DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE.

Structure and syllabus

Of

Second Year B. Tech. (Electrical Engineering)

With effect from Academic Year 2018-19

Approved in the 11 Academic Council held on 8 June 2018

TEACHING AND EVALUATION SCHEME OF SECOND YEAR B.TECH ELECTRICAL ENGINEERING

S. No	Course Code	Course Title	Teaching Scheme			Evaluation Scheme			Credits
			L	T	P	MSE	CA	ESE	
III SEMESTER.									
1	BTBS301	Engineering Mathematics-III	3	1	0	20	20	60	4
2	BTEEC302	Network Analysis and Synthesis	2	1	0	20	20	60	3
3	BTEEC303	Fluid Mechanics and Thermal Engineering	2	1	0	20	20	60	3
4	BTEEC304	Measurement and Instrumentation	2	1	0	20	20	60	3
5	BTEEOEL 305	Elective –I (A) Electrical Engineering Materials (B) Applied Physics (C) Signals and Systems	3	0	0	20	20	60	3
6	BTHM306	Basic Human Rights	2	0	0	-	20	-	Audit
7	BTHS 307	Engineering Economics	2	0	0	20	20	60	2
8	BTEEL308	Network Analysis and Synthesis Lab	0	0	2	-	60	40	1
9	BTEEL309	Measurement and Instrumentation Lab	-	0	4	-	60	40	2
10	BTEEL310	Electrical workshop/ Mini project	-	-	2	-	60	40	1
11	BTEEP311	Field Training/ Internship/ Industrial Training Evaluation						100	1
		TOTAL	16	04	08	120	320	580	23
IV SEMESTER.									
1	BTEEC401	Electrical Machine-I	3	1	0	20	20	60	4
2	BTEEC402	Power System-I	2	1	0	20	20	60	3
3	BTEEC403	Electrical Installation and Estimation	2	1	0	20	20	60	3
4	BTEEC404	Numerical Methods and Programming	2	1	0	20	20	60	3
5	BTEEDEL 405	Elective –II (A) Solid State Devices (B) Analog and Digital electronics (C) Electromagnetic Theory	2	0	0	20	20	60	2
6	BTXX406	Product Design [Online course]	2	0	0	20	20	60	2
7	BTEEOEL 407	Elective –III (A) Industrial safety (B) Introduction to Non-Conventional energy sources (C) Software Techniques.	2	0	0	20	20	60	2
8	BTEEL408	Electrical Machine-I Lab	0	0	2	-	60	40	1
9	BTEEL409	Power System lab-I	0	0	2	-	60	40	1
10	BTEEL410	Numerical Methods and Programming Lab	-	0	2	-	60	40	1
11	BTEEL411	Elective-II Lab	0	0	2	-	60	40	1
12		Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in Third semester and Fourth Semester or in at one time.)							Credits to be evaluat e d at in V Sem
	TOTAL		15	04	08	140	380	580	23

Semester III

Engineering Mathematics III

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

Course Contents:

Unit 1: Laplace Transform

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

[07 Hours]

Unit 2: Inverse Laplace Transform

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

[07 Hours]

Unit 3: Fourier Transform

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

[07 Hours]

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

[07 Hours]

Unit 5: Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

[07 Hours]

Unit 6: Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without roofs).

[07 Hours]

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batchwise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

BTEEC 302. NETWORK ANALYSIS AND SYNTHESIS.

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To review basic components of electric network. To design and develop network equations and their solutions. To apply Laplace theorem for electric network analyses To analyze AC circuit.	
Unit	Contents	Contact Hrs
1	Active & Passive Circuit Element: Independent & dependent voltage & current sources, R, L, C & mutual inductance circuit parameters, Their mathematical modes, Voltage current power relations. Classification of element: Lumped distributed, Linear & non-linear, Unilateral, Bilateral, Time invariant & variant, Pace invariant & variant, Super position, Thevenin's, Norton's Reciprocity, Maximum power transfer, Substitution, Tellegen's theorem.	6
2	Network Equations: Network topology, Graph, Tree, Branches, Chords, Equilibrium equation on loop basis & node basis Number of network equation required, Choice between nodal & loop analysis, Source transformation, Network mutual inductance, Dot conventions, Concept of super mesh, Super node Concept of duality & dual networks.	6
3	Solution of Network Equations: Classification solution of first, Second order differential equations of series & parallel R-L, R-C, R-L-C circuits, General & particular solutions, Particular integral & complimentary functions, Time constant, Mathematical analysis of circuit transients, initial conditions in network, Procedure of evaluality, Conditions in network problems, Solution of D.C. resistive network & A. C. sinusoidal steady state networks, Writing loop equations, Node equations directly in matrices form. Numericals	6
4	Application of Laplace's Transform: Solution of differential equation using Laplace transform, Unit step, Impulse & ramp functions, Laplace transform of singular & shifted function, Convolution integral, Concept of complex frequency, Transform impedance & transform admittance, Series & parallel combination of these transform networks.	6
5	Two port network: Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets.	6
6	Sinusoidal Steady State A. C. Circuit: R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC & VL, Magnification, Bandwidth, Q factor. Parallel Resonance: Resonance frequency for tank circuit frequency, Locus diagram of series R-L, R-C with variable R & X. Filter: Introduction classification, Low pass, High pass, Band pass & band reject filter, active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms.	6
	Ref Books: 1. Mac.E Van Valkenburg, "Network Analysis", 2. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons. 3. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis", 4. Mac.E Van Valkenburg, "Network Synthesiss", 5. Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series,	

BTEEC 303. FLUID MECHANICS AND THERMAL ENGINEERING.

Teaching scheme:
Theory: 2 hrs
Tutorial: 1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic Mechanical engineering	
Course Outcome	To introduce properties of fluid and hydraulic measurement To understand dynamics of fluid flow To understand basic concepts of IC engines To understand concept of refrigeration and air conditioning	
Unit	Contents	Contact Hrs
1	Introduction to properties of fluids & hydraulic measurements (pressure at plane & curved surfaces, criteria of pressure), Fluid kinematics and dynamics & simple numerical.	6
2	Flow through pipe Laminar flow, Haugen Poisellie's equation Turbulent flow, Darcy Weisbach formula, Friction factor, use of Moddys Diagram only, Pipes in series & parallel, minor losses. Introduction to reciprocating and centrifugal pumps, their characteristics and applications	6
3	Internal Combustion Engines: Introduction to First Law & second Law of Thermodynamics, Concept of Entropy & Enthalpy Classification Otto, Diesel & air-fuel cycles, Constructional details of two stroke, four stroke engines, study of various systems such as fuel supply, ignition cycle, over heating, cooling, lubrication, calculation of IP, BP, MEP, efficiencies, heat balance, engine trial, performance, gas turbine, classification, cycles, performance improvement .	6
4	Air compressors: Classification, principle of operation of reciprocating & rotary compressors, Constructional details of single & multi stage compressor, work input, P-V diagram, efficiencies, improving compressor performance, reciprocating type only, use of compressed air	6
5	Refrigeration & Air conditioning: Refrigeration: Different systems, principle of cycles of operations of vapour compression & vapour absorption systems, COP calculations of vapour compression refrigeration system, refrigerants, desirable & undesirable properties, application of refrigeration.	6
6	Air conditioning: Psychrometry, DBT, WBT, RH, Psychometric chart, air conditioning processes such as heating, cooling, humidification, dehumidification, study of central air conditioning plant & its control, application of air conditioning.	6
	Ref Books: 1. Joel Reyner, "Engineering Thermodynamics",(Longman Publications) 2. Nag P. K., "Engineering Thermodynamics", (Tata McGraw Hill Publications) 3. Arora C.P, "Refrigeration & Air Conditioning", (Tata McGraw Hill Publications) 4. Eastop T. D. & Mcconkey A., "Applied Thermodynamics For Engineering Technologists" (Longman Publications) 5. Modi P.N & Seth S.M, "Hydraulic Fluid Mechanics",(Standard Book House Publications) 6. Lewitt W., "Hydraulic & Fluid Mechanics",(Sir Issac Pitman Publications),10th Edition	

BTEEC 304 MEASUREMENT AND INSTRUMENTATION

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To understand philosophy of measurement. To understand different methods analog and digital measurement. To study principle of construction and operation of different transducer and dismay methods.	
Unit	Contents	Contact Hrs
1	Philosophy Of Measurement- Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards.	6
2	Analog Measurement of Electrical Quantities – Electro dynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electro dynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energymeter. Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor	6
3	Measurement of Parameters - Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter	6
4	Digital Measurement of Electrical Quantities-Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter.	6
5	Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications Instrumentation amplifiers – differential amplifiers) Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.	6
6	Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only)	6
	Reference Books: 1. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co. 2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill 3.Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education. 4. D. Patranabis, Sensors & Transducers, PHI. 5. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill. 6. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication. 7. H.K.P. Neubert, Instrument transducers, Oxford University press.	

BTHM306. BASIC HUMAN RIGHTS

Teaching scheme:
Theory: 2 hrs
Total credit: P/NP (Audit course)

Examination Scheme:
Internal Assessment: 20 Marks

Pre requisite		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	The Basic Concepts: Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.	6
2	Human Rights and Human Duties: Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom	6
3	Society, Religion, Culture, and their Inter-Relationship: Impact of Social Structure on Human behaviour, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.	6
4	Social Structure and Social Problems: Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.	6
5	State, Individual Liberty, Freedom and Democracy: The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.	6
6	Human Rights in Indian Constitution and Law: The constitution of India: (i) Preamble (ii) Fundamental Rights (iii) Directive principles of state policy (iv) Fundamental Duties (v) Some other provisions Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission	6
	Reference Books: 1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005. 2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.	

BTEEOEL 305 .(A) ELECTRICAL ENGINEERING MATERIALS.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, Physics, Chemistry	
Course Outcome	To study about crystal structure To understand magnetic material structure To study about conducting and superconducting materials To study dielectric and nano materials.	
Unit	Contents	Contact Hrs
1	Crystallography Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, $BaTiO_3$) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.	6
2	Magnetic Materials Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Antiferromagnetic and Ferrimagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.	7
3	Conducting and Superconducting Materials Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)	7
4	Semiconducting Materials Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell	6
5	Dielectric Materials Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials	7
6	Nano Materials Nanomaterials : Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials.	7
	Reference Books : 1. Material Science and Engineering – V. Raghavan 2. Electrical Engineering Materials – A.J. Dekker 3. Solid State Physics – A.J. Dekker 4. Science of Engineering Materials and Carbon Nanotubes - C.M. Srivastava and C. Srinivasan	

BTEEOEL305.(B). Applied physics

Teaching scheme:
Theory: 3hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Physics-II	
Course Outcome	1.Understand concept of Electromagnetic theory and Magnetism 2. Understand concept od Dielectric and Super conductivity 3. Understand concept of nanomaterial	
Unit	Contents	Contact Hrs
1	Electromagnetic Theory covering, Coulomb‟s law for distribution of charges, Polarization Gauss‟s law, Electric current and equation of continuity, Magnetic induction and Lorentz force, Steady current and Biot-Savert law, Ampere‟s law, Magnetization and magnetic intensity, Faradays law of induction, Generalization of Ampere‟s law, Maxwell‟s equations	4
2	Dielectrics: Introduction to dielectrics, Concept of Polarization; Dipole and dipole moment, Electric field due to dipole (without derivation); Depolarization field, depolarization factors, Local electric field at an atom, Lorentz field, Lorentz relation; Dielectric constant and polarizability – ClausiusMossotti equation (with derivation); Types of polarization – electronic, ionic, dipolar, space charge; Temperature and frequency dependence of dielectric constant	5
3	Magnetism : Magnetic field and Magnetization; Magnetic susceptibility, Paramagnetism - Paramagnetism due to partially filled shells, transition elements (3d), rare earths (4f) and actinides, Magnetization and total angular momentum (definition and relationship); Concept of magnetic moment, gyromagnetic ratio, Lande‟s g-factor, Bohr Magneton, Curie‟s Law – derivation for „spin only‟ system (L = 0), expression for non-zero orbital angular momentum system (J = L + S); Ferromagnetism, antiferromagnetism, and ferrimagnetism; Exchange interaction between magnetic ions; Molecular field, Expression for Curie-Weiss law, concept of θP ;Ferromagnetism and Ferrimagnetism – Curie temperature, hysteresis, Hard ferromagnets, permanent magnets – SmCo5, Nd2Fe14B, Sintered Alnico, Sintered Ferrite – 3 etc. – Comparison and applications; Soft ferromagnets –Permalloys, Ferrites etc. – Comparison and applications; Neel temperature, Curie-Weiss law; Magnetic resonance, NMR and MRI, MASER;	5
4	Superconductivity :Zero resistance, Critical temperature Tc ,Perfect diamagnetism, Meissner effect, Critical field Hc, Type I and Type II superconductors, Cooper pairs and formation of superconducting gap at Fermi level, Electron-Phonon interaction and BCS theory, Isotope effect, Applications – Superconducting magnets, Transmission lines, Josephson effect (DC & AC, qualitative), SQUID; (7 Lectures)	4
5	Physics of Nanomaterials : Nanoscale; Properties of nanomaterials- Optical (SPR, luminescence, tuning band gap of semiconductor nanoparticles), Electrical (SET), Magnetic, Structural, Mechanical; Brief description of different methods of synthesis of nanomaterials (physical - laser ablation, ball milling; chemical - vapor deposition, sol gel); Reduction of dimensionality, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Density of states and energy spectrum for Zero dimensional solid, One dimensional quantum wire, Two dimensional potential well, Particle in a three dimensional box; Some special nanomaterials like, Aerogels – properties and applications, Carbon nanotubes - properties and applications, Core shell nanoparticles - properties and applications; Applications of nanomaterials: Electronics, Energy, Automobiles, Space, Medical, Textile, Cosmetics; Nanotechnology and Environment;	7
6	Quantum Computation and Communication covering, the idea of „qubit‟ and examples of single qubit logic gates- Classical bits, Qubit as a two level system; Bloch vector representation of state of qubit; Polarization states of photon and measurements; Pauli gates, Hadamard gate, Phase shift gate, Quantum gates as rotations in Bloch sphere; EPR paradox, concept of entanglement and Bell‟s inequality- The paradox, joint state of entangled particles; Proof of Bell‟s inequality; Two-qubit controlled gates; entanglement generation and the Bell basis- Generic twoqubit state, Controlled-NOT gate; Quantum circuit for transforming computational basis to Bell basis; Qualitative discussion on the „circuit‟ model of „quantum computation; An overview of classical cryptography: Vernam cypher; Public key cryptosystem; The „Rivest-Shamir-Adleman‟ or „RSA‟ protocol; Comments on No-cloning theorem and impossibility of faster-than-light transfer of information; The BB84 protocol in quantum cryptography- The protocol; its validity on the basis of Heisenberg‟s uncertainty	8

	principle; Quantum Teleportation- Basic idea; measurement using Bell operator, need for classical communication channel; quantum circuit describing teleportation protocol;	

Ref Books:

1. Kittel C., Introduction to Solid State Physics, Wiley Eastern
2. Callister W.C. Jr., Material Science and Engineering: An Introduction, 6th Edn., John Wiley & Sons
3. Kulkarni Sulabha K., Nanotechnology: Principles & Practices, Capitol Publishing Co.
4. Charles P. Poole, Jr., Frank J. Owens, Introduction to Nanotechnology, Wiley Eastern
5. Nielsen M. A., I. L. Chuang, Quantum Computation & Quantum Information, Cambridge Univ. Press

BTEEOEL305. (C). SIGNALS AND SYSTEMS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To study classification of signals and system To analyze diff. types of time signal	
Unit	Contents	Contact Hrs
1	CLASSIFICATION OF SIGNALS Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random singals,	5
	CLASSIFICATION OF SYSTEMS CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.	5
2	ANALYSIS OF CONTINUOUS TIME SIGNALS Fourier series analysis, Spectrum of C.T. singals, Fourier Transform and Laplace Transform in Signal Analysi	7
3	LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response , Fourier and Laplace transforms in analysis, State variable equations and matrix representation of systems	7
4	ANALYSIS OF DISCRETE TIME SIGNALS Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform.	7
5	LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms , State variable equations and matrix representation of systems.	7
	REFERENCES: 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007. 2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007 3. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007 4. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007. 5. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc, 2004. 6. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Wiley	

BTHS307. ENGINEERING ECONOMICS

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.	4
2	Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)	4
3	Meaning of Demand, Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)	4
4	Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.	5
5	Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (Main features). Supply and law of supply, Role of demand and supply in price determination.	4
6	Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks	2
	Reference Books: 1. Chopra P. N., Principle of Economics, Kalyani Publishers 2. Dewett K. K., Modern economic theory, S. Chand 3. H. L. Ahuja., Modern economic theory, S. Chand 4. Dutt Rudar & Sundhram K. P. M., Indian Economy 5. Mishra S. K., Modern Micro Economics, Pragati Publications	

BTEEL308. Network Analysis and Synthesis Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To understand principles of various network theorems and network principles	
Course Outcome	Verifies principles of network	
Expt No	Title of Expt	
1	Verification of Superpostion theorem	
2	Verification of Thevinion's theorem	
3	Verification of Norton's theorem	
4	Verification of maximum power transfer theorem	
5	Verification of reciprocating theorem	
6	Determination of transient response of current in RL & RC circuits with step voltage input	
7	Analysis of RL/ RC and RLC circuits	
8	Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases	
9	Determination of frequency response of current in RLC circuit with sinusoidal ac input	
10	Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values	
11	Determine characters tics of filter	

BTEEL309. Measurements and instrumentation Lab

Teaching scheme:
Lab work : 4 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Study of Reyleigh's current balance method	
2	To study AC bridges	
3	Study of different types of ohm meter	
4	Study of megger	
5	Study of instrument T/F and it's types	
6	Study of wattmeter	
7	Construction of ammeter and voltmeter	
8	To study different types of transdusers	
9	Study digital frequency meter and digital voltmeter	
10	To study linear variable differential transformer	
11	Study of digital torque measurement	

BTEEL310. Electrical workshop/ Mini Project

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 25 Marks
Pr/oral: 25 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To provide hands on experience towards building of prototype	
Course Outcome	Build and verifies basic scientific principles.	
Expt No	Title of Expt	
1	Study various resources and components in electrical engineering projects	
2	Study datasheet of basic circuit components of a project	
3-5	Study various software in building of project like: Electric Circuit, X-Circuit, Electrician app, Electronic Tutorials, Logisim, Circuit simulator, Free PCB Ki CAD EDA software suit, SYC labs, Tina-TI etc	
6	Preparation of PCB for a given project	
7	Verification and analysis of project	
8	Report writing	

Semester IV

BTEEC 401. ELECTRICAL MACHINES – I

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical technology,	
Course Outcome	To study diff. types, construction and operating principle of diff. types of electrical machines	
Unit	Contents	Contact Hrs
1	Single Phase Transformer: Transformer construction, Ideal and practical transformer, exact and approximate equivalent circuits, no load and on load operation, phasor diagrams, power and energy efficiency, voltage regulation, parallel operation, effect of load on power factor, Per Unit system, excitation phenomenon in transformers, switching transients, Auto transformers, Variable frequency transformer, voltage and current transformers, welding transformers, Pulse transformer and applications.	7
2	Three Phase Transformers: Constructional features of three phase transformers, Cooling methodology, Standard and special transformer connections, Phase conversion, Parallel operation of three phase transformers, three winding transformers and its equivalent circuit, On load tap changing of transformers, Modern trends in transformers, Type and routine tests, Standards.	8
3	Electromechanical Energy Conversion Principles: Energy in a magnetic systems, field energy and mechanical force, energy in singly and multiply excited magnetic systems, determination of magnetic force and torque from energy and coenergy, Forces and torques in magnetic field systems, dynamic equations of electromechanical systems and analytical techniques	6
4	DC Generators: Construction of armature and field systems, Working, types, emf equation, Armature windings, Characteristics and applications, Building of emf, Armature reaction - Demagnetizing and Cross magnetizing mmfs and their estimation; Remedies to overcome the armature reaction; Commutation process, Causes of bad commutation and remedies	9
5	D.C. Motors: Principles of working, Significance of back emf, Torque Equation, Types, Characteristics and Selection of DC Motors, Starting of DC Motors, Speed Control, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses; Applications, Permanent Magnet DC Motors, Type and Routine tests.	9
6	Special Machines: Constructional details of reluctance machine, variable-reluctance machines, basic VRM analysis, practical VRM analysis, stepper motors and their analysis, Brushless DC motors.	6
	REFERENCES: 1. Bhattacharya S. K, "Electrical Machines",(Tata McGraw Hill Publications) 2. Kothari Nagrath, "Electrical Machines", (Tata McGraw Hill Publications) 3. M. N. Bandopadhyay, "Electrical Machines", (Tata McGraw Hill Publications) 4. Fitzaralda, "Electrical Machines", (Tata McGraw Hill Publications)	

BTEEC402 : POWER SYSTEM-I:

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To Understand basic operation of power system, power system components and their characteristics.	
Unit	Contents	Contact Hrs
1	**Load and Energy survey**: load duration curve, plant factor and plant economics. Introduction to different sources of energy. Construction, principle and working of different thermal power plants with neat block diagram of main parts, fuel economisation, for thermal power plants based on Coal, Oil and nuclear energy. Hydroelectric Power Plant: Advantages and limitations, selection of site, hydrological cycles and hydrographs, storage and pondage, essential elements of hydroelectric plant, classification, different types of turbines and their selection, layout of hydro-station, simple numerical.	7
2	**Major Electric Equipments**: Descriptive treatment of alternator exciter & excitation systems, Transformers, Control panels, Metering & other control room equipments. Inductance: Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, Concept of GMD, Inductance of three phase line with equal & unequal spacing, vertical spacing.	5
3	**Capacitance**: Concept of electric field, Potential difference between two points in space, Effect of earth's surface on electric field, Computation of capacitance of single phase, three phase transmission lines with & with out symmetrical spacing for solid & composite conductors.	6
4	**Transmission:** Types of conductors, Choice of conductor materials, Stranded copper & ACSR conductor, Insulation consideration, Different types of insulator, supports, distribution of voltage across the insulator string, String efficiency, skin effect, Ferranty effect, proximity effect	6
5	**Current and Voltage relation:** Representation of short, medium & long transmission lines, P. U. quantities, evaluation of ABCD parameters and surge impedance loading, power flow through transmission line, circle diagram, evaluation of relation between sending and receiving end current & voltage, Interpretation of transmission line equation, Numericals, Line current, % regulation, Transmission efficiency, numericals based on above	7
6	**Mechanical Design of Transmission Line**: Effect of wind & ice coating on transmission line, sag due to equal & unequal supports, with their derivation, Numericals. Corona: Phenomenon of corona, factors affecting the corona, Power loss & disadvantages of corona.	5
	REFERENCES: 1. Gupta B. R. " Power Plant Engineering".(Eurasia publications) 2. Nag P. K. " Power Plant Engineering",(Tata McGraw Hill Publications) 3. Kothari Nagrath, "Electric Power System", (Tata McGraw Hill Publications) 4. Wadhva S. L.,"Electric Power System",(Tata McGraw Hill Publications) 5. Stevension W. B., "Power System", (English Language Book Society publications)	

BTEEC 403 ELECTRICAL INSTALLATION AND ESTIMATION

Teaching scheme:
Theory: 2 hrs
Tutorial-1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, electrical measurement and instrumentation.	
Course Outcome	To prepare estimates and costing of electrical installations of power system, To understand procedures of contracting and purchase.	
Unit	Contents	Contact Hrs
1	Estimating and Determination of conductor size for internal wiring, HT and LT Overhead Lines and Underground Cables: Various steps to form an estimate, Price catalogue, Schedule of labour rates, Schedule of rates and estimating data, Conductor size, calculations for internal domestic wiring, Permissible voltage drops for lighting and industrial load, simple numericals, Conductor size calculation for underground cables: General considerations, Simple numericals, Conductor size calculations for overhead lines with A.C.S.R. conductors, simple numericals.	7
2	Preparation of estimate of quantity of material required for wiring of a house (typical plan of house including electric layout is to be given). Drawing of electrical circuit for such electrification. Specification for accessories like AC energy meter, main switch, Tumbler switch, Electric heater, Fluorescent tube, Chokes for tubes, starters, bulbs, and Insulation tapes.	5
3	**Principles of Contracting**: Purchasing techniques, Spot quotations, Floating limited enquiry, Typical example of quotation form, preparation of comparative statement, Analysis of comparative statement, Tenders types (Single tender, Open tender), Earnest money, Security deposit, Various steps involved in complete purchase, Typical order formats, various criteria for selecting the supplier, General considerations in order form, Procedures to be followed for submitting the tenders & quotations. Purchase Department, Objective, activities, duties and functions, purchase organization, Centralized and decentralized purchasing, relative advantages and disadvantages, Applications	6
4	**Study of different types of components in electrical distribution system:** Cables: Classification, general construction, types of cables, jointing of cables, measurement of insulation resistance, Insulators: Requirements, materials used, types (Pin, Suspension, Strain, Stay) Substation: Different types, classification, design consideration, various symbols, complete arrangement of substation (Single and double bus bar), key diagrams for typical substations. Review of Insulated Wires: Types: Rubber covered taped and compounded or VIR, Lead alloy sheathed, Tough rubber sheathed, Weather proof, Flexible wire splicing, Termination (Twist splicing, Married joint, Tap joint, Pig tail joint) Different Types of Switches: Tumbler, flush, pull, grid, architrave, rotary snap, Push button, Iron clad water proof, Quick break knife switch. Ceiling roses, Mounting blocks, Socket outlets plugs, Main switches, Distribution fuse boards, MCB (Miniature Circuit Breakers)	7
5	**Different Tools Used**: Screwdriver, Pliers of various types, wrench, and blowlamp, Precaution for using tools	4
6	**Wiring System**: Selection of types of wiring. Methods of wiring (Cleat, Casing capping, Metal sheathed and Conduit) Calculation and Estimation of power rating of different AC and DC machines, schematic and wiring diagrams for motor control and protection circuit	6
	REFERENCES: 1. Uppal .S. L – Electrical Wiring, Estimation & Costing(Khanna Publication). 2. Raina & Bhattacharaya – Electrical Design Estimating & Costing (Willy Estern).	

BTEEC404. NUMERICAL METHODS AND PROGRAMMING.

Teaching scheme:
Theory: 2 hrs
Tutorial-1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Mathematics 1, mathematics 2, mathematics 3, C programming	
Course Outcome	To study and understand MATLAB programming. To review mathematical concepts . To develop computer program for linear and nonlinear equations.	
Unit	Contents	Contact Hrs
1	Introduction to MATLAB Programming: Array operations , Loops and execution control Lecture . Working with files: Scripts and Functions , Plotting and program output	5
2	Approximations and Errors: Defining errors and precision in numerical methods Taylor's / Maclaurin series, Truncation and round-off errors, Error propagation, Global and local truncation errors.	6
3	Numerical Differentiation and Integration: Methods of numerical differentiation and integration, trade-off between truncation and round-off errors, error propagation and MATLAB functions for integration	6
4	Linear and Nonlinear Equations: numerical methods in linear algebra, and use of MATLAB to solve practical problems. Gauss Elimination ,LU decomposition and partial pivoting, Iterative methods: Gauss Siedel and Special Matrices: Tri-diagonal matrix algorithm, Nonlinear equations: NewtonRaphson method and MATLAB routines fzero and fsolve., Nonlinear equations in single variable , MATLAB function fzero in single variable, Fixed-point iteration in single variable , Newton-Raphson in single variable , MATLAB function fsolve in single and multiple variables, Newton-Raphson in multiple variab	6
5	Regression and Interpolation: Linear least squares regression(including lsqcurvefit function) , Functional and nonlinear regression (including lsqnonlin function), Interpolation in MATLAB using spline and p chip	5
6	Ordinary Differential Equations (ODE) – 1 Explicit ODE solving techniques in single variable, Introduction to ODEs; Implicit and explicit Euler's methods, Second-Order Runge-Kutta Methods, Higher order Runge-Kutta methods, Error analysis of Runge-Kutta method. Stiff ODEs and MATLAB ode15s algorithm ,Practical example for ODE-IVP ,Solving transient PDE using Method of Lines	7
	Reference Books: 1. Fausett L.V. (2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., and Pearson Education. 2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed., and McGraw Hill. 3. NPTEL notes. http://nptel.ac.in/courses/122106033/	

BTEEDEL405:A. SOLID STATE DEVICES.

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	basic electrical engineering,	
Course Outcome	1. To study construction and characteristics of solid state devices. 2. To apply operational amplifier models in circuits employing negative feedback. 3. To design electronics circuit using Timer IC and voltage regulators. 4. To perform analysis of amplifiers using small signal models for the circuit elements. 5. To calculate the frequency response of circuits containing BJT, Op-Amp etc	
Unit	Contents	Contact Hrs
1	Semiconductor Devices and their applications: Applications of diodes - clippers, clampers, multipliers, Types of diodes - Zener diode, Tunnel diode, schottky diode, LED, PIN diode, Photodiode etc, BJT- CB, CE, CC configurations, biasing, FET biasing, MOSFET biasing, NMOS, PMOS, CMOS, Device modeling.	4
2	Signal and Power Amplifiers: Analysis of CB, CC, CE and FET amplifiers. Low and high frequency response of transistor and FET amplifier, Feedback in amplifiers, Oscillators. Transistor power amplifiers.	4
3	Operational Amplifiers: The ideal Op-Amp, equivalent circuit of Op-Amp, ideal voltage transfer curve, open loop Op-Amp configurations, Op-Amp parameters, block diagram representation of feedback configurations, frequency response, high frequency Op-Amp.	4
4	Active Filters and Oscillators: Active filters: low pass filter, high pass filter, band-pass filters, band reject filters, all pass filters, comparators and oscillators.	4
5	Generalized Linear Applications: DC and AC amplifiers, instrumentation amplifier, logarithmic amplifier, voltage to current converter, current to voltage converter, the integrator, the differentiator.	4
6	Specialized IC Applications: The 555 Timer as monostable, astable multivibrator, phase locked loops operating principles, 565 PLL applications, voltage regulators- fixed, adjustable, switching, special. Analog switch and analog multiplier.	4
	Ref Books: 1. Millman, Halkias and Satyabrata Jit, " Electronic Devices and Circuits", 4th edition, McGraw Hill Education (India) Private Limited, 2015. 2. Robert L. Boylestad and Louis Nashelsky, "Electronic devices and circuit theory", 11th edition, Prentice Hall India Ltd, 2015. 3. Ramakant A. Gayakwad, "Op-Amps and linear integrated Circuits" 4th edition, Pearson Education, 2015.	

BTEEDEL405:2. ANALOG AND DIGITAL ELECTRONICS

Teaching scheme:
Theory: 4 hrs
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	basic electrical engineering,	
Course Outcome	To review basic number system. To understand deign and characteristics of digital logic gates. To study different techniques in use of digital circuits. To design digital systems.	
Unit	Contents	Contact Hrs
1	Transistor as an Amplifier, load line, Small signal low frequency analysis of single stage amplifier in different configuration, High frequency equivalent circuit of transistor (hybrid pi), Cascade amplifier, High input resistance circuits-C coupled amplifier Frequency response, Definition of 3 db bandwidth, Effect of cascading on gain & BW, Classification of amplifiers	4
2	Block diagram of operational amplifier, Properties of ideal operational amplifier, Explanation of different terms appearing in OP-Amp application (offset, bias, quantities, PSRR, CMRR, Ad, AC, Slew rate etc.), Operation of circuit diagram of OP-Amp using discrete components & I.C. diagram, Different types of current of current sources in I.C. technology, frequency response of OP-Amp, OP-Amp parameters & minimization technique of temperature effect, Inverting & Non-inverting operation of Op-Amp & analysis for AG, RI, RO, Linear & non-linear circuit application of OP-Amp	4
3	Number Systems, Basic Logic Gates & Boolean Algebra: Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and Vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion	4
4	Digital Logic Gate Characteristics: TTL logic gate characteristics: Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, and C-MOS & MOSFET. Interfacing logic families to one another. Sequential Systems: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops Counters: Synchronous & asynchronous ripple and decade counters, Modulus counter, skipping state counter, counter design, state diagrams and state reduction techniques. Ring counter. Counter applications. Registers: buffer register, shift register	4
5	Minimization Techniques: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logiConversion of truth tables in POS and SOP form. Incomplete specified functions.Variable mapping.Quinn-McKlusky minimization techniques. c functions with K-map	4
6	Combinational Systems: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders.BCD adder. Binary multiplier. Decoder: Binary to Graydecoder, BCD to decimal, BCD to 7-segment decoder' Multiplexer, DE multiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode Switching matrix. Design of logic circuits by multiplexers, encoders, decoders and DE multiplexers.	4
	Ref Books: 1. Mandal, Digital Electronics: Principles and Applications, TMH 2009 2. Leach, Digital Principles and Applications, ed. 7, TMH 2008 3. M. Morris Mano, Digital Logic and Computer Design, Pearson Edu. 2014	

BTEEDEL 405. 3 Electro Magnetic Theory

Teaching scheme:
Theory: 2 hrs
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, machine 1, physics	
Course Outcome	To understand vector relations in diff. forms To analyze diff. laws and their solution To study about magneto static To understand time varying field and effect of magnetism in transmission line	
Unit	Contents	Contact Hrs
1	Introduction: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholz theorems	4
2	Electrostatics: Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. The potential functions and displacement vector.	4
3	Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells	5
4	Magnetostatics: Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector poten Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cellstial, self & mutual inductance.	5
5	Time Varying Fields: Faraday's law, Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction & polarization of UPW, standing wave ratio. Pointing vector and power considerations.	4
6	Transmission Lines: The high-frequency circuit. LCR ladder model. The transmission Lin equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR	4
	Ref Books: 1. G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson. 2006 2. S. Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pub. 2013 3. R. S. Kshetrimayum, Electromagnetic Field Theory, Cengage Learning. 2012 4. J. D. Kraus: Electromagnetic. 5th edition, MGH. 1999	

BTXX 406. Product Design Engineering.

Teaching scheme:
Theory: Online
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Outcome	1. Understands modeling of product 2. Able to work in team 3. Understand importance of documentation 4. Understand basic principles of health and safety in project management 5. Understand data management in pr 6.	
Unit		Contact Hrs
1	Creating Simple Products and Modules.	
2	Document Creation and Knowledge Sharing.	
3	Self and Work Management	
4	Team Work and Communication	
5	Managing Health and Safety	
6	Data and Information Management	
	References: 1.Model Curriculum for "Product Design Engineer – Mechanical", NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7) 2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education. 3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press. 4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design Mc- GRAW- HILL book company. 5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc. 6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.	

EEL 406. 2. Introduction to Non-Conventional Energy Sources,

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Energy and environmental engineering, basic electrical engineering	
Course Outcome	To review energy scenario. To understand basic concepts , construction and operational features of different non-conventional sources.	
Unit	Contents	Contact Hrs
1	Introduction: World energy situation, conventional and non-conventional energy sources, Indian energy scene.	2
2	Solar Energy: Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector - parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system	4
3	Wind Energy: Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy	6
4	Geothermal Energy: Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. Tidal Energy: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India	5
5	Nuclear Fusion Energy: Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement – magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybridand cold fusion	4
6	Biomass Energy: Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production	4
	Ref Books: 1. A. N. Mathur: Non-Conventional Resources of Energy. 2010 2. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006	

EEL 406. 2. Introduction to Non-Conventional Energy Sources,

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Energy and environmental engineering, basic electrical engineering	
Course Outcome	To review energy scenario. To understand basic concepts , construction and operational features of different non-conventional sources.	
Unit	Contents	Contact Hrs
1	Introduction: World energy situation, conventional and non-conventional energy sources, Indian energy scene.	2

2	Solar Energy: Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector - parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system	4
3	Wind Energy: Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy	6
4	Geothermal Energy: Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. Tidal Energy: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India	5
5	Nuclear Fusion Energy: Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement – magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybridand cold fusion	4
6	Biomass Energy: Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production	4
	Ref Books: 3. A. N. Mathur: Non-Conventional Resources of Energy. 2010 4. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006	

EEL 406.3 Software Techniques.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic C programming	
Course Outcome	To understand different techniques of software models. To understand verification and validation of software. To analyze software project management.	
Unit	Contents	Contact Hrs
1	Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers	3
2	Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model.	3
3	Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development	7
4	Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.	5
5	Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process break-down structure, COCOMO and COCOMO-II.	6
6	Advanced Topics: Formal Methods in Software Engineering – Z notation, Hoare‟s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspectoriented Programming.	7
	Reference books: 1. Fundamentals of Software Engineering – Carlo Ghezzi et. al. 2. Software Engineering – Design, Reliability Management – Pressman. 2. Software Engineering – Ian Sommerville. 2. Software Engineering - Shoeman. 3. Software Engineering with Abstraction – Berzins and Luqi	

EEL 406.3 Software Techniques.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic C programming	
Course Outcome	To understand different techniques of software models. To understand verification and validation of software. To analyze software project management.	
Unit	Contents	Contact Hrs

1	Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers	3
2	Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model.	3
3	Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development	7
4	Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.	5
5	Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process break-down structure, COCOMO and COCOMO-II.	6
6	Advanced Topics: Formal Methods in Software Engineering – Z notation, Hoare‟s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspectoriented Programming.	7
	Reference books: 3. Fundamentals of Software Engineering – Carlo Ghezzi et. al. 2. Software Engineering – Design, Reliability Management – Pressman. 4. Software Engineering – Ian Sommerville. 2. Software Engineering - Shoeman. 3. Software Engineering with Abstraction – Berzins and Luqi	

BTEEL409. Electrical Machine-I Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 25 Marks
Pr/oral: 25 Marks

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	To verify V-I relation & to draw phasor diagram of i) star-star ii) star-delta iii) delta-star iv) delta-delta connection of 3 phase transformer	
2	To verify relation in i) scott connection ii) open delta connection	
3	To study the parallel operation of 3 phase transformer	
4	To study construction of stator and rotor of DC machine	
5	To determine magnetization, internal and external characteristics of a series generator	
6	To determine internal and external characteristics of dc machine	
7	To study the construction of stator and rotor of 3 phase induction motor i) squirrel cage ii) wound rotor	
8	To determine performance characteristics of 3 phase squirrel cage induction motor	
9	To determine performance characteristics of 3 phase slip ring induction motor	
10	To study different types of single phase induction motor	
11	To determine performance characteristics of single phase induction motor	
12	To determine S-T characteristics of universal motor	

BTEEL410. Numerical Methods and Programming Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 25 Marks
Pr/oral: 25 Marks

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Program for scan conversion of a straight line	
2	Program for scan conversion of a circle	
3	Program for scan conversion of an ellipse	
4	Program for scan conversion of a rectangle	
5	Program for scan conversion of an arc	
6	Program for scan conversion of a sector	
7	Program for finding roots of f(x)=0 by newton raphsonm method	
8	Program for finding roots of f(x)=0 by bisection method	
9	Program for solving numerical integration by simpson's 1/3 rule	
10	Program for solving ordinary differential equation by runge kutta method	

BTEEL411. Elective-II Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

8-10 experiments covering full content of the syllabus and at least one experiment from each unit.

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		