Electrical Engineering				
Second Year (Third Semester)				
Sl.No	**Course Code**	**Subject (Theory)**	**Contact Hrs. L-T-P**	**Credit**
1	MA1201	Mathematics–III	3-0-0	3
2	EE1201	Professional Core-1: Electrical Machines – I	3-0-0	3
3	EE1202	Professional Core-2: Network Theory	3-0-0	3
4	EC1203	Professional Core-3: Analog and Digital Electronic Circuits	3-0-0	3
5	EE1203	Advanced Competency Course-1: Optimisation and Soft Computing (PC-4)	3-0-0	2
6	HS1201	Engineering Economics	3-0-0	2
Subject (Sessional)				
7	EE1281	Electrical Machines Lab – I	0-0-3	1.5
8	EE1282	Network Lab	0-0-3	1.5
9	EC1283	Analog and Digital Electronic Circuits Lab	0-0-3	1.5
10	EE1283	Optimisation and Soft Computing Lab	0-0-3	1.5
		Total	**18-0-12**	**22**
Second Year (Fourth Semester)				
Sl.No	**Course Code**	**Subject (Theory)**	**Contact Hrs. L-T-P**	**Credit**
1	EE1204	Professional Core-5 : Measurement and Instrumentation	3-0-0	3
2	EE1205	Professional Core-6 : Electrical Machines-II	3-0-0	3
3	EE1206	Professional Core-7 : Power Electronics	3-0-0	3
4	EE1207	Professional Core-8: Power Generation Transmission and Distribution	3-0-0	3
5	CS1204	Advanced Competency Course-2 : Programming in Python (PC-9)	3-0-0	2
6	HS1202	Organizational Behavior	3-0-0	2
Subject (Sessional)				
7	EE1284	Electrical Machines Lab-II	0-0-6	3
8	EE1285	Power Electronics Lab	0-0-3	1.5
9	CS1284	Programming in Python Lab	0-0-3	1.5
	Summer Internship and Research Experience (SIRE- I) *			
		Total	**18-0-12**	**22**

ELECTRICAL ENGINEERING			
Subject Code	**MA1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Mathematics–III**		
SYLLABUS			
Module-I	Random variables (Discrete and Continuous. Cumulative Distribution Function (CDF). Variance and standard deviation. Moments. Functions of a random variable. Distributions: Binomial, Poisson, normal, Gaussian, uniform (definitions and examples only). Moment generating function.		**6 Hrs**
Module-II	Pairs of random variables. Joint probability density function. Joint probability mass function. Marginal distribution. Functions of two random variables, PDF and expected values of the sum of two random variables		**6 Hrs**
Module-III	Probability Models of n Random Variables. Vector notation. Independence of random variables and random vectors. Functions of random vectors. Expected value vector and correlation matrix.		**6 Hrs**
Module-IV	Stochastic Processes. Definitions and examples. Types of stochastic processes. Random variables from random processes. The Poisson process.		**6 Hrs**
Module-V	Markov Chains. Discrete-time Markov chain. Discrete-Time Markov chain dynamics. Limiting state probabilities for a finite Markov chain. State classification.		**6 Hrs**
Essential Reading	1. Roy D. Yates, Rutgers and David J. Goodman, Stochastic Processes, 2d Edition, John Wiley and Sons, INC. 2. Gregory F Lawler, Introduction to Stochastic Processe, Chapman & Hall/ CRC Press (Taylor Francis Group).		
Course Outcomes	The objective of this course is to familiarize the prospective engineers with techniques in Probability and Statistics. It aims to equip the students to deal with advanced level of Statistics that would be essential for Engineering disciplines. CO1. To apply different distributions in real life problems of industries CO2. To deal with problems that contains multivariable probability distribution. CO3.To enrich knowledge Probability Models of multi-Random Variables CO4. To learn use of stochastic processes in daily life		
Subject Code	**EE1201**	**Total Contact Hour**	**30**
Semester	3rd	**Total Credit**	**3**
Subject Name	**ELECTRICAL MACHINES-I**		
Pre-requisites	**BASIC ELECTRICAL ENGINEERING**		
SYLLABUS			
Module-I	Transformers: Review of Single phase transformer: no load andon load operation, Phasor diagram, equivalent circuit, lossesand efficiency, condition for maximum efficiency, voltage regulation, open circuit and short circuit tests, Sumpner'stest.		**6 Hrs**
Module-II	Review of DC Machines: armature windings, lap and wavewindings, simplex and multiplex windings, E.M.F. Equation,Armature reaction: Cross magnetizing and demagnetizingAT/pole, compensating winding, commutation, reactance voltage, methods of improving commutation.		**6 Hrs**
Module-III	Review of DC Generators –Methods of Excitation, build up ofE.M.F., critical field resistance and critical speed, causes for failure to self excite and remedial measures, Loadcharacteristics of shunt, series and compound generators, parallel operation of DC generators, load sharing		**6 Hrs**
Module-IV	Review of DC Motors: characteristics and application of shunt,series and compound motors, Starting of DC motor, Speed control of DC Motors: Armature voltage and field flux control methods, Ward Leonard method. Calculation of efficiency, Testing: brake test, Swinburne's test, Hopkinson's test, Field's test, Retardation test, separation of stray losses in a DC motor.		**6 Hrs**
Module-V	Three phase Transformers: Constructional features – threephase connection of transformers (Dd0, Dd6, Yy0, Yy6, Dy1, Dy11, Yd1, Yd11, zigzag), Scott connection, open delta connection, three phase to six phase connection, oscillating neutral, tertiary winding, three winding transformer, equal and unequal turns ratio, parallel operation, load sharing. Inrush of Switching currents.		**6 Hrs**
Essential Reading	1. J. Nagrath, D. P. Kothari, "Electric Machines", TMH Publishers. 2. A. E. Clayton, N. Hancock, "Performance and Design of D.C Machines", BPB Publishers		
Supplementary Reading	1. A. E. Fritzgerald, C. Kingsley, and S. Umans, "Electric Machinery", TMH Publisher. 2. P.S. Bhimra, Electrical Machinery (Part 1, Part 2), Khanna Publishers.		
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Describe and analyze the performance of single phase transformers. CO2. Describe the construction and basic principles of dc machines. CO3.Express and analyze the performance of DC generators. CO4. Describe and analyze the performance of DC motors. CO5. Define and analyze the performance of three phase transformers.		
Subject Code	**EE1202**	**Total Contact Hour**	**30**
Semester	3rd	**Total Credit**	**3**
Subject Name	**NETWORK THEORY**		
Pre-requisites	**BASIC ELECTRICAL ENGINEERING**		
Course Objective			

Module-I	Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problems Electrical Circuit Analysis Using Laplace Transforms: Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, and transformed network with initial conditions. Transient Response: Transient study in series RL, RC, and RLC networks by time domain and Laplace transform method with DC and AC excitation. Response to step, impulse and ramp inputs of series RL, RC and RLC circuit.	**10 Hrs**
Module-II	Two Port networks: Types of port network, short circuit admittance parameter, open circuit impedance parameters, transmission parameters, condition of reciprocity and symmetry in two port network, inter-relationship between parameters, input and output impedances in terms of two port parameters, image impedances in terms of ABCD parameters, Tee and Pie circuit representation, Cascade and Parallel Connections.	**8 Hrs**
Module-III	Network Functions & Responses: Concept of complex frequency, driving point and transfer functions for one port and two port network, poles & zeros of network functions. Restriction on Pole and Zero locations of network function, Time domain behavior and stability from pole-zero plots, Time domain response from pole zero plots.	**8 Hrs**
Module-IV	Network Synthesis: Realizability concept, Hurwitz property, positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions, Foster and Cauer forms.	**8 Hrs**
Module-V	Graph theory: Introduction, Linear graph of a network, Tie-set and cut-setschedule, incidence matrix, Analysis of resistive network using cut-set and tie-set, Dual of a network. Filters: Classification of filters, Characteristics of ideal filters.	**6 Hrs**
Essential Reading	1. A. Chakrabarti, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai Publications. 2.Mac.E Van Valkenburg,"Network Analysis", PHI Learning publishers. 3.Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.	
Supplementary Reading	1. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis", Dhanpat Rai Publications. 2.Mac.E Van Valkenburg, "Network Synthesis", PHI Learning publishers. 3.Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series, TMH publishers.	
Course Outcomes	CO1. Study coupled circuits and learn the transient and steady state behavior of 1st and 2nd order circuit and understand the concept of time constant CO2. Define the different parameters of two port network CO3. Concept of network function and stability study from pole-zero plots CO4. Synthesis of electrical networks CO5. Analyze the network using graph theory and understand the importance of filters in electrical system	
Subject Code	EC1203	**Total Contact Hour** **30**
Semester	**3rd**	**Total Credit** **3**
Subject Name	**Analog and Digital Electronic Circuits**	
Pre-requisites	**Basic Electronics**	
SYLLABUS		
Module-I	Biasing of BJT: Fixed bias circuit, Self-bias circuit. Transistor at Low Frequencies: h-parameters, Transistor hybrid Model, amplifier Using h-parameter, Miller's theorem. Transistor at high frequency: Hybrid-pi CE transistor model.	**6 Hrs**
Module-II	Biasing of BJT: Fixed bias circuit, Self-bias circuit. Transistor at Low Frequencies: h-parameters, Transistor hybrid Model, amplifier Using h-parameter, Miller's theorem. Transistor at high frequency: Hybrid-pi CE transistor model.	**6 Hrs**
Module-III	The basic operational amplifier (OP-AMP): inverting and non- inverting configurations and applications. Digital circuits: NOR DTL gates, HTL gate, TTL gate, RTL and DCTL.	**6 Hrs**
Module-IV	Boolean Algebra & Logic gates: Property and functions of Boolean algebra, Canonical & standard form; min-terms & max-terms, standard forms; Digital Logic Gates. Gate level Minimization: K- Map method, Product of Sum simplification, Sum of Product simplification, Don't care conditions.	**6 Hrs**

Module-V	Combinational digital systems: Standard gate assembles, Binary adder, arithmetic functions, Multiplexer, Demultiplexer, Encoder. Sequential digital systems: A 1-bit memory, Flip-flops, shift registers, Counters and applications.	**6 Hrs**
Essential Reading	1. Milliman. J, Halkias. C and Parikh. C.D., "Integrated Electronics", Tata Mc. Graw Hills 2nd Ed. 2010. 2. R.L Boylestad and L. Nashelsky, "Electronic Devices & Circuit Theory: Pearson Education. 3.M. Morris Mano, "Digital Design", PHI Publishers.	
Supplementary Reading	1. Mohammad Rashid, "Electronic Devices and Circuits", Cengage Learning Publishers. 2. Sergio Fransco, "Design with Operational Amplifiers& Analog Integrated Circuits", TMH Publishers. 3. Charles H.Roth, "Fundamentals of Logic Design", Cengage Learning Publishers.	
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Design of various types of amplifiers using BJT and FET using the concept of DC and AC analysis CO2. Analyse the frequency response of various amplifiers. Comprehend the fundamental concepts in feedback amplifier circuits. CO3. Acquaint with the design of logic gates using BJT. CO4.Use the concept of Boolean algebra for the analysis and design of various combinational and sequential circuits. Design of various logic gates starting from simple ordinary gates to complex programmable logic devices. CO5. Analyse the sequential logic circuits design both in synchronous and asynchronous modes for various complex logic and switching devices.	

Subject Code	**EE1203**	**Total Contact Hour**	**35**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Optimization and Soft Computing**		
Pre-requisites	**Knowledge of MATLAB**		

SYLLABUS		**Contact Hours**
Module-I	Introduction to Optimization: Objective function and constraints, Solution approaches,Multiobjective optimization. Evolution of Soft Computing: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, various typesof soft computing techniques, Applications of Soft Computing.	**7 Hrs**
Module-II	Introduction to Fuzzy Logic: Fuzzy Sets : Basic Definition andTerminology, Set-theoretic Operations, Fuzzy versus Crisp set, Fuzzy Relation, Linguistic variables, Fuzzification and Defuzzification Method,Membership Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Some applications of Fuzzy logic.	**7 Hrs**
Module-III	Artificial Neural Network: Concept of Biological neurons and its working, Important Terminology in ANN, Supervised and Unsupervised Learning, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.	**7 Hrs**
Module-IV	Introduction to genetic algorithm and their terminology, Working Principles, operators in genetic algorithm- coding - selection - cross over – mutation, Stopping condition for genetic algorithm flow, Introduction to Fitness function.	**7 Hrs**
Module-V	Introduction to Non-traditional Metaheuristic Optimization Techniques, Concept of Swarm Intelligence Algorithm, Particle Swarm Optimization, Ant colony optimization (ACO)	**7 Hrs**
Essential Reading	1. D.K. Chaturvedi, Soft Computing Techniques and its Applications in Electrical Engineering, Springer 2. A.E. Eiben , J.E. Smith, Introduction to Evolutionary Computing, Springer. 3. S.N.Sivanandam, S.N.Deepa , Principles of Soft Computing, Wiley India Pvt Ltd.	
Supplementary Reading	1. S S Rao, Engineering Optimization: Theory and Practice, Wiley. 2. Jang, Sun and Mizutani, Neuro-Fuzzy and Soft Computing archive.nptel.ac.in/courses/106/105/106105173/	
Course Outcomes	CO1. Formulate optimization problem and evaluate the application of soft computing for solution. CO2. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. CO3. Apply Artificial Neural Network to solve optimization problems. CO4.Apply genetic algorithm to solve optimization problems. CO5.Apply swarm intelligence algorithms to solve optimization problems.	

Subject Code	**HS1201**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Engineering Economics**		

SYLLABUS		**Contact Hours**
Module-I	**Basic Principles of Economics:** Definition, Nature, Scope and significance of economics for Engineers. Demand & Supply and their Determinants,Elasticity-Government policies and application. Basic Macro economics concept: National income accounting (GDP/GNP/NI/Disposable Income etc) and identities for both closed and open economies.	**6 Hrs**

Module-II	**Utility Analysis:** Cardinal and ordinal measurability of utility, Assumptions of cardinal utility analysis, law of diminishing marginal utility, Consumer's equilibrium: Principle of equi-marginal utility; Indifference curve-Concepts, properties, Budget line, Equilibrium of the consumer, Revealed preference hypothesis, Individual choice under Risk and Uncertainty: St. Petersburg paradox and Bernoulli's hypothesis, Neumann-Morgenstern method of constructing utility index, Friedman-Savage hypothesis	**6 Hrs**
Module-III	**Production, Cost and Market Structure:** Production function: short run production function and law of variable proportion; Long run production function: Isoquants, isocost line, returns to scale, Optimum factor combinations, Cost Analysis: Concepts, Classification- Short run and Long run cost curves, Analytical and accounting cost concepts; Market structure: Market classifications, Perfect competition: Characteristics, price and output determination in Short run and long run, Monopoly market: Price and output determination, price discrimination Modern theories of firms: Baumol's theory of sales revenue maximisation, Bain's limit pricing model.	**6 Hrs**
Module-IV	**Money and Banking:** Money-Function of Money, Demand for Money Theory. Quantity theory of money; Banking: Commercial Banks and their Functions, Central bank's Functions. Role of the Banks in Economic Development, Monetary and Fiscal Policy Tools and their impact on the economy.	**6 Hrs**
Module-V	**Capital Budgeting and Investment Analysis:** Time value of money: use of cash flow diagram, Annual economic worth, present worth, future worth, Internal Rate of Return (IRR), Net Present Value (NPV), Payback period method, Analysis of public projects: Cost-Benefit analysis, Cost effectiveness	**6 Hrs**
Essential Reading	1. Koutsoyiannis, A. (1979). Modern Microeconomics. The Macmillan Press Ltd., London 2. Pindyck, R. S., D. N. Rubinfeld and P. L. Meheta (2009). Microeconomics, Pearson India, New Delhi 3. Panneerselvam, R. (2007). Engineering Economics, Prentice-Hall of India, New Delhi 4. Mankiw Gregory N. (2002). Principles of Economics, Thomson Asia	
Course Outcomes	CO1- Utilise economics principles in consumption process CO2- Describe the utility measurement and measure the utility associated with risk CO3- Efficient use of resources in production and take decision regarding optimum output CO4- Describe market mechanism and analyse product market to take proper decisions CO5- Implement economic principles in company related decision making	

	SESSIONAL		
Subject Code	EE1281	**Total Contact Hour**	**16**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Electrical Machines LABORATORY -I**		
	List of Experiments		
1	Open circuit and short circuit on single phase transformer		
2	Parallel operation of two single phase transformer and load sharing		
3	Back –to-back test of Single phase transformer		
4	Load characteristics of DC shunt/compound generator		
5	Load characteristics of DC series Motor		
6	Swinburne test of DC shunt machine		
7	Brake test of DC shunt machine		
8	Three phase connection of transformers		
Course Outcomes	CO1. Perform parallel connection of single phase transformers CO2. Evaluate performance of DC series and shunt motors. CO3. Compute the efficiency of transformer by different experimental tests. CO4. Perform tests to evaluate performance of DC machine and transformers. CO5. Estimate load performance of DC series motor		

	SESSIONAL		
Subject Code	**EE1282**	**Total Contact Hour**	**12**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**NETWORK LABORATORY**		
	List of Experiments		
1	Verification of Superposition and Thevenin's Theorem.		
2	Verification of Maximum Power Transfer Theorem.		
3	Find out the resonance frequency, band width and Q-factor of a series R-L-C circuit.		
4	Transient response of a series R-L, R-C and R-L-C circuit using DC excitation.		
5	Determination of Z, Y, ABCD and h parameters of a two port network.		
6	Spectral Analysis of a non-sinusoidal waveform.		
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Implement the linear circuits by using network theorems. CO2. Describe the resonant circuit by understanding its basic properties and find the resonance frequency, bandwidth, Q-factor and of a R-L-C series circuit. CO3. Describe and evaluate the Transient response of R-L, R-C and R-L-C circuits using DC excitation. CO4. Define ABCD, Z, Y and h parameters of a two port network and know the property of symmetry and reciprocity of network CO5. Define and analyze the importance and reason that lead to a non-sinusoidal waveform..		

	SESSIONAL		
Subject Code	EC1283	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**ANALOG AND DIGITAL ELECTRONIC CIRCUITS LABORATORY**		

2	Determination of the frequency response of High pass filters.		
3	Study of output characteristics of FET.		
4	Analysis of BJT biasing circuits.		
5	RC phase shift oscillator and to observe its output waveform.		
6	Realization of half-adder, full-adder, half-subtractor and full-subtractor.		
7	Design and implementation of multiplexer and demultiplexer.		
8	Realization of S-R and J-K flip flop using 7400.		
9	Design of 3-bit asynchronous counter and Mod-N counter.		
10	Design of SISO, SIPO, PISO, PIPO shift registers.		
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Demonstrate the operation of basic filter circuits, clipper and clamper circuits. CO2. Demonstrate the characteristics of transistors. CO3. Implement different power amplifier circuits. CO4. Design combinational circuits such as adder, subtractor and multiplexers. CO5. Design of sequential circuits such as FFs, counters and shift registers.		
	SESSIONAL		
Subject Code	EE1283	**Total Contact Hour**	**14**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Optimization and Soft Computing LABORATORY**		
	List of Experiments		
1	Solution of single objective optimization problem using MATLAB Optimization Toolbox (lin-prog, quadprog, fmincon).		
2	Solution of single objective optimization using OCTAVE sqp and GAMS solvers.		
3	Implementation of fuzzy tool box to solve optimization problem.		
4	Design of Fuzzy rule base and Fuzzy Inference System to solve an optimization problem.		
5	Implementation of Genetic Algorithms to solve an optimization problem.		
6	Implementation of Artificial Neural Networks to solve optimization problems.		
7	Implementation of Particle Swarm Optimization to solve optimization problems.		
Course Outcomes	Upon completion of the course, the students will be able to: CO1. Demonstrate the use of MATLAB, OCTAVE and GAMS solvers. CO2. Demonstrate the use of fuzzy logic to solve optimization problems. CO3. Demonstrate the use of genetic algorithm to solve optimization problems. CO4. Demonstrate the use of artificial neural networks to solve optimization problems. CO5. Demonstrate the use of swarm optimization algorithms to solve optimization problems		

4TH SEMESTER

Subject Code	EE1204	**Total Contact Hour**	**3**
Semester	**4th**	**Total Credit**	**30**
Subject Name	**Measurement and Instrumentation**		
	SYLLABUS		
Module-I	Measuring Instruments: Classification, Absolute and secondary instruments, indicating instruments, deflecting, control and damping torques, Ammeters and Voltmeters, PMMC, Moving Iron (MI) type, expression for the deflecting torque and control torque, extension of range using shunts and series resistance.		**6 Hrs**
Module-II	Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type KWH meter – Calibration of wattmeter, energy meter. Measurement of active and reactive powers in balanced and unbalanced systems. Galvanometers: General principle and performance equations of D'Arsonval Galvanometers, Vibration Galvanometer and Ballistic Galvanometer.		**6 Hrs**
Module-III	DC/AC Bridges: General equations for bridgebalance, measurement of self-inductance by Maxwell's bridge (with variable inductance & variable capacitance), Hay's bridge, Owen's bridge, measurement of capacitance by Schearing bridge, errors, Wagner's earthing device. Method of measuring low, medium and high resistance: Kelvin's double bridge for measuring low resistance, Wheat-stone's bridge, measurement of high resistance – loss of charge method.		**6 Hrs**
Module-IV	Instrument Transformers: Potential and current transformers, ratio and phase angle errors, phasor diagram, methods of minimizing errors. Potentiometers: DC Potentiometer, Crompton potentiometer, construction, standardization, application. AC Potentiometer, Drysdale polar potentiometer; standardization, application.		**6 Hrs**
Module-V	Digital Multi-meter: Block diagram, principle of operation, Accuracy of measurement, Digital Frequency meter: Block diagram, principle of operation Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor,.		**6 Hrs**
Essential Reading	1. A K. Sawhney, "A Course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai Publications. 2. Helfrick& Cooper, "Modern Electronic Instrumentation and Measurement Techniques",PHI Publshers.		
Supplementary	1. Larry Jones &A Foster Chin, "Electronic Measurement & Instrumentation Systems", John Wiley & Son Publishers. 2.Golding &Waddis, "Electrical Measurement and Measuring Instruments",Reem Publishers.		

Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Implement the principles of basic electrical measuring instruments. CO2. Analyze the performance characteristics of measurable instrumentaions. CO3. Design and analyze the working of different AC and DC bridges CO4. Analyze instrument transformers and potentiometers to measure AC and DC values of unknown voltage. CO5. Evaluate the operation of Digital instruments and transducers.

Subject Code	**EE1205**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**ELECTRICAL MACHINES-II**		
Pre-requisites	**BASIC ELECTRICAL ENGINEERING (BEE 01001),**		
	SYLLABUS		
Module-I	Review of Three phase synchronous generators, Cylindrical rotor theory: armature reaction, armature reaction reactance, synchronous reactance, phasor diagram, open & short circuit characteristics, short-circuit ratio, load characteristics.		**6 Hrs**
Module-II	Voltage regulation: EMF method, MMF method, modified MMF method, ZPF method, Theory of salient pole machine: Blondel's two reaction theory, phasor diagram, direct and quadrature axis synchronous reactances, Slip Test. Power Angle characteristics.		**6 Hrs**
Module-III	Parallel operation: Synchronizing method, load sharing between alternators in parallel. Sudden Short Circuit of a Synchronous Generator, Transient and Sub transient reactances. Synchronous Motors:Operating principle, torque-angle characteristics, V-curves & inverted V-curves, Hunting.		**6 Hrs**
Module-IV	Review of Three Phase Induction Motors, condition for maximum torque, Losses and efficiency. Equivalent circuit, phasor diagram, circle diagram and performance equations. Methods ofstarting (DOL,stator resistance starter, autotransformer starter, star-delta starter, rotor resistance starter). Methods of speed control. Double cage induction motor, Cogging and Crawling of Induction motor.		**6 Hrs**
Module-V	Single phase induction motor: theory of operation (Double Revolving field theory, equivalent circuit, Determination of parameters). Methods of starting: split phasestarting, Repulsion starting, shaded pole starting, performance characteristics. Single phase series motor, theory of operation performance and application. Universal motor.		**6 Hrs**
Essential Reading	1. J. Nagrath, D. P. Kothari, "Electric Machines", TMH Publishers. 2. M. G. Say, "Performance and design of AC machines", CBS Publishers		
Supplementary Reading	1. A. E. Fritzgerald, C. Kingsley, and S. Umans, "Electric Machinery", TMH Publisher. 2. P.S. Bhimra, Electrical Machinery (Part 1, Part 2), Khanna Publishers.		
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Describe cylindrical rotor theory of synchronous machines. CO2. Evaluate voltage regulation and analyze power angle equation. CO3. Analyze and evaluate the performance characteristics of synchronous motors. CO4. Describe and evaluate the performance of three phase induction motors. CO5. Analyze and evaluate the performance of single phase motors and Universal motor.		

Subject Code	CH1206	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Power Electronics**		
	SYLLABUS		**Contact Hours**
Module-I	Power Electronic Devices: Static and Dynamic characteristics of Power Diodes, Power BJTs, Power MOSFETs, Insulated Gate Bipolar Transistors (IGBT), Thyristor Family (SCR, DIAC, TRIAC, GTO, MCT). Thermal viewpoint.2-Transistor Model of Thyristor,Series and Parallel operation of Thyristors. Thyristor Protection from over voltage, overcurrent,dv / dt and di/ dt protection.Cooling and mounting techniques. Safe Operating Area and different current and voltage ratings. Triggering and basics of driver circuits of thyristors, Different types of commutation schemes: Natural and Forced commutation.		**6 Hrs**
Module-II	AC-DC Rectifiers:Uncontrolled rectifiers. 1-Phase Half & Full Wave Controlled Rectifier with various kinds of loads (R, R-L-E (motor)). Midpoint and Bridge type converters. Half Controlled and Fully Controlled Bridge circuits, different waveforms, Input Line Current Harmonics, Power factor, current distortion and displacement factors.Inverter Mode of Operation in Continuous mode. Effect of source inductance assuming constant load currentin single phase converters. Effect of freewheeling diode. Three phase bridge converters for different types of load with constant load current,different waveforms.		**6 Hrs**
	DC-DC converter:Classification of types of choppers, One, Two and Four quadrant operations, Step up and down choppers, concepts of duty ratio and average voltage, power circuit of buck & boost converters in continuous mode of operation, analysis and waveforms		

Module-IV	DC-DC Regulators: Generic Linear Regulator. Different Topologies: Shunt, series, modified shunt, negative voltage regulator, protection.Switch Mode Power Supply:Basic scheme of SMPS and its difference & advantages over linear regulators. Different types of SMPS with single and bidirectional core excitation. Basic steady state operation and analysis of Forward and Flyback converters.	**6 Hrs**
Module-V	DC-AC Converters:Single-phase Half and Full bridge Inverter, Pulse Width Modulated (PWM) technique for voltage control, SPWM Technique 1-phase inverters, Three-phase Voltage Source Bridge type of Inverters. (120 and 180 Degree conduction modes), Current Source Inverter (Single-phase CSI with ideal switches, Single-phase capacitor commutated CSI and Single-phase auto-sequential capacitor commutated CSI). Applications: UPS, Induction Heating, Electronic Ballast, AC/DC drives speed control.	**6 Hrs**
Essential Reading	P. S. Bimbhra, Power Electronics, Khanna Publishers.	
Supplementary Reading	1. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009. 2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007. 3. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India.	
Course Outcomes	Upon completion of the course, the students will be able to: CO1. Describe power switching devices and their drive circuits. CO2. Analyze and evaluate the performance of thyristor rectifiers. CO3. Express and evaluate the performance of AC-AC and DC-DC converters CO4. Analyze and evaluate the performance of DC-DC linear regulators and SMPS. CO5. Analyze and evaluate the performance of single phase and three phase inverters.	

Subject Code	EE1207	**Total Contact Hour**	**35**
Semester	**4th**	**Total Credit**	**3**
Subject Name	Power Generation Transmission and Distribution		
	SYLLABUS		**Contact Hours**
Module-I	Conventional Power Generation: Hydro power potential, components of Hydro power plant, Hydraulic turbines. Block diagram of thermal power plant, relationship between MW capacity and fuel consumption, steam turbines. Nuclear power plant schematic and components. Boiling water reactors, pressurized water reactors, fast breeder reactors. Heavy water reactors.Diesel and Gas Turbine Station.		**7 Hrs**
Module-II	Economics of Power Generation: Load curve, load duration curve. Maximum demand, load factor, diversity factor, plant capacity and use factor. Choice of size and number of generating units, Types of reserves. Life Cycle Cost, Levelized cost of generation. Energy pricing and tariff structures. Power Exchanges.		**7 Hrs**
Module-III	Performance of transmission Lines: Resistance, inductance and capacitance of single and three phase lines with symmetrical and unsymmetrical spacing transposition, charging current, skin effect and proximity effect. Analysis of short, medium and long lines, equivalent circuit, representation of the lines and calculation of transmission parameters,Ferranti effect, reactive power compensation.		**7 Hrs**
Module-IV	Overhead line Insulators: Voltage distribution in suspension type insulators, method of equalizing, voltage distribution, economic use of insulators. Mechanical Design of Overhead Transmission Line, Sag and stress calculation, tension and sag at erection, effect of ice and wind, vibration dampers Under Ground Cable: Type and construction, grading of cables, capacitance in three core cables and dielectric loss,current ratings, types of cables.		**7 Hrs**
Module-V	Distribution Systems: types of distributors and feeders (radial & ring), voltage drop and load calculation for concentrated and distributed loads, Primary and secondary distribution network, Capacitor placement in distribution networks. Distribution system planning, Service area calculation.		**7 Hrs**
Essential Reading	1. B. R. Gupta, Generation of Electrical Energy, S Chand Publishers. 2. J.Nagrathand D.P. Kothari, "Power System Analysis", TMH Publisher. 3. V.K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand and Company Ltd. 4. S.L.Uppal, "Electric Power", Khanna Publisher, 1998.		
Supplementary Reading	1. John J Grainger, W. D. Stevenson, "Power System Analysis", TMHPublisher. 2. C L Wadhwa, "Electrical Power Systems", New Age International Publishers. 3. Ashfaq Hussain,"Electric Power System", CBS Publisher And Distributor. 4. Hadi Saadat, "Power System Analysis", 5th reprint, TMH publishing Company Ltd.		

Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Describe the components and working of conventional power plants. CO2. Apply knowledge on power generation planning and economics. CO3. Compute the transmission line parameters and evaluate performance. CO4. Perform mechanical design and evaluate line insulators and underground cables. CO5. Evaluate performance of primary and secondary distribution systems.		
Subject Code	**CS1204**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Programming in Python**		
Course Objective	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling		
SYLLABUS			
Module-I	**Beginning Python Basics:** Introduction to Python Features of Python, Application of Python Data Types, Keywords, Identifiers, Literals, Constants. Python Indentation. Operators and expressions. Naming Conventions with examples, Managing Input and Output, Concept of Indentation. Conditional statement, Looping statements, break and continue, pass & return statements, Nesting of loops.		**6 Hrs**
Module-II	**Modules:** Built-in Modules, Import statement, Packages, Date and Time Modules. Array and its operations, Handling Strings and Characters, List: slicing, bound, cloning, nested list, list and methods, Adding Element: append, extend, count, index and insert). Mutability: Sort, reverse, remove, clear and pop. Map, Filter.		**8 Hrs**
Module-III	Tuple and methods, Sets and methods, Dictionary: Basic operation, iterator and methods. **Function:** Introduction to Functions, passing arguments, Anonymous functions (Lambda Function), Recursive Functions.		**6 Hrs**
Module-IV	**Object Oriented Programming:** Classes and Objects, Class methods. Encapsulation, Data Abstraction, Constructor, Destructor and Inheritance. **Exception Handling:** Handling Exceptions: try-except, try-finally		**6 Hrs**
Module-V	**Strings and Regular Expressions :** Methods of String Objects, Escape Sequence, Iterating Strings, String Module, String Formatting, Regular Expressions: Re-Module. **File Handling:** Introduction to File Handling, File Operations, Directories.		**4 Hrs**
Essential Reading	1. Python Programming for Beginners by Adam Stewart 2. Python Cookbook by David Beazley and Brian K. Jones		
Supplementary Reading	1. Introduction to Python Programming By Gowrishankar S. Veena A 2.Python Programming: Using Problem Solving Approach, Oxford University Press by Reema Thareja 3.Python Programming University Press by Ch Satyanarayan, M Radhika, B N Jagadesh		
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.		
Subject Code	**HS1202**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Organizational Behaviour**		
Course Objective	1: To understand the relevance of organizational behavior concepts and theories in real-life organizational settings & to develop skills in critical thinking, decision –making, problem-solving in applying organizational behavior concepts to practical situations. 2: To provide an understanding of individual behavior in the workplace, including personality, motivation, perception, learning, and attitudes. 3: To understand the impact of team composition, diversity, and communication on team performance & to understand the role of motivation and leadership in managing organization. 4: To explore how organisational culture affects behavior, communication and decision making by enhancing creativity and innovation and give an episteme how to cope with change and stress. 5: To Develop intercultural competence, including awareness, knowledge, and skills for effective communication, negotiation, and collaboration across culture		
SYLLABUS			
Module-I	**Fundamentals of OB & Understanding the Basic Framework of OB:** Evolution of OB through Quality Management movement, Definitions, Scope & Importance of OB,Challenges (Diversity, Globalisation& Ethical Perspective) and opportunities for OB, models of OB, applying OB to solving problems.		**6 Hrs**
Module-II	**Understanding the Determinants of Individual Behavior: Personality:** Determinants of personality, Theories of Personality (Type &Psychoanalytic theory), MBTI, Big five personality traits and other major traits influence workplace behavior. **Perception:** Meaning, Perceptual Process, Application of Perception at Workplace. **Motivation:** Motivation Framework, Content theory (Maslow's need hierarchy & Hertzberg's two factors theory), Process theory (Adam's Equity & Vroom's Expectancy theory), Job Design And motivation, Importance of motivation at Workplace. **Learning:** Theories of learning (Classical Conditioning, Operant Conditioning,& Cognitive Theory), Principles of Learning. Bhavioral modification through learning.		**6 Hrs**
Module-III	**Understanding Group and Team Behavior at Workplace: Group & Team:** Defining and classifying groups, the five-stage model of group development Group properties: Roles, norms, status, size and cohesiveness, Group decision making. **Leadership:** Meaning, Definition & types of leadership, Traditional theories of leadership, Trait theories, Behavioral theories, Contingency theories, Contemporary		**6 Hrs**

Module-IV	**Understanding Group and Team Behavior at Workplace:** **Organisational Culture:** Meaning, Definition, Cultural dimensions,effect of Organisational culture **Organisational Change & Development:** Nature, Levels & types of Change, Change Agents: Resistance to Change, Force field theory of Change, Managing the Change.	**6 Hrs**
Module-V	**Conflict & International Organisational Behavior:** **Managing Conflict and Negotiations:** Meaning,views, & levels of Conflict, Process of conflict, Conflict resolution techniques. **Transactional Analysis:** Meaning, Importance of TA, Life position, Ego states And their encounters. **IOB:** Internationalisation of Business, Cultural differences and similarities, Understanding Interpersonal behavior across culture through Hofstede's Cultural Dimensions	**6 Hrs**
Essential Reading	1. "Organizational Behavior: Text, Cases, & Games" by K. Aswathappa .Publisher: Himalaya Publishing House 2. "Essentials of Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge. Publisher: Pearson Education.	
Supplementary Reading	1. "Organizational Behavior: Improving Performance and Commitment in the Workplace" by Jason A. Colquitt, Jeffery A. LePine, and Michael J. Wesson. Publisher: McGraw-Hill Education. 2. "Organizational Behavior: Human Behavior at Work" by John W. Newstrom and Keith Davis. Publisher: McGraw-Hill Education. 3. "Organizational Behavior: An Evidence-Based Approach" by Fred Luthans. Publisher: McGraw-Hill Education. 4. "Organizational Behavior: Emerging Knowledge, Global Reality" by Steven L. McShane and Mary Ann Von Glinow. Publisher: McGraw-Hill Education. 5. "Organizational Behavior and Management" by Ivancevich, Konopaske, and Matteson. Publisher: McGraw-Hill Education. 6. "Organizational Behavior: Theory, Research, and Practice" by John R. Schermerhorn Jr., James G. Hunt, and Richard N. Osborn. Publisher: Wiley	
Course Outcomes	CO1. Explain the importance of organizational behavior in improving individual and organizational effectiveness with Ethical practices. CO2. Evaluate the effectiveness of different leadership styles and their application in different situations. CO3.Develop critical thinking, Creativity& Innovation, problem-solving, and communication skills necessary for success in organisational settings. CO4. Develop strategies for managing organisational change effectively and maintainingsustainability. CO5. Apply organistional behavior concepts and theories to practical organisational situations.	

	SESSIONAL		
Subject Code	**CH1284**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Electrical Machines LABORATORY-II**		
Pre-requisites			
	List of Experiments		
1	Voltage regulation of alternator by EMF method		
2	Voltage regulation of 3 phase alternator by ZPF method		
3	Synchronization of alternator with infinite bus		
4	Determination of power angle characteristics of an Alternator		
5	V curve and inverted V curve of a 3-Ph synchronous motor		
6	No load and Blocked rotor test of three phase Induction motor		
7	Load test of 3-Ph Induction Motor		
8	Speed control of a 3 phase induction motor		
9	Determination of Parameters of single phase induction motor		
10	Determination of Parameters of 3 phase three winding transformer and trace the waveform of Magnetizing Current & Induced e.m.f		
Course Outcomes	Upon completion of the subject the students will demonstrate the ability to: CO1. Perform various tests on synchronous machines and to determine their characteristics. CO2. Synchronize a given alternator to infinite bus. CO4. Determine parameters of three phase and single phase induction motors. CO4. Describe different losses of single phase transformer CO5. Determine characteristics, parameters and connections of three phase transformers		
	SESSIONAL		
Subject Code	**EE1285**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**POWER ELECTRONICS LABORATORY**		
Pre-requisites	None		
	List of Experiments		
1	Familiarization with power electronics components. (SCR, IGBT, MOSFET, GTO, BJT) & Draw the V-I Characteristics of BJT, MOSFET, SCR.		
2	Study of Single phase Full and Half wave converters with R and R-L-E(Motor) loads with and without freewheeling action		
3	Study of Three Phase Full and Half wave uncontrolled converters with R and R-L loads		
4	Study of Three Phase Full and Half wave controlled converters with R and R-L loads		
5	To study different triggering circuits for thyristors (Cosine Law & UJT Triggering)		
6	To study single phase AC regulator using Triac (R & R-L Loads)		
7	To study the single phase cycloconverter with R and R-L Loads		
8	To study IGBT based PWM Inverter.		
9	To study the speed control of DC motor using single-phase full wave converter.		
10	To study the operation single quadrant step-down chopper circuit.		
Course Outcomes	Upon completion of the course, the students will be able to: CO1. Demonstrate power electronics components and their V-I Characteristics. CO2. Produce waveforms across the loads and switches. CO3.Implement triggering circuits for power electronic devices. CO4. Demonstrate operation of AC-DC and AC-AC converters.		

Subject Code	**CS1284**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Programming in Python Laboratory**		
Course Objectives	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling		
	List of Experiments		
1	Program on basics of python Programming Language.		
2	Program on basic Data Structures in Python.		
3	Program on Conversion from on data type to another.		
4	Program on Functions in Python.		
5	Program using Object Oriented Programming in Python.		
6	Program using Inheritance in Python.		
7	Program using String in Python.		
8	Program using Regular expression in Python.		
9	Program using File Handling in Python.		
10	Program using basics of Pandas and Matplotlib module in Python.		
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.		