SEMESTER IV

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				No. of Hrs. for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total	
1.	PCC	**24EE401T**	Elements of Electromagnetics	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
2.	PCC	**24EE402T**	Electrical Power System	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
3.	PCC	**24EE404T**	Electrical Machines - II	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
4.	PCC	**24EE404P**	Electrical Machines - II Lab	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**50**	**-**
5.	PCC	**24EE403P**	Technical Skill Development - I	**-**	**-**	**4**	**2**	**-**	**50**	**-**	**50**	**-**
6.	AEC	**24EE406T**	Value Education Course	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
7.	VSC	**24EE441P**	Career Development - IV	**-**	**-**	**2**	**1**	**-**	**50**	**-**	**50**	**-**
8.	SEC	**24EE405P**	Micro Project - II*	**-**	**-**	**2**	**1**	**-**	**50**	**-**	**50**	**-**
9.	MDM	**24EE431M**	Multidisciplinary Minor - II	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
			Total	**15**	**-**	**10**	**20**	**100**	**275**	**325**	**700**	

*** Field Project or Community engagement project in the major discipline**

Multidisciplinary Minor - II	
24EE431M	MDM – II Power Electronics

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FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24EE401T	Elements of Electromagnetics	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
1. To introduce to students the theory of Electromagnetic fields and vector algebra. 2. To prepare students to know the characteristics of different types of field sources and effects. 3. To develop students with an understanding of the properties of dielectrics, conductors and magnetic material 4. To prepare students develop understanding of Steady magnetic fields and Maxwell's equation for time variant fields.	Students will be able to: 1. Define vectors and 3 dimensional coordinate systems, convert from one form to another and apply matrix algebra. Practice computations with various forms of field sources like point, line and surfaces. 2. Evaluate Energy and potential related to steady electric fields. 3. Derive the boundary conditions and formulate the properties of conductors and dielectrics. 4. Evaluate the magnetic field properties under various operating conditions. 5. Derive time varying form of fields equations. Make comparison between non time varying fields and time varying fields.

Unit I	**[9Hrs]**
Vector analysis: Idea of vector & scalars, Vector Algebra, vector addition, vector subtraction, dot product, scalar product in Cartesian coordinates system, Cylindrical coordinates system, conversion of variables from Cartesian to cylindrical system and vice versa. Spherical coordinate system, transformation of Cartesian to spherical and vice versa. **Coulomb's law**, **Electrical field intensity and electric, flux density**: Coulomb's law, electric field intensity, field of point charges, line charges and surface charges, field due to continuous volume charge distribution, field of line charge, filed of sheet charges, concept of flux density.	
Unit II	**[9Hrs]**
Gauss's law, Energy and potential of charge system: Gauss's law, application of gauss law, Divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient.	
Unit III	**[9Hrs]**
Conductors, Dielectric and Capacitance: Poisson's and Laplace's Equations, Uniqueness theorem, Continuity equation, conductor properties, Properties of Dielectric materials, Capacitance of parallel plate capacitor.	
Unit IV	**[9Hrs]**
The steady Magnetic Field and Magnetic forces: Biot-Savart's law, Ampere's Circuital law, Stokes theorem, Magnetic flux density. Properties of magnetics materials, permeability.	
Unit V	**[9Hrs]**
Maxwell's equations in time varying form, Derivation, Elementary idea of Electromagnetic waves, Uniform plane wave.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Engineering Electromagnetics	W. Hayt	7th edition	Tata Macgraw-hill
2	Principles of Electromagnetics	Mathew N. O. Sadiku	4th edition	Oxford university press
3	Schaum's Outline Series: Theory and problems in Electromagnetics	Joseph Edminister	2nd edition	Tata Macgraw-hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Applied Electromagnetics	Plonus		Tata Macgraw-hill
2	Electromagnetics	Kraus		Tata Macgraw-hill
3	Fundamentals of Electromagnetics with MATLAB	Karl E. Lonngren, Sava V. Savov, Randy J. Jost		PHI learning

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FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24EE402T	Electrical Power System	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
Students will develop the ability to: 1. model & represent the power system components. 2. represent & calculate the transmission line parameters. 3. explain the concepts of load flow analysis.	**Students will be able to:** 1. Explain the generation, transmission, and distribution of power & represent power system in per unit. 2. Calculate transmission line parameters of a power system. 3. Classify various distribution schemes, LT & HT cables. 4. Evaluate performance of transmission lines by interpretation of equations and analytical solutions in system design. 5. Describe basic concepts of load flow analysis & Insulators.

Unit I	**[9 Hrs]**
Structure of electrical power systems: - Brief exposure of generation, transmission & distribution aspects; Elementary consideration of economic bulk power supply system; Use of high voltage; General system consideration, Concept of real, reactive, and complex power; Power Transfer in AC circuits and Reactive Power. Load and their characteristic; Voltage & Frequency dependence of loads; Per Unit (PU) system representation.	
Unit II	**[9 Hrs]**
Representation of power system components, Inductance & Capacitance of transmission lines.	
Unit III	**[9 Hrs]**
Elementary distribution schemes & Cables: - Feeders and Distributors; LT & HT cables.	
Unit IV	**[9 Hrs]**
Performance of transmission lines: - Voltage regulation & efficiency of power transmission line using simple series equivalent representation, T- representation, pi- representation.	
Unit V	**[9 Hrs]**
Load flow studies & Insulators: - Introduction to load flow studies, Classification of buses, Formation of bus admittance matrix, Static load flow equations; Concept of insulator, types of insulators, String efficiency.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Elements of Power System	Gaurav Gadge	1	Electro-Tech Publication, Satara
2	Power System Analysis	C. L. Wadhawa	6	New Age International
3	Power System Analysis	Ashfaq Hussain	5	CBS

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Elements of Power System Analysis	W. D. Stevenson	4	Mc-Graw Hill
2	Electric Energy System Theory	O. E. Elgerd	2	Mc-Graw Hill
3	Modern Power System Analysis	Nagrath & Kothari	3	Tata Mc-Graw Hill

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ELECTRICAL ENGINEERING

FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24EE404T	Electrical Machines - II	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended 1. To acquire practical knowledge of construction, working and operation of Induction Motors, Synchronous Machines and Special Motors 2. To develop foundation of electrical machines for understanding the behavior of Power system.	**Students will be able to** 1. Describe the concepts of starting, speed control and braking of three-phase induction motor and analyse the Torque-speed characteristics 2. Discuss the construction, operation and characteristics of single-phase ac motors 3. Explain basic concept, construction, working of the synchronous generator 4. Analyse concept, construction, working of the synchronous motor and its performance evaluation. 5. Evaluate the basic operation and performance of special machines and select special machines for different applications.

Unit I Starting, Speed Control and Braking of Three Phase Induction Motor **[9 Hrs]**

Starting methods of 3-phase Induction Motor: Direct On-line (DOL) starting, Auto-transformer starting, Star Delta starting.
Speed control Methods: By change in input voltage, input frequency, V/F method, rotor resistance control and consequent pole changing technique. Braking methods: Plugging, Regenerative braking, DC and AC braking

Unit II Single Phase AC Motors **[9 Hrs]**

Single Phase induction motor, Double revolving field theory and development of equivalent circuit, torque slip characteristics. Methods of starting using auxiliary winding, capacitor start-run type, capacitor start induction run type, applications.
Introduction to universal motor and shaded pole motor: constructional features and performance characteristics, application.

Unit III Three Phase Synchronous Generator **[9 Hrs]**

Construction of cylindrical and salient pole synchronous machines, induced EMF, operation as a generator, voltage equation, phasor diagrams, calculation of voltage regulation by synchronous impedance method, calculation of efficiency, Condition for parallel operation, synchronization with infinite bus. short circuit ratio, effects of variable excitation and power input on generator operation. damper windings, power angle curve.

Unit IV Three Phase Synchronous Motor **[9 Hrs]**

Principle of operation, Starting of Synchronous Motor, Phasor diagram, Torque equation, load / torque angle, effect on variable excitation and load on motor operation, V and inverted V curves, Power input and power developed equations, voltage regulation.

Unit V Introduction to Special Motors **[9 Hrs]**

Construction, operation and application of Permanent magnet synchronous motor, brushless DC motor. hysteresis motor, reluctance motor, stepper motor.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Electrical Machinery	Dr. P.K. Mukherjee & S. Chakraborty	2	Dhanpat Rai publication
2	Electrical Machinery	Dr. P.S. Bimbhra	3	Khanna publisher
3	Electrical Machines	I.S. Nagrath & Dr. D.P. Kothari	2	McGraw Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Electrical. Machinery	Fitzogerald and Kingsley and Kusco	2	McGraw Hill
2	Performance & Design of A.C. Machine	M.G. Say	1	CBS publishers
3	Alternating current machines	A. S. Langsdorfi	2	Tata Mcgraw-Hill education

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24EE404P	Electrical Machines – II Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To study performance of 3-phase Induction motor. 2. To study performance of Alternator. 3. To study performance of Synchronous motor.	**Students will be able to** 1. To identify the tests performed 3-phase induction motor 2. To illustrate the tests performed 3-phase alternator 3. To analyze the process of synchronization in alternator 4. To discuss characteristics of Synchronous motor 5. To identify and differentiate various special machines

Expt. No. (Any 08)	Title of the experiment (Any 08)
1	Speed Control Of Induction Motor (Slip Ring) By Rotor Resistance Control
2	**D**etermination Of Regulation Of Three Phase Alternator By Direct Loading .
3	Determination Of Regulation Of Three Phase Alternator By Open Circuit And Short Circuit Test.
4	To Study Synchronization Of Alternator With Infinite Bus.
5	To Determine Xd And Xq Of A Salient Pole Synchronous Machine By Slip Test.
6	Determination Of Negative And Zero Sequence Reactance Of Synchronous Generator
7	To Determine Xd" And Xq" Of A Salient Pole Synchronous Machine.
8	To plot V and inverted V characteristics of Synchronous motor.
9	To study performance of BLDC motor.
10	To study speed control of Schrage motor.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Laboratory Courses in Electrical Engineering	R.L. Kharbanda and S. G. Tarnekar		
2	Laboratory manual of Electrical Machines	D.P.Kothari and B.S. Umre		
3	Electrical Technology Volume II	B. L. Thareja		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Electrical Machinery	Dr. P.K. Mukherjee & S. Chakraborty		Danpat Rai publication
2	Electrical Machinery	Dr. P.S. Bimbhra		Khanna publisher
3	Electrical Machines	I.S. Nagrath & Dr. D.P. Kothari		McGraw Hill

FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24EE403P	Technical Skill Development - I	-	-	4	2	50	-	50

Course Objectives	Course Outcomes
1. To analyze electrical circuits in software like MATLAB 2. To evaluate the performance of electrical circuits using various network theorems.	1. To simulate and analyze performance of electrical circuits in MATLAB software 2. To model, simulate and develop electrical networks in MATLAB software 3. To write programs in MATLAB using conditional statements and to plot waveforms

Expt. No.	Title of the experiment [Any 8 to be performed]
1	To verify Superposition Theorem using simulation in MATLAB Software
2	To analyze series R-L-C network in MATLAB Software
3	To verify Norton's Theorem using simulation in MATLAB Software
4	To verify Thevenin's Theorem using simulation in MATLAB Software
5	To verify Reciprocity Theorem using simulation in MATLAB Software
6	To verify Maximum Power Transfer Theorem using simulation in MATLAB Software
7	Write a program in MATLAB to find largest of three integer numbers entered by the user
8	Write a program in MATLAB to plot sine and cosine waveform
9	Write a program in MATLAB to find factorial of a number using for loop
10	Write a program in MATLAB to draw a unit circle

Text Books

S.N	Title	Authors	Edition	Publisher
1	Basic Electrical Engineering	V.K.Mehta	II	S.Chand
2	Getting started with MATLAB	Rudra Pratap	III	Oxford

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Electrical Technology	B.L.Theraja	II	S.Chand

FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24EE406T	Value Education Course	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
Development of a holistic perspective through self-exploration and development of clarity about harmony between self, family, society and nature.	**At the end of the course, students will be able to:** 1. Demonstrate awareness about self and their surroundings and its interdependence. 2. Apply the concepts of aspirations and happiness. 3. Recognize and explain the nine universal values in relationship and their application in visualizing a harmonious society. 4. Discuss concepts of conservation of nature and harmony and reusability. 5. Identify the scope of eco-friendly systems for enriching institutions.

Unit I : Introduction **[9Hrs]**

Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations , Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority , Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario , Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II : Understanding Harmony **[9Hrs]**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body' , Understanding the needs of Self ('I') and 'Body' - happiness and physical facility , Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) ,Understanding the characteristics and activities of 'I' and harmony in 'I' , Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail , Programs to ensure Sanyam and Health.

Unit III : Values in relationships **[9Hrs]**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship , Understanding the meaning of Trust; Difference between intention and competence , Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship , Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals , Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit IV : Co-existing with nature **[9Hrs]**

Understanding the harmony in Nature , Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature , Understanding Existence as Coexistence of mutually interacting units in all-pervasive space ,Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit V : Holistics approach for engineers **[9Hrs]**

Natural acceptance of human values , Definitiveness of Ethical Human Conduct , Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order , Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. , Case studies of typical holistic technologies, management models and production systems , Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations ,Sum up

Text Books

S.N	Title	Authors	Edition	Publisher
1	Human Values and Professional Ethics	Gaur, Sangal, Bagaria	2010	Excel Books, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Jeevan Vidya: Ek Parichaya	A. Nagaraj	1999	Jeevan Vidya Prakashan, Amarkantak
2.	Human Values	A.N. Tripathi	2004	New Age Intl. Publishers, New Delhi
3.	The Story of My Experiments with Truth	M.K.Gandhi	2009	Fingerprint! Publishers

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FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24EE441P	Career Development – IV	-	-	2	01	50	-	50

Course Objectives	Course Outcomes
The sole objective of imparting aptitude training is to make students able to critically evaluate various real-life situations by resorting to an analysis of key issues and factors. This Aptitude Training helps them to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions. To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.	1. Students shall understand the concepts of Quadratic Equation, AP, GP, and HP. 2. Students shall understand the concepts of Averages and Mixture and allegations 3. Students shall understand the concepts of Blood relation. 4. Students shall understand the concept of Dice and Cubes 5. Students shall understand the concepts of clocks and Calendars.

Unit I	**[6Hrs]**
Aptitude : Quadratic Equation Arithmetic progression, Geometric progression, Harmonic progression Imax: Critical Thinking, Interview Simulation, Engineering Leadership, Spatial Reasoning	
Unit II	**[6Hrs]**
Aptitude : Average Mixture and Allegation Imax: Interactive Interview Training, Start-Up & Entrepreneurship,	
Unit III	**[6Hrs]**
Aptitude : Blood Relation :- Family Tree, Coding Blood Relation, Pointing to a Person Problem Imax: Engineering Ethics, Employability, Engineering Judgment	
Unit IV	**[6Hrs]**
Aptitude : Cubes and Dice Problems:- Number of cuts to be made, Number of colorful Faces of Cubes, Hidden Dice Number Imax: Disposition for Innovation, Disposition for Start up	
Unit V	**[6Hrs]**
Aptitude : Clocks :- Angle made by Hour hand, Minutes hand, Mirror and water Image of Clock, Behind and Ahead time concept Calendars :- Day on Specific date, Coded Calendars Problems, Calendars repetition Imax: Creating A Winning Resume, Patriotism Self - respect & Start - up	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24EE405P	Micro Project - II	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
This course is intended • To enable the Students to undertake short research projects and fabricate it.	**Students will be able to** • Explain fabrication work of project set up / devices or developed software.

S.N.	Project
1	**Projects are based on :** Field Project or Community engagement project in the major discipline

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FOURTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24EE431M	MDM – II Power Electronics	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended to 1. introduce students, the basic theory of power semiconductor devices and their practical application in power electronics 2. familiarize the operation principle of AC-DC, AC-AC, DC- DC, DC-AC conversion circuits and their applications 3. provide the basis for further study of power electronics circuits and systems.	A student who successfully fulfil the course requirements will be able to 1. explain basic operation of SCR and basic principle of switching circuits 2. describe basic operation of various power semiconductor devices, along with their applications in electrical circuits. 3. analyze basic operation and characteristics of various power semiconductor devices 4. explain the concepts of AC to DC and AC to AC circuit 5. describe the concepts of DC to AC and DC to DC circuit

Unit I	**[10Hrs]**
SCR: V-I characteristics, Turn on & Turn off characteristics, Gate characteristics, Ratings, Over voltage and Over current protection, Snubber circuit. Introduction and classification of Commutation techniques of SCR.	
Unit II	**[10Hrs]**
Static controllable switches I : Characteristics & working of UJT, TRIAC, DIAC, Phase control using TRIAC and DIAC, UJT as relaxation oscillator.	
Unit III	**[08Hrs]**
Static controllable switches II: Characteristics & working of MOSFET, Gate turn off thyristor and Insulated gate bipolar transistor. Introduction to advanced Power Devices.	
Unit IV	**[09Hrs]**
Phase Controlled Rectifiers (AC-DC Converters): Single phase half Wave controlled, full wave controlled rectifiers with R and RL load, Bridge Configurations with R and R-L load, Effect of Freewheeling diode. **AC-AC Converters** • Basic Principle, Operation, Single phase AC voltage controller for R and R-L loads.	
Unit V	**[08Hrs]**
DC-DC Converters (Choppers) Working principle of chopper, Control Strategies of chopper, Types of chopper: Step-Up & Step-Down chopper for RL Load, Introduction to Class-A, Class-B, Class-C, Class-D and Class-E chopper. **DC-AC Converters (Inverter)** Classification of inverter, Working principle of single phase Half bridge and Single Phase Full bridge inverter for R and R-L load.	

Text Books

S. N.	Title	Authors	Edition	Publisher
1	Power Electronics Circuits Devices and Applications	M. H. Rashid	Third	Pearson
2	Power Electronics	M. D. Singh & K. B. Khanchandani	Second	Tata McGraw Hill
3	Power Electronics	P. C. Sen.	Second	Tata McGraw Hill

Reference Books

S. N.	Title	Authors	Edition	Publisher
1	Power Electronics: Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, William P. Robbins	Third	John Wiley & Sons

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