV dc 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..		**8**
Unit 6	MT dc Links: Multi-Terminal and Multi In feed Systems. Series and Parallel MT dc systems using LCCs. MT dc systems using VSCs. Modern Trends in HV dc Technology. Introduction to Modular Multi-level Converters		8

8BTEE02 Line-Commutated and Active PWM Rectifiers			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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 wave shape, effect of source inductance; commutation overlap		**8**
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 wave shape.		**8**
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	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, closed- loop control structure..		**8**
Unit 5	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		**8**
Unit 6	Isolated single-phase ac-dc fly back converter Dc-dc fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc fly back converter, steady state analysis, unity power factor operation, closed loop control structure.		**8**

8BTEE03 ADVANCED ELECTRIC DRIVES			**40hrs**
Lecture:03	**Tutorial:01**	**Practical :00**	
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 line side rectifier, current fed inverters with self-commutated devices. Control of CSI,H bridge as a 4-Q drive.		**8**
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).		**8**
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 mo- tors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM		**8**
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.		**8**
Unit 6	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		**8**

8BTEE04 Energy Systems Lab		
Lecture:00	**Tutorial:00**	**Practical :02**

1. V-I characteristics of solar panels at various levels of insulation.

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.

6. 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. Experiment on Performance Assessment of Hybrid (Solar-Wind- Battery) Pow- er System.

13. Simulation study on Intelligent Controllers for on-grid and off-grid Hybrid Power Systems.