## THIRD SEMESTER

| Sl. No | Course Code | Course Title | Category | CA Marks | End Sem Marks | Total Marks | Hours/Week | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | L | T | P | C |
| **THEORY** | | | | | | | | | | |
| 1 | 22EES307 | Data Structures (Common to EEE, ECE & CSE) | ES | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 2 | 22EPC301 | Electric Circuit Theory | PC | 40 | 60 | 100 | 3 | 1 | 0 | 4 |
| 3 | 22EPC302 | Field Theory | PC | 40 | 60 | 100 | 3 | 1 | 0 | 4 |
| 4 | 22EPC303 | Electronic Devices and Circuits | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 5 | 22EPC304 | Electrical Machines-I | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 6 | 22EPC305 | Digital Circuits | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | | |
| 7 | 22EPC306 | Electric Circuits and Electronic Devices Laboratory | PC | 60 | 40 | 100 | 0 | 0 | 3 | 1.5 |
| 8 | 22EPC307 | Electrical Machines Laboratory – I | PC | 60 | 40 | 100 | 0 | 0 | 3 | 1.5 |
| **TOTAL** | | | | **360** | **440** | **800** | **18** | **2** | **6** | **23** |

## FOURTH SEMESTER

| Sl. No | Course Code | Course Title | Category | CA Marks | End Sem Marks | Total Marks | Hours/Week | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | L | T | P | C |
| **THEORY** | | | | | | | | | | |
| 1 | 22EBS407 | Fourier Series and Transform Calculus (Common to EEE & EIE Branches) | BS | 40 | 60 | 100 | 3 | 1 | 0 | 4 |
| 2 | 22EPC408 | Linear Integrated Circuits | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 3 | 22EPC409 | Electrical Machines-II | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 4 | 22EPC410 | Power Generation, Transmissionand Distribution | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| 5 | 22EPC411 | Principles of Signals and Systems | PC | 40 | 60 | 100 | 3 | 0 | 0 | 3 |
| **THEORY WITH PRACTICAL COMPONENT** | | | | | | | | | | |
| 6 | 22EPC412 | Electrical and Electronic Measurements | PC | 50 | 50 | 100 | 3 | 0 | 2 | 4 |
| **PRACTICAL** | | | | | | | | | | |
| 7 | 22EES408 | Engineering Exploration | ES | 60 | 40 | 100 | 0 | 0 | 3 | 1.5 |
| 8 | 22EPC413 | Analog Circuits and Digital IC Laboratory | PC | 60 | 40 | 100 | 0 | 0 | 3 | 1.5 |
| 9 | 22EPC414 | Electrical Machines Laboratory –II | PC | 60 | 40 | 100 | 0 | 0 | 3 | 1.5 |
| **TOTAL** | | | | **430** | **470** | **900** | **18** | **1** | **11** | **24.5** |

| 22EES307 | DATA STRUCTURES<br>(Common to EEE, ECE & CSE Branches) | III SEMESTER |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| Programming In C | PC | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| **Course Objectives** | The objective of the course is to enable the students to analyze the time complexity of an algorithm, Understand and Use List, Stack, Queue, Tree and graph Data structures and effectively use sorting and searching Techniques. | |
| **UNIT – I** | **INTRODUCTION AND ABSTRACT DATA TYPES** | **(9 Periods)** |
| Algorithm Analysis: Calculation of Running Time – Abstract Data Type- List ADT: Array implementation of List, Linked Lists, Doubly Linked List, Circularly Linked Lists- Cursor implementation of Linked List | | |
| **UNIT – II** | **STACK AND QUEUE ADT** | **(9 Periods)** |
| Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls – Queue ADT: Queue Model, Implementation of Queues, Applications. | | |
| **UNIT – III** | **TREE ADT** | **(9 Periods)** |
| Preliminaries – Implementation of Trees – Tree Traversals – Binary Tree: Implementation, Expression Tree – Search Tree ADT – AVL Trees - BTrees – Red Black Trees. | | |
| **UNIT – IV** | **GRAPH ALGORITHMS** | **(9 Periods)** |
| Definitions – Representation of Graphs – Traversal- Topological sort – Shortest Path Algorithms: Dijkstra's Algorithm – Network Flow Problem – Minimum Spanning Tree: Prim's and Kruskal's algorithm. | | |
| **UNIT – V** | **SORTING AND SEARCHING** | **(9 Periods)** |
| Sorting: Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – Bucket Sort – External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge – Searching : Linear Search – Binary Search – Hashing : Hash Functions– Collision Resolution: Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| *1* | *Mark Allen Weiss **"Data Structures and Algorithm Analysis in C"** Second Edition, Pearson Education Limited, 2002.* |

**REFERENCES:**

| | |
|---|---|
| *1* | *Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, **"Introduction to Algorithms",** Third Edition, PHI learning Pvt. Ltd., 2011.* |
| *2* | *Sartaj Sahni, "**Data Structures, Algorithms and applications in C++",** Second Edition, Universities Press, 2005.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| **CO1** | Analyze the time complexity of various algorithms | K4 |
| **CO2** | Define and use list, stack and queue Data Structures | K3 |
| **CO3** | Define and use Tree Data Structure | K3 |
| **CO4** | Define and use Graph Data Structure | K4 |
| **CO5** | Use appropriate sorting and searching Techniques | K4 |

**COURSE ARTICULATION MATRIX:**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cos/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CO1** | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| **CO2** | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 1 | 2 | 1 | 1 |
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 1 | 2 | 1 | 1 |
| **CO4** | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 1 | 2 | 1 | 1 |
| **CO5** | 2 | 2 | 1 | 1 | - | - | - | - | - | | - | 1 | 2 | 2 | 2 |
| **22EES 307** | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | 1 | 2 | 1 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **b) CO and Key Performance Indicators Mapping** | | | | | | | | | | | | | | | |
| CO1 | 1.1.1,1.3.1,1.4.1,2.1.2,2.2.2,2.3.1,2.4.1,3.1.6,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,4.2.2,4.3.1,12.2.2. | | | | | | | | | | | | | | |
| CO2 | 1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2 | | | | | | | | | | | | | | |
| CO3 | 1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2 | | | | | | | | | | | | | | |
| CO4 | 1.3.1,1.4.1,2.1.1,2.1.2,2.2.2,2.2.3,2.4.2,2.4.4,3.1.1.,3.1.3,3.1.6,3.2.3,3.3.1,3.4.1,4.1.2,4.1.3,4.2.2, 4.3.4,5.1.2,5.2.2,5.3.2,6.1.1,7.2.2,10.2.2,11.3.1,12.1.1,12.2.2,12.3.2 | | | | | | | | | | | | | | |
| CO5 | 1.3.1,1.4.1,2.1.2.2.1,2.2.3,2.3.1,2.4.4,3.1.3,3.1.6, 3 .2.3, 3.3.2, 4.1.2, 4.2.1,4.3.1,6.1.1, 10.3.1,11.2.1, 12.1.1,12.2.2,12.3.2 | | | | | | | | | | | | | | |

| **ASSESSMENT PATTERN – THEORY** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| **CAT1** | - | 20 | 30 | 50 | - | - | 100 |
| **CAT2** | - | 10 | 80 | 10 | - | - | 100 |
| **Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1** | - | - | 80 | 20 | - | - | 100 |
| **Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2** | - | - | 80 | 20 | - | - | 100 |
| **ESE** | - | 30 | 50 | 20 | - | - | 100 |

| 22EPC301 | ELECTRIC CIRCUIT THEORY | III SEMESTER |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 1 | 0 | 4 |

| | | |
|---|---|---|
| **Course Objectives** | To gain knowledge in basic concepts of circuit theory and finally be able to analyze and synthesize electric circuits | |
| **UNIT – I** | **DC AND AC CIRCUIT ANALYSIS** | **(12 Periods)** |
| Ohm's law and Kirchhoff's Laws – Waveform representation – Form Factor and Peak Factor derivation for alternating waveforms - R, L, C series-parallel circuits - Star-delta transformation - Source transformations - Mesh and nodal methods – Phase relation in R, L and C - Power factor - Real, reactive and apparent powers – Problems in AC and DC circuits. | | |
| **UNIT – II** | **NETWORK THEOREMS AND POLYPHASE CIRCUITS** | **(12 Periods)** |
| Superposition theorem – Thevenin's and Norton's theorems - Maximum power transfer theorem - Reciprocity theorem. Three phase system – Interconnection of three- phase sources and loads - Balanced and unbalanced circuits - Power measurement | | |
| **UNIT – III** | **RESONANCE, COUPLED CIRCUITS AND TRANSIENTS** | **(12 Periods)** |
| Resonance in series and parallel circuits – frequency response - derivation of bandwidth - Introduction to coupled circuits – Mutual inductance – Coefficient of coupling - Dot rule - Single and double tuned circuits - Problems. Transient response – DC response of RL, RC, R L C circuits – Sinusoidal response of RL, RC, RLC circuits. | | |
| **UNIT – IV** | **TWO PORT NETWORKS** | **(12 Periods)** |
| Two port networks - Open circuit impedance and short circuit admittance parameters – Transmission and inverse transmission parameters – Hybrid and inverse hybrid parameters- Image parameters - Applications. | | |
| **UNIT – V** | **FILTERS DESIGN AND SYNTHESIS OF CIRCUITS** | **(12 Periods)** |
| Classification of filters - Low pass and high pass filters - Band pass and Band stop filters- Constant K and m-derived filters. Hurwitz Polynomials – Positive Real Function – Synthesis of reactive one port RL, RC networks using Foster and Cauer methods. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1 | *Sudakar A. and Shyam Mohan S.Palli* ***"Circuits and Networks (Analysis and Synthesis)"*** *Tata Mc Graw Hill Book Co., New Delhi, III Ed., 2017* |
| 2 | *Charles K. Alexander, Matthew N.O. Sadiku* ***"Fundamentals of Electric Circuits"*** *McGraw Hill Book Co., 7 Ed. 2020* |

**REFERENCES:**

| | |
|---|---|
| 1 | *Hayt W.H and Kemmerley J.E,* ***"Engineering Circuit Analysis"****, Tata McGraw Hill Book Co., V Ed., 2019* |
| 2 | *C.P. Kuriakose* ***"Circuit Theory: Continuous and Discrete – time systems – Elements of Network Synthesis"*** *PHI, Delhi, 2018* |
| 3 | *Gangadhar K.A.,* ***"Circuit Theory"****, Khanna Publishers, II Ed., 2019* |
| 4 | *M.E.Van Valkenburg,* ***"Network Analysis"****, PHI, Delhi, 2019* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Apply electric circuit laws to DC and AC circuits and solve problems | K3 |
| CO2 | Analyze complex circuits using theorems and solve three phase circuits | K4 |
| CO3 | Understand the concepts of resonance, coupled circuits and transients and solve problems | K2 |
| CO4 | understand two port networks and solve the networks using different parameters | K2 |
| CO5 | Design filter circuits and Synthesize electric networks. | K6 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 2 | 1 | 1 |
| CO2 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 1 |
| CO3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 1 |
| CO4 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | 2 |
| CO5 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 2 | 2 | 2 |
| **22EPC301** | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **b) CO and Key Performance Indicators Mapping** | | | | | | | | | | | | | | | |
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,3.2.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3 | | | | | | | | | | | | | | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,3.2.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3 | | | | | | | | | | | | | | |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,3.2.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3 | | | | | | | | | | | | | | |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,3.2.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3 | | | | | | | | | | | | | | |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,3.2.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4 | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 20 | 40 | - | 30 | - | 100 |
| CAT2 | 10 | 20 | 30 | 10 | 30 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | - | 40 | 40 | 20 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | 20 | 40 | 40 | - | - | 100 |
| ESE | 10 | 20 | 30 | - | 30 | 10 | 100 |

| 22EPC302 | FIELD THEORY | III SEMESTER |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 1 | 0 | 4 |

| | | |
|---|---|---|
| **Course Objectives** | To learn the concepts of static and dynamics of charges, understand electromagnetic fields and work on problem solving and application of these ideas for design | |
| **UNIT – I** | **ELECTROSTATIC POTENTIAL AND FIELD** | **(12 Periods)** |
| Types of charges - Charge distribution - Coulomb's Law - Gauss' law - their applications - Potential - Electric field intensity - Boundary Conditions - Laplace and Poisson's equations – Dielectrics – Capacitance - Electrostatic energy- Problems | | |
| **UNIT – II** | **MAGNETIC POTENTIAL AND FIELD** | **(12 Periods)** |
| Biot - Savart's law - Ampere's law - Their applications - Scalar and Vector magnetic potentials - Magnetic torque - Force - Boundary conditions – Energy density in magnetic field – Lifting power of electromagnet – Problems | | |
| **UNIT – III** | **ELECTRO MAGNETIC FIELDS** | **(12 Periods)** |
| Problems in divergence and curl of vector fields in various coordinates - Faraday's laws - Maxwell's equations - Current densities - Time harmonics fields - Problems | | |
| **UNIT – IV** | **ELECTROMAGNETIC WAVES** | **(12 Periods)** |
| Wave equations – Uniform plane waves in free space - Uniform plane waves in lossless dielectrics – Uniform plane waves in lossy dielectrics – Uniform plane waves in good conductor - Poynting's theorem - Problems. | | |
| **UNIT – V** | **FIELD MODELING, EMI AND EMC** | **(12 Periods)** |
| Field plotting - Laplace equation in rectangular coordinates – Separation of variables - Finite difference method - Finite element method - Infinite square through with lid – Infinite square through with different potentials on four sides – Moment method – EMI and EMC – Sources – Conducted and Radiated EMI – Elimination methods - Problems. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1 | *John D. Kraus and Daniel A. Fleisch **"Electromagnetics with Applications",** Mc Graw Hill International Ed., 2018.* |
| 2 | *William H.Hayt **"Engineering Electromagnetics"**, Mc Graw Hill Book Co., 2020.* |

**REFERENCES:**

| | |
|---|---|
| 1 | *AshutoshPramanik **"Electromagnetism"** Prentice Hall of India Pvt. Ltd, 2018.* |
| 2 | *Gangadhar K.A., **"Field Theory"**, Khanna Publishers, 2017.* |
| 3 | *Joseph Edminister, **"Electromagnetics"**, 2nd Ed., Tata McGraw Hill Book Co., 2019.* |
| 4 | *Mathew N.D Sadiku, **"Elements of Electromagnetics"**, Oxford university press, Fourth Edition., 2021.* |
| 5 | *Dr.Dhananjayan.P. **"Engineering Electromagnetics"**, Lakshmi Publications, 2021.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the basics of electric field | K2 |
| CO2 | Ascertain the concepts of magnetic field | K3 |
| CO3 | Master the fundamentals of electromagnetic field | K3 |
| CO4 | Illustrate the knowledge gained to analyze electromagnetic waves | K3 |
| CO5 | Estimate the field parameters for a given problem based on field modeling | K4 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 3 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 3 | 3 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 2 |
| **22EPC302** | 3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 3 | 2 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | | |
|---|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.1.4, 4.2.1,4.3.1,5.1.1,5.1.2,6.1.1 | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.1.4, 4.2.1,4.3.1,5.1.1,5.1.2,6.1.1 | |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.1.4, 4.2.1,4.3.1,5.1.1,5.1.2,6.1.1 | |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.1.4, 4.2.1,4.3.1,5.1.1,5.1.2,6.1.1 | |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.1.4, 4.2.1,4.3.1,5.1.1,5.1.2,6.1.1 | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 20 | 40 | - | 30 | - | 100 |
| CAT2 | 10 | 20 | 20 | 20 | 30 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | - | 40 | 40 | 20 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | - | 40 | 40 | 20 | - | 100 |
| ESE | 10 | 20 | 20 | 20 | 30 | - | 100 |

| 22EPC303 | ELECTRONIC DEVICES AND CIRCUITS | III SEMESTER |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 0 | 0 | 3 |

| Course Objectives | To impart knowledge about various electronic devices and circuits and to identify the suitability of electronic devices for real time applications. | |
|---|---|---|
| **UNIT – I** | **DIODES AND APPLICATIONS** | **(9 Periods)** |
| PNdiode: VIcharacteristics – transition and diffusion capacitance – reverse recovery time – diodemodels – Applications : Half-wave and Full-wave rectifiers and filters – power supply regulators – Clipping and clamping circuits – Avalanche and Zener break down – Zenerdiodes – varactor and optical diodes. | | |
| **UNIT – II** | **BI-POLAR JUNCTION TRANSISTORS AND AMPLIFIERS** | **(9 Periods)** |
| BJT: Structure–operation and characteristics – as an amplifier and switch– DC operating point – base, emitter and voltage-divider bias –Miller's theorem –BJT amplifier : operation –AC equivalent circuits–CE, CC, CB configurations - multistage – RC coupled – transformer coupled– Darlington and differential amplifiers. | | |
| **UNIT – III** | **FIELD-EFFECT TRANSISTOR AND BIASING** | **(9 Periods)** |
| JFET: Structure, operation and characteristics with parameters – biasing configurations – MOSFET: Structure – types (Depletion and Enhancement) – operation and characteristics– biasing configurations – V MOSFET – CMOS technology. | | |
| **UNIT – IV** | **AMPLIFIERS ANALYSIS AND FEEDBACK TECHNIQUES** | **(9 Periods)** |
| BJT and FET amplifiers – basics of frequency response – Low–high and total Frequency response –Power amplifiers –operation – characteristics– parameters of Class A, AB, B and C amplifiers – Operational Amplifier : inverting and non inverting amplifiers –concepts of feedbacks –Negative feedback: shunt and series feedback- Positive feedback: WienBridge and RC phase shift oscillators. | | |
| **UNIT – V** | **OTHER SEMICONDUCTOR DEVICES** | **(9 Periods)** |
| Basic constructions, characteristics curves, parameters and applications : SCR – DIAC – TRIAC - Unijunction Transistors - programmable Unijunction Transistors –IGBT –photo transistors and optical couplers–New semiconductor materials –SiliconCarbide- GalliumArsenide. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK :**

| | |
|---|---|
| 1 | *Thomas L.Floyd, **"Electronic Devices"**, 9th Edition. ,Prentice Hall Inc. 2012* |
| 2 | *Robert Boyle stad, **"Electronic Devices and Circuit Theory"**, 9th Edition, Pearson, 2010* |

**REFERENCES:**

| | |
|---|---|
| 1 | *Jacob Millman, Christos C Halkias and SatyabrataJIT ,**"Electron Devices and Circuits"**, 2nd Ed.,Tata Mc GrawHill, 2008.* |
| 2 | *Allen Mottershead, "**Electronic Devices and Circuits, An Introduction**", Eastern Economy Ed.,Prentice-HallofIndia,2009* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the construction and working of semiconductor devices | K2 |
| CO2 | Analyze the characteristics of the devices and their equivalent circuit models | K4 |
| CO3 | Design of electronic circuits using devices and components | K3 |
| CO4 | Explore the suitability the device for various applications | K5 |
| CO5 | Study the special semiconductor and power electronic devices | K2 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | 1 | 1 | - | 3 | 3 | 1 |
| CO2 | 3 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 1 |
| CO3 | 3 | 3 | 1 | 2 | 2 | - | - | - | - | 2 | 3 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | 2 | - | - | 1 | 2 | - | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | 2 | 2 | - | 1 | 3 | 3 | 2 | 2 | 2 |
| **22EPC303** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | 1 | 2 | 2 | 2 | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | | |
|---|---|---|
| CO1 | 1.2.1,1.3.1,1.4.1,2.3.1,2.3.2,2.4.4,3.1.3,3.1.6,3.2.1,4.1.4,4.2.1,4.3.4,5.1.1,5.3.1,6.1.1,7.1.1,7.2.2,10.1.1,10.3.1,11.1.1 | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6,3.2.1,3.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,12.1.2,12.2.2,12.3.2 | |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.6,3.2.1,3.2.2,3.2.3,4.1.1,4.1.3,4.1.4,5.1.1,5.2.1,5.3.1,12.1.2,12.2.2,12.3.2,10.1.1,10.2.2,10.3.1,11.1.1,11.2.1,11.3.1,11.3.2,12.3.1,12.3.2 | |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.4.2,2.4.3,2.4.4,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.3.1,4.1.2,4.1.4,4.2.1,5.1.2,5.2.2,5.3.2,7.1.1,7.2.2,10.1.1,10.3.1,11.2.1,11.1.2, 11.3.2 | |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.2.4,2.4.2,2.4.3,2.4.4,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.3.1,4.1.2,4.1.4,4.2.1,5.1.2,5.2.2,5.3.2,7.1.1,7.2.2,10.1.1,10.3.1,11.2.1,11.1.2, 11.3.2,8.2.1,8.2.2,11.1.1,11.1.2,11.2.1,12.1.2,12.2.1,12.3.1,12.3.2 | |

| ASSESSMENT PATTERN | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 30 | 30 | 20 | 10 | - | 100 |
| CAT2 | 10 | 30 | 30 | 20 | 10 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | 30 | 30 | 20 | 20 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | 30 | 30 | 20 | 20 | - | 100 |
| ESE | 10 | 30 | 30 | 20 | 10 | - | 100 |

| 22EPC304 | ELECTRICAL MACHINES-I | SEMESTER III |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| Engineering Physics, Field theory | PC | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| **Course Objectives** | To obtain knowledge about energy in the magnetic system, the working principle of DC generators, DC motors and Transformers. Also to perform testing in various DC machines and transformers. | |
| **UNIT – I** | **PRINCIPLES OF ELECTROMECHANICAL ENERGY CONVERSION** | **(9 Periods)** |
| Energy in magnetic system – Field energy- co energy - Force -torque equations- eddy currents - eddy current losses – flux distribution curve in the air gap – Singly-multiply excited magnetic field systems - mmf of distributed ac windings – Winding Inductances - Rotating Magnetic Field- mmf waves - Magnetic saturation - leakage fluxes. | | |
| **UNIT – II** | **DC GENERATORS** | **(9 Periods)** |
| Constructional details- principle of operation – Armature winding -Emf equation – Types of dc generators - Armature reaction: Effects of armature reaction - demagnetizing & cross magnetizing ampere-turns – compensating windings – interpoles : commutation – Characteristics of DC generators - losses - efficiency - Parallel operation of dc generators- applications. | | |
| **UNIT – III** | **DC MOTORS** | **(9 Periods)** |
| Constructional details - principle of operation- back emf – Types -Torque equation losses - efficiency – power flow diagram – Electrical - mechanical characteristics of different types of DC motors – Starters – Speed control methods – Types of Electric braking | | |
| **UNIT – IV** | **TRANSFORMERS** | **(9 Periods)** |
| Principle of operation – Types-constructional features of single phase -three phase transformers –EMF equation - Phasor diagram – Transformers on load - Equivalent circuit – Voltage Regulation - efficiency- All day efficiency Three phase transformer connections – Scott connection – Parallel operation of three phase transformers – Inrush current phenomenon - its prevention - Auto transformers, Off-load - on-load tap changing transformer-Isolation Transformer. | | |
| **UNIT – V** | **TESTING OF DC MACHINES AND TRANSFORMERS** | **(9 Periods)** |
| DC machines: Brake test, field test, Retardation test - Swinburne's test - Hopkinson's test. Transformers: Open Circuit -Short Circuit Tests-– Phasing, Identification -Polarity of transformer winding - Sumpner's test. | | |
| **Contact Periods**:<br>**Lecture:45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1 | *Nagrath J. and D. P. Kothari, **"Theory of Electric Machines"**, Tata McGraw Hill, 2006* |
| 2 | *Fitzgerald A. E., C. Kingsley and S. Umans, **"Electric Machinery"**, 7/e, McGraw Hill, 2020* |

**REFERENCES:**

| | |
|---|---|
| 1 | *Bimbra P. S., **"Electrical Machinery"**, 7/e, Khanna Publishers, 2021.* |
| 2 | *BL. Theraja, AK, Theraja, **"A Textbook of Electrical Technology"** Volume II : AC And DC Machines" , S.Chand Publications, Multicolour Illustrative Edition, 2005.* |
| 3 | *Abhijith Chakrabarti, Sudipta Debnath, **"Electrical Machines"**, McGraw Hill Education, NewDelhi 2015.* |
| 4 | *Deshpande M. V., **"Electrical Machines"**, Prentice Hall India, New Delhi, 2011.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Apply basic laws of electromagnetic principles for static and dynamic electric machines. | K1 |
| CO2 | Analyze the performance of electrical machines for the different level of utilization in Industries. | K4 |
| CO3 | Identify suitable machines for any specific application. | K6 |
| CO4 | Perform testing of the electrical machines. | K3 |
| CO5 | Evaluate the performance of electrical machines. | K5 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | 1 | 1 | 2 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | 1 | 1 | 1 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 2 | 3 | 1 | - | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 3 | 1 | - | - | - | - | - | 1 | 2 | 2 | 2 | 1 |
| **22EPC 304** | 3 | 2 | 2 | 3 | 1 | - | - | - | - | 1 | 1 | 1 | 3 | 2 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | | |
|---|---|---|
| CO1 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.4,2.4.1,2.4.2,3.1.1,3.1.3,3.1.6,3.2.2,3.2.3,3.3.1,3.4.1,4.1.1,4.1.2,4.2.2,4.3.4,5.1.2,5.3.2,10.1.3,10.3.2,11.1.2,12.1.1,12.2.1,12.3.1, | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.2.1,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.3.1,3.3.2,3.4.2,4.1.2,4.1.3,4.1.4,4.2.1,4.3.1,4.3.2,4.3.4,5.1.1,5.3.1,10.2.1,10.3.2,11.1.1,12.1.2, | |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.3.1,2.3.2,2.4.3,2.4.4,3.1.2,3.1.4,3.1.5,3.2.1,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.2.1,4.2.2,5.1.1,5.2.1,5.2.2,11.3.1,12.2.1,12.2.2, | |
| CO4 | 1.1.1,1.3.1,2.1.2,2.2.1,2.2.3,2.2.4,2.3.1,3.1.3,3.1.6,3.2.1,3.2.2,3.4.1,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.2,4.3.4,5.1.2,10.1.2,10.3.1,11.3.1,12.1.1,12.3.1, | |
| CO5 | 1.1.2,1.2.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.4,3.3.2,3.4.1,4.1.1,4.1.2,4.1.4,4.2.2,4.3.3,4.3.4,5.3.2,11.1.2,12.1.1,12.2.1,12.3.2, | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 30 | 30 | 20 | 10 | - | 100 |
| CAT2 | 10 | 30 | 30 | 20 | 10 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | 30 | 30 | 20 | 20 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | 30 | 30 | 20 | 20 | - | 100 |
| ESE | 10 | 30 | 30 | 20 | 10 | - | 100 |

| 22EPC305 | DIGITAL CIRCUITS | SEMESTER III |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 0 | 0 | 3 |

| Course Objectives | To learn the concepts and design techniques used in digital electronics and also to familiarize the Hardware description language in the design of digital circuits | |
|---|---|---|
| **UNIT – I** | **NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES** | **(9 Periods)** |
| Number system- error detection, corrections & codes conversions- Boolean Algebra and Logic gates – Boolean functions - Canonical and Standard Forms - Digital Logic gates – Gate level minimization - NAND and NOR Implementation- minimization using K-maps & Quine McCluskey Digital Logic Families - comparison of RTL, DTL, TTL, ECL and MOS families - operation, characteristics of digital logic family. | | |
| **UNIT – II** | **COMBINATIONAL CIRCUITS** | **(9 Periods)** |
| Combinational circuits - Analysis and Design Procedure- Binary adder subtractor - Decimal adder – Binary multiplier – Magnitude comparator – Multiplexers - Demultiplexers - code converters- Encoders and Decoders. | | |
| **UNIT – III** | **SYNCHRONOUS SEQUENTIAL CIRCUITS** | **(9 Periods)** |
| Sequential circuits- Latches – Flip flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment - Design Procedure- Moore and Mealy models - Registers, Shift Registers, Ripple Counters, Synchronous Counters. | | |
| **UNIT – IV** | **ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES** | **(9 Periods)** |
| Asynchronous Circuits - Analysis Procedure - Circuits with Latches – Reduction of State Flow Tables – Race Free State Assignment – Hazards - Design Example.<br>Programmable Logic Devices: PROM – PLA –PAL, CPLD-FPGA. | | |
| **UNIT – V** | **HARDWARE DESCRIPTION LANGUAGE** | **(9 Periods)** |
| Introduction to Verilog: Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Implement logic gates, half adder and full adder using Verilog data flow description. Behavioral description: Structure, variable assignment statement, sequential statements, Verilog behavioral description of Multiplexers (2:1,4:1,8:1) and De-multiplexers - Encoders (8 to 3), Decoders (2 to 4). Latches - flip flops. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| *1* | *Morris Mano.M **"Digital Design"** Pearson Education, New Delhi, 6th Ed., 2018.* |
| *2* | *Samir Palnitkar, **"Verilog HDL- A guide to Digital Design and Synthesis"** Pearson Education, New Delhi, 2ndEd., 2003.* |

**REFERENCES :**

| | |
|---|---|
| *1* | *Ronald J. Tocci, Neal S Widmer, Gregory L Moss, **"Digital Systems: Principles and Applications",** Prentice Hall, 12thEd., 2017* |
| *2* | *Floyd Thomas L.,**"Digital fundamentals"** Pearson Education, New Delhi, 11thEd.,2015.* |
| *3* | *Charles H.Roth, **"Fundamentals of Logic Design"** 7th Ed., Cl-Engineering, 2013.* |
| *4* | *Nazeih M. Botros , **"HDL Programming VHDL and Verilog",** Dreamtech press ,2009.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the fundamentals of digital electronics and logic families. | K2 |
| CO2 | Illustrate reduction of logical expressions using Boolean algebra and k-map. | K4 |
| CO3 | Use the procedures for the analysis and design of combinational circuits | K3 |
| CO4 | Analyze the design capability in synchronous and asynchronous sequential circuits | K4 |
| CO5 | Design digital logic circuits in different types of modeling using HDL | K6 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 3 | 3 |
| **22EPC305** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 3 | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | | |
|---|---|---|
| CO1 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.4,2.3.2,2.4.1,2.4.4,3.1.1,3.1.2,3.1.3,3.1.6,3.2.1,3.2.3,4.1.1,4.1.4,4.2.2,4.3.4,12.2.1,12.2.2,12.3.1,12.3.2 | |
| CO2 | 1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.3, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.3, 4.3.4 | |
| CO3 | 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.3, 4.3.4, 12.1.2 | |
| CO4 | 1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,4.3.4,12.1.2,12.2.2,12.3.2 | |
| CO5 | 1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.1,3.1.3,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.3,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,12.1.2,12.2.2,12.3.2 | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 20 | 40 | 30 | - | - | 100 |
| CAT2 | 10 | 20 | 30 | 30 | 10 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | - | 50 | 50 | - | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | - | 40 | 40 | 20 | - | 100 |
| ESE | 10 | 20 | 30 | 30 | - | 10 | 100 |

| 22EPC306 | ELECTRIC CIRCUITS AND ELECTRONIC DEVICES LABORATORY | SEMESTER III |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 0 | 0 | 3 | 1.5 |

| Course Objectives | To enable the students to gain experimental skill.on the concepts learned in Electrical and Electronic circuits |
|---|---|

**List of Experiments:**

1. Study of measuring instruments
2. Verification of Ohm's Law and Kirchhoff's laws.
3. Verification of network theorems.
4. Analysis of First order R-L and R-C Circuits/.Second order RLC Circuits
5. Measurement of average, rms, form and peak factor of time varying signals
6. Study of Fluorescent lamp circuit
7. Three phase power measurement
8. Semiconductor diode characteristics.
9. Zener diode characteristics and voltage regulation.
10. Transistor characteristics - common emitter mode and common base mode.
11. Characteristics of UJT and generation of sawtooth waveforms.
12. Characteristics of FET.
13. Circuit analysis using technical software
14. IV and PV characteristics of PV panel.

**Contact Periods**:
**Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**

| COURSE OUTCOMES: Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| CO1 | Verify the basic laws of circuit theory and various network theorems. | K4 |
| CO2 | Infer the characteristics of basic semiconductor devices. | K4 |
| CO3 | Measure the real and reactive power in three phase network | K4 |
| CO4 | Analyze the circuits and devices using simulation tool. | K4 |
| CO5 | Determine the parameters of electronic circuits. | K4 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| **22EPC306** | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | |
|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1,6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,8.1.1,8.2.1,8.2.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 |

| 22EPC307 | ELECTRICAL MACHINES LABORATORY – I | SEMESTER III |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 0 | 0 | 3 | 1.5 |

| Course Objectives | To give hands on training for evaluating the performance and characteristics of DC Machines and Transformers. |
|---|---|

**List of Experiments:**

1. Swinburne's test and Speed control of d.c. shunt motor.
2. Open circuit characteristics and load test on d.c. shunt generator.
3. Open circuit characteristics and load test on d.c. compound generator.
4. Open circuit characteristics and load test on separately excited d.c. generator
5. Load test on d.c. shunt motor.
6. Load test on d.c. series motor.
7. Load test on d.c. compound motor.
8. Hopkinson's Test
9. OC and SC tests on single phase transformers.
10. Load test on single phase transformer.
11. Sumpner's test.
12. Separation of losses in transformers.
13. Separation of losses in dc machines
14. Three phase transformer connections.

**Contact Periods**:
**Lecture: 0 Periods Tutorial:0 Periods Practical: 45 Periods Total: 45 Periods**

| COURSE OUTCOMES: Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| CO1 | Analyze the electrical / mechanical / performance characteristics of DC machines/transformers. | K4 |
| CO2 | Illustrate the different speed control methods for DC Motors.. | K4 |
| CO3 | Develop the transformer model and analyze the performance. | K5 |
| CO4 | Interpret component of iron loss of DC machine / transformer. | K5 |
| CO5 | Study practically the losses occurring in DC machines and transformers. | K4 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 2 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 3 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 3 | 3 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 2 | 2 | 2 |
| **22EPC 307** | 3 | 3 | 3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 3 | 2 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | |
|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1, 6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2 |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1, 6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2 |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1, 6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2 |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1, 6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2 |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2, 2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1, 4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,4.3.4,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,6.1.1, 6.2.1,7.1.1,7.1.2,7.2.1,7.2.2,9.1.1,9.1.2,9.2.1,9.2.2,9.2.3,9.2.4,9.3.1,10.1.1,10.1.2,10.1.3, 10.2.1,10.2.2,10.3.1,10.3.2 |

| 22EBS407 | FOURIER SERIES AND TRANSFORM CALCULUS (Common to branches EEE & EIE) | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | BS | 3 | 1 | 0 | 4 |

| Course Objectives | The main objective of this course is to provide students with the foundations of Fourier series and transforms methods and analysis techniques mostly used in various applications in engineering and technology. | |
|---|---|---|
| **UNIT – I** | **FOURIER SERIES** | **(9+3 Periods)** |
| Dirichlet's Conditions – General Fourier series –Odd and even functions- Half range Sine and Cosine series – Parseval's Identity on Fourier series–Harmonic Analysis. | | |
| **UNIT – II** | **BOUNDARY VALUE PROBLEMS** | **(9+3 Periods)** |
| Classification of partial differential equations – Method of separation of variables–One dimensional wave equation–One dimensional heat equation–Transient and Steady state conditions–Fourier series solution. | | |
| **UNIT–III** | **LAPLACE TRANSFORMS** | **(9+3 Periods)** |
| Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform. Convolution theorem. Evaluation of integrals by Laplace transform, solving ordinary differential equations by Laplace Transform method | | |
| **UNIT – IV** | **FOURIER TRANSFORMS** | **(9+3 Periods)** |
| Statement of Fourier integral Theorem–Fourier transform pair–Fourier Sine and Cosine Transforms–Properties –Transforms of Simple functions-Convolution Theorem–Parseval's Identity-Finite Fourier transforms. | | |
| **UNIT – V** | **Z-TRANSFORMS** | **(9+3 Periods)** |
| Z-transforms - Elementary properties-Inverse Z-transforms - Initial and Final value theorems - Convolution theorem – Formation of difference equations-Solution to difference equations of second order with constant coefficients using Z- transform. | | |
| **Contact Periods:** **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| *1* | *Kandasamy, Thilagavathy and Gunavathy., **"Engineering Mathematics"**, for III Semester, S.Chand&Co, Ramnagar, New Delhi. Revised edition 2017.* |
| *2* | *Veerarajan.T.,**"Transforms and partial Differential equations"**, Tata Mc Graw Hill Publishing Co.,New Delhi.2015* |

**REFERENCES:**

| | |
|---|---|
| *1* | *J.Ray Hanna And John H. Rowland, **"Fourier Series, Transforms and Boundary Value Problems"**, Dover Publication Inc, Mineola, New York, Second Edition , 2008.* |
| *2* | *B.S.Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, New Delhi, 44th Edition, 2018.* |
| *3* | *Ray Wylie C and Louis C Barrett, **"Advanced Engineering Mathematics"**, McGraw Hill Education(India)Pvt Ltd., New Delhi, 6th Edition 2014.* |
| *4* | *N.P.Bali and Manish Goyal., **"Transforms and partial Differential equations"**, University Science Press, New Delhi, 2010.* |
| *5* | *S. Larsson, V. Thomee, **"Partial Differential Equations with Numerical Methods"**, Springer, 2003.* |

| COURSE OUTCOMES: Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| **CO1** | Express the periodic functions arising in the study of engineering problems as trigonometric series. | K5 |
| **CO2** | Solve the partial differential equation arising in engineering problems as wave and heat flow in steady state (Cartesian coordinate) using Fourier series. | K5 |
| **CO3** | Apply Laplace Transform technique to solve the given integral equation s and ordinary differential equations. | K5 |
| **CO4** | Find Fourier transforms, finite and infinite Fourier sine and cosine transforms. | K5 |
| **CO5** | Apply the Z transform methods to find solutions of difference equations in engineering problem. | K5 |

## COURSE ARTICULATION MATRIX

**a) CO and PO Mapping**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| **22EBS407** | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 1 | 2 | - | - |

**1 – Slight, 2 – Moderate, 3 – Substantial**

| **b) CO and Key Performance Indicators Mapping** | |
|---|---|
| CO1 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2. |
| CO2 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 11.2.1, 11.3.1, 12.1.2, 12.3.2. |
| CO3 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2. |
| CO4 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2. |
| CO5 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2. |

| ASSESSMENT PATTERN | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| **CAT1** | 20 | 45 | 35 | - | - | - | 100 |
| **CAT2** | 15 | 45 | 40 | - | - | - | 100 |
| **Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1** | 20 | 45 | 35 | - | - | - | 100 |
| **Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2** | 25 | 40 | 35 | - | - | - | 100 |
| **ESE** | 25 | 40 | 35 | - | - | - | 100 |

| 22EPC408 | LINEAR INTEGRATED CIRCUITS | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| Electronic Devices and Circuits | PC | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| **Course Objectives** | 1.To learn the concept of IC fabrication technology and applications.<br>2.To study the OPAMP characteristics.<br>3.To design and develop real time OPAMP applications. | |
| **UNIT – I** | **IC FABRICATION AND REALIZATION** | **(9 Periods)** |
| IC Classification - fundamental of monolithic IC technology: epitaxial growth, masking and etching, diffusion of impurities - Realization of monolithic ICs and packaging - Fabrication of diodes, capacitance, resistance and FETs. | | |
| **UNIT – II** | **OPERATIONAL AMPLIFIERS CHARACTERISTICS** | **(9 Periods)** |
| Functional block diagram - Ideal op-amp - Open loop and closed loop operation – CMRR - Input bias and offset currents - Input and output offset voltages - Compensation techniques - Frequency response of op-amp – Transfer characteristics - Slew rate - Bandwidth. | | |
| **UNIT – III** | **APPLICATIONS OF OPERATIONAL AMPLIFIERS** | **(9 Periods)** |
| Inverting and Non Inverting amplifiers – Differential amplifiers - Integrator and differentiator - V/I & I/V converters - Log and Antilog Amplifiers - Active Filters – Voltage to frequency converters – Sample and Hold circuits – Instrumentation amplifiers – Comparators – Clippers - Clampers - Zero crossing detectors – Square and triangular waveform generator | | |
| **UNIT – IV** | **555 TIMERS, A/D AND D/A CONVERTERS** | **(9 Periods)** |
| 555 timer – Functional block diagram - Astable and monostable operation of 555 timer – Applications – Frequency counters – A/D converters( Flash and successive approximation types) - D/A converters(R- 2R ladder and weighted resistor types | | |
| **UNIT – V** | **APPLICATION ICs** | **(9 Periods)** |
| Positive and negative voltage regulators (IC723) Adjustable voltage regulators (LM117/LM317) – Dual tracking regulators (78xx & 79xx Series) – Phase Locked loop (IC565)- Programmable supply – SMPS - LM 380 power amplifier - ICL 8038 function generator IC. | | |
| **Contact Periods :**<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1 | *Roy Choudhry D. and Shail Jain "**Linear Integrated Circuits**" New Age international, New Delhi,4th Ed., 2017* |
| 2 | *David A.Bell **"Op-amp & Linear ICs"** Oxford, 3rd Ed., 2021* |

**REFERENCES:**

| | |
|---|---|
| 1 | *RamakantA.Gayakwad, "**OPAMPs and Linear Integrated Circuits**", Prentice Hall of India Pvt.Ltd. New Delhi, 4th Ed. 201* |
| 2 | *Jacob Millman, Christos C.Halkias, Integrated Electronics - Analog and Digital circuits.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the fabrication of semiconductor devices and circuits | K2 |
| CO2 | Analyze working of circuits in practical conditions | K4 |
| CO3 | Identification of suitable solutions to real time problems | K2 |
| CO4 | Application of circuits for interfacing and generation of waveforms | K3 |
| CO5 | Use of general purpose circuits to specific applications and Utility of devices in regulated supply for electronic circuits | K3 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/ POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 2 | 1 | 1 | 1 | - | 2 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO2 | 3 | 2 | 1 | 2 | - | 2 | - | - | - | - | - | 1 | 3 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | 2 | 2 |
| **22EPC408** | 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 3 | 2 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | | |
|---|---|---|
| CO1 | 1.2.1, 1.3.1, 2.2.2, 2.2.4, 2.3.1, 2.4.4, 3.1.5, 3.1.6, 3.2.3, 4.1.2, 6.1.1, 12.1.1, 12.3.1, | |
| CO2 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.6, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 6.1.1, 12.1.1, | |
| CO3 | 1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1,2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2, 12.1.1, 12.1.2, 12.2.1 | |
| CO4 | 1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 3.1.2, 3.1.3, 3.1.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 7.2.2, 12.2.1, 12.2.2, 12.3.2 | |
| CO5 | 1.1.1, 1.1.2, 1.3.1, 2.1.3, 2.2.2, 2.2.4, 2.3.1, 2.4.2, 3.1.2, 3.1.3, 3.1.4, 3.1.6, 3.3.1, 3.3.2, 3.4.2, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 6.2.1, 7.1.1, 7.2.2, 12.2.1, 12.2.2, 12.3.2 | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 20 | 20 | 30 | 30 | - | - | 100 |
| CAT2 | - | 20 | 30 | 30 | 20 | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | 20 | 40 | 40 | - | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | 20 | 40 | 40 | - | - | 100 |
| ESE | 10 | 20 | 30 | 30 | - | 10 | 100 |

| 22EPC409 | ELECTRICAL MACHINES-II | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| Concept of Electromechanical Energy Conversion | PC | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| **Course Objectives** | To acquire the knowledge of working principles and performance of rotating AC machinery and special machines. | |
| **UNIT – I** | **SYNCHRONOUS GENERATOR** | **(9 periods)** |
| Construction – Rotor types – emf equation – Synchronous reactance – Armature reaction-Voltage regulation – EMF, MMF, ZPF –Synchronizing and parallel operation – Synchronizing torque-Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics. | | |
| **UNIT – II** | **SYNCHRONOUS MOTOR** | **(9 periods)** |
| Principle of operation – Torque equation – Operation on infinite bus bars - V and inverted V curves – Power input and power developed equations – Starting methods – Current loci for Constant power input, constant excitation and constant power developed - Necessity of Damper windings - Applications. | | |
| **UNIT – III** | **THREE PHASE INDUCTION MOTOR** | **(10 periods)** |
| Construction – Principle –Rotor types - Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests -Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.<br>Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control - Voltage control, Frequency control and pole changing – Cascaded Connection-V/f control – Slip power recovery Scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking. | | |
| **UNIT – IV** | **SINGLE PHASE INDUCTION MOTOR AND STARTING METHOD** | **(9 periods)** |
| Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors - Shaded pole induction motor - Capacitor-start capacitor run induction motor. | | |
| **UNIT – V** | **SPECIAL MACHINES** | **(8 periods)** |
| Linear induction motor - Hysteresis motor - AC series motor-Switched Reluctance Motor-Stepper motor –Permanent magnet A.C motor (BLDC and PMSM) ( Qualitative treatment only)- Magnetic levitation. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods** **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods** | | |

**TEXT BOOKS :**


| | |
|---|---|
| 1 | *Kothari D. P. and Nagrath I. J., "**Electric Machines**" Tata McGraw Hill, 5th Ed., 2017.* |
| 2 | *Fitzgerald A.E., Charles Kingsly C. Stephen D. Umans., "**Electric Machinery**" Tata McGrawHill, 6th Ed., 2013.* |

**REFERENCES :**

| | |
|---|---|
| 1 | *Sahdev, S. K.. "**Electrical Machines**", Cambridge University Press, United Kingdom, 2017.* |
| 2 | *Melkebeek, Jan A., "**Electrical Machines and Drives: Fundamentals and Advanced Modelling**", Springer International Publishing, Germany, 2018.* |
| 3 | *E.G. Janardanan, "**Special electrical machines**", PHI learning Private Limited, Delhi, 2014.* |
| 4 | *Ghosh, Smarajit, "**Electrical Machines**", Pearson Education India,, 2012.* |

| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the operating principle of rotating AC machines. | K2 |
| CO2 | Familiarize the characteristics of synchronous and induction machines. | K2 |
| CO3 | Apply the knowledge of Induction and Synchronous machines for specific applications | K3 |
| CO4 | Execute speed control and starting methods for various AC motors. | K3 |
| CO5 | Familiarize special electrical machines and their applications | K4 |

**COURSE ARTICULATION MATRIX :**

**a) CO and PO Mapping**

| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 1 | 3 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 1 | 2 | 3 |
| **22EPC409** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial

**b) CO and Key Performance Indicators Mapping**

| | |
|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.4,2.3.1,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.1,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.4,4.2.1,4.3.1,4.3.3, 5.1.1,5.1.2,5.2.2,12.1.1,12.2.1, 12.2.2,12.3.2 |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,3.1.1, 3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.2,4.1.4,4.2.1,4.3.1,4.3.2,4.3.3,5.1.2, 5.2.1,5.2.2,5.3.1,5.3.2,12.2.1,12.2.2,12.3.2 |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 3.1.1,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.3,4.2.1,4.2.2,4.3.1,4.3.3,5.1.1, 5.2.2,5.3.1,12.2.2,12.3.2 |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.4.1,2.4.2,2.4.3, 3.1.1,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.2,4.1.2,4.2.1,4.3.1,4.3.3,5.2.1,5.2.2, 5.3.1,12.1.1, 12.2.1,12.2.2 |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 2.4.4,3.1.1,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.2.1,4.3.1,4.3.3, 5.2.1,5.2.2, 5.3.1,12.3.2 |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 20 | 40 | 30 | - | - | 100 |
| CAT2 | 10 | 30 | 30 | 30 | - | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | - | 50 | 40 | 10 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | - | 40 | 40 | 20 | - | 100 |
| ESE | 10 | 20 | 30 | 40 | - | - | 100 |

| 22EPC410 | POWER GENERATION, TRANSMISSION AND DISTRIBUTION | SEMESTER: IV |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 0 | 0 | 3 |

| Course Objectives | To know the various components of Power Systems and design an electric power network in electrical and mechanical point of view. | |
|---|---|---|
| **UNIT – I** | **GENERATION OF ELECTRICAL ENERGY** | **(9 Periods)** |
| Structure of electric power system – Working and Site Selection of: Conventional Energy Generation- Thermal, Hydro, Pumped storage plant, Nuclear, Diesel and Gas turbine power plant- Non-Conventional Energy Generation- Wind, Tidal, Solar, GeoThermal, Biogas and Fuel Cell. Comparison of different types of power plants. | | |
| **UNIT – II** | **TRANSMISSION LINE PARAMETERS AND DESIGN** | **(9 Periods)** |
| Types of conductor- conductor materials, Line Resistance, inductance and capacitance of solid, stranded and bundled conductors-configuration –Symmetrical and unsymmetrical spacing – Transposition of lines – Concept of GMR and GMD –Skin and proximity effect – Interference with neighboring communication circuits.<br>Mechanical design of transmission line-Line supports- Sag and tension calculations considering the effect of ice and wind loading-stringing chart | | |
| **UNIT – III** | **MODELLING AND PERFORMANCE OF TRANSMISSION LINES** | **(9 Periods)** |
| Classification of Transmission lines-regulation and efficiency-short Transmission lines effect of load power factor on transmission efficiency and regulation of line-Medium Transmission line: end condenser method, nominal-T and π methods. Ferranti effect-Long Transmission line: Analysis by Rigorous method, Surge Impedance Loading- Power flow through a Transmission line- Concept of Power circle diagram- Corona: Phenomenon-Corona loss –methods of reducing Corona | | |
| **UNIT – IV** | **LINE INSULATORS AND POWER CABLES** | **(9 Periods)** |
| Insulator materials-types of insulators- potential distribution across string of suspension insulators- string efficiency and methods of improving string efficiency. Cables: general construction of cables-insulation resistance of power cables-capacitance and insulation stress in cables, sheathing-grading of cables, tan **δ** and power factor- heating of cable-breakdown of cables. | | |
| **UNIT – V** | **SUBSTATION AND DISTRIBUTION SYSTEM** | **(9 Periods)** |
| Substation: Classification-Bus-Bar Arrangements in substation. Distribution system: Design consideration-classification of DS. DC distributor fed at one end, both ends, ring main- 3-wire DC distribution system A.C. Distribution: A.C. Distributors with concentrated loads- 3-phase 4-wire star connected load circuits- consequence of disconnecting neutral in a 3-phase 4- wire system. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOK :**


| | |
|---|---|
| 1 | *S.N.Singh **"Electric Power Generation, Transmission and Distribution"** Prentice Hall of India Pvt.Ltd, New Delhi, second edition, 2011.* |
| 2 | *D.P.Kothari and I.J.Nagrath, "**Power System Engineering**", 2nd edition, Tata McGraw Hill, Third edition, 2019* |
| 3 | *C.L.Wadwa, **"Electrical Power Systems",** New Age International, Seventh Edition, 2022.* |

**REFERENCES :**


| | |
|---|---|
| 1 | *J.B.Gupta,* ***"Transmission and Distribution of Electrical Power",*** *S.R.Kataria & Sons, 2014* |
| 2 | *Luces M. Fualkenberry, Walter Coffer,* ***"Electrical Power Distribution and Transmission"****, Pearson Education, 2007* |
| 3 | *A. Chakrabarti, Soni Ml, P. V. Gupta, U.S. Bhatnagar,* ***"A Text Book On Power System Engineering"*** *, Dhanpat Rai Publishing Company, 2008.* |
| 4 | *Mehta V.K., Rohit Mehta.,****"Principles of Power Systems"****, S.Chand and Co., 2013.* |


| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the structure of the power system and different energy sources. | K2 |
| CO2 | Evaluate the parameters of the transmission line for different configurations. | K4 |
| CO3 | Develop a model and assess the performance of overhead lines. | K3 |
| CO4 | Classify different types of distribution systems and evaluate the performance of the Distribution network. | K5 |
| CO5 | Analyze transmission and distribution network with respect to electrical and mechanical aspects. | K4 |

**COURSE ARTICULATION MATRIX :**

**a) CO and PO Mapping**

| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 1 | - | - |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | - |
| CO3 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | - |
| CO5 | 3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | - |
| **22EPC410** | 3 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial

**b) CO and Key Performance Indicators Mapping**

| | |
|---|---|
| CO1 | 1.2.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.1, 12.1.2, 12.2.1 |
| CO2 | 1.1.2, 1.2.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.1.1, 6.2.1, 12.1.1, 12.1.2, 12.2.1 |
| CO3 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 12.1.1, 12.1.2, 12.2.1 |
| CO4 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 12.1.1, 12.1.2, 12.2.1 |
| CO5 | 1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.5, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 6.1.1, 6.2.1, 12.1.1, 12.1.2, 12.2.1 |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 25 | 40 | 25 | - | - | 100 |
| CAT2 | 10 | 20 | 40 | 30 | - | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | - | 40 | 30 | 30 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | - | 35 | 35 | 30 | - | 100 |
| ESE | 10 | 20 | 35 | 25 | 10 | - | 100 |

| 22EPC411 | PRINCIPLES OF SIGNALS AND SYSTEMS | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| **Course Objectives** | To understand the basic properties of signal and systems and characterization of systems in time and frequency domains and to analyze continuous, linear time-invariant systems using state variable formulation and solve the resulting state equations. | |
| **UNIT – I** | **CLASSIFICATION OF SIGNALS AND SYSTEMS** | **(9 Periods)** |
| Standard signals : Step – Ramp –Pulse –Impulse – Sinusoids –Classification of signals : Continuous time (CT) and Discrete Time (DT) signals–Periodic and Aperiodic signals – Deterministic and Random signals –Energy and Power signals –Classification of systems :CT systems and DT systems –Linear and Nonlinear –Time-variant and Time-invariant –Causal and Non-causal –Stable and Unstable. | | |
| **UNIT – II** | **ANALYSIS OF CONTINUOUS TIME SIGNALS** | **(9 Periods)** |
| Fourier series : Spectrum of Continuous Time signals – Properties -Fourier transform: continuous time aperiodic signals and periodic signals- properties– Fourier and Laplace Transform in signals Analysis | | |
| **UNIT – III** | **LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS** | **(9 Periods)** |
| Differential Equation :CT system representations– Frequency response of systems characterized by Differential Equations -Block diagram representation – Impulse response, convolution integrals – State space representation | | |
| **UNIT – IV** | **ANALYSIS OF DISCRETE TIME SIGNALS** | **(9 Periods)** |
| Z transforms – Properties - Inverse Z transforms - Initial and final value theorems - Convolution theorem Baseband Sampling of CT signals – Aliasing, Reconstruction of signal from DT signal, Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – Fast Fourier Transform (FFT)– Properties | | |
| **UNIT – V** | **LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS** | **(9 Periods)** |
| Difference Equations – Block diagram representation – Impulse response – Convolution sum – DTFT and Z Transform analysis of Recursive and Non-Recursive systems – Frequency response of systems characterized by Difference Equations – State space representation | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods** | | |

**TEXT BOOKS:**

| | |
|---|---|
| 1 | *Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "**Signals and Systems**", Pearson Publication, 2015* |
| 2 | *Simon Haykin and Barry Van Veeh, "**Signals and Systems**", Wiley India, New Delhi, 2021* |

**REFERENCES :**


| | |
|---|---|
| 1 | *H P Hsu, Rakesh Ranjan, "**Signals and Systems**", Schaum's Outlines, Tata McGraw Hill, 7th Reprint, 2010* |
| 2 | *John Alan Stuller, "**An Introduction to Signals and Systems**", Thomson, 2008* |
| 3 | *Edward W Kamen & Bonnie's Heck, "**Fundamentals of Signals and Systems**",Pearson Education, 2007.* |
| 4 | *Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. "**Signals & systems**", Fourth Edition, Pearson Education, 2002.* |
| 5 | *S.Salivahanan, A. Vallavaraj, C. Gnanapriya, "**Digital Signal Processing**", McGraw Hill International/TMH, 2007.* |


| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Acquire knowledge about various test signals | K2 |
| CO2 | Investigate properties of signals and corresponding systems | K4 |
| CO3 | Review of mathematical concepts for analyzing systems | K2 |
| CO4 | Analyze continuous and discrete time signals in frequency domain | K4 |
| CO5 | Modelling of time invariant systems using different methodologies | K4 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| **22EPC411** | 3 | 3 | 2 | 2 | 3 | - | - | - | 3 | 1 | 1 | - | 3 | 3 | 3 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| b) CO and Key Performance Indicators Mapping | | |
|---|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 | |
| CO3 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 | |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 | |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.22.4.1,2.4.2,2.4.3,2.4.4,3.2.1,3.2.2,3.2.3,3.4.1,3.4.2,4.1.3,4.1.4,4.2.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,9.1.1,9.1.2,9.2.19.2.2,9.2.3,9.2.4,9.3.1,10.3.1,10.3.2,11.1.1 | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 25 | 25 | 30 | 20 | - | - | 100 |
| CAT2 | 20 | 25 | 35 | 20 | - | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | 25 | 25 | 25 | 25 | - | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | 25 | 25 | 25 | 25 | - | - | 100 |
| ESE | 25 | 25 | 20 | 30 | - | - | 100 |

| 22EPC412 | ELECTRICAL AND ELECTRONIC MEASUREMENTS | SEMESTER IV |
|---|---|---|

| PREREQUISITES : | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 3 | 0 | 2 | 4 |

| | | |
|---|---|---|
| **Course Objectives** | To learn the construction, operation and its importance of instruments in measurements and provide practical experience to supplement the theoretical knowledge gained in the field of measurements. | |
| **UNIT – I** | **MEASUREMENTS OF ELECTRICAL QUANTITIES AND ERROR ANALYSIS** | **(9 Periods)** |
| Functional elements of Instruments, -Standards and calibrations - Principle of operation of permanent magnet moving coil, moving iron, dynamometer, induction, thermal and rectifier instruments - Extension of instrument ranges<br>Limiting errors of instruments - Combination of limiting errors – Gross, systematic and random errors in measurements - Statistical analysis of errors | | |
| **UNIT – II** | **MEASUREMENTS USING BRIDGES** | **(9 Periods)** |
| Wheatstone, Kelvin, Wein, Hay's, Maxwell, Anderson and Schering bridges - Q meter - Measurement of self and mutual inductances - Wagner earthing device - Megger. | | |
| **UNIT – III** | **MEASUREMENTS OF MAGNETIC QUANTITIES AND INSTRUMENT TRANSFORMERS** | **(9 Periods)** |
| Flux meters – B-H curve and permeability measurements on ring and bar specimens – Iron loss measurement by magnetic squares – Instrument transformers - types and errors - Instruments for measurement of frequency and power factor - maximum demand Indicator | | |
| **UNIT – IV** | **ELECTRONIC INSTRUMENTATION** | **(9 Periods)** |
| Sensors and Transducers – Signal Conditioning - Digital voltmeter – DMM – Digital Clamp meter - True RMS meter - Standard signal generators - Function generator - Spectrum analyzer - Power Quality analyzer- Introduction to virtual Instrumentation | | |
| **UNIT – V** | **DISPLAY DEVICES AND RECORDERS** | **(9 Periods)** |
| Digital storage oscilloscope – Active and passive probes - Errors in measurement – calibration of probes - Seven segment display – Dot matrix, LED, LCD - Concepts of Smart meters – Net metering - Data logger. | | |
| **LIST OF EXPERIMENTS** | | **(30 Periods)** |
| 1. Calibration of Ammeter, Voltmeter, Wattmeter and Energy meter.<br>2. Measurement of High Resistance by Loss of Charge method.<br>3. Burden Characteristics of Current Transformers.<br>4. Measurement of Sequence Impedances of Synchronous Machines.<br>5. Instrumentation Amplifier.<br>6. Study of DSO.<br>7. Study of smart meter and data logging.<br>8. Creating Virtual Instrumentation for simple applications. | | |
| **Contact Periods**:<br>**Lecture: 45 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 75 Periods** | | |

**TEXT BOOKS :**

| | |
|---|---|
| 1 | *Sawhney A.K.,* ***"A Course in Electrical and Electronics Measurements and Instrumentation"*** *DhanpatRai & Sons, 19th edition 2015* |
| 2 | *David A Bell,* ***"Electronic Instrumentation and Measurements"****, Third Edition, Ox for University Press, 2013* |

**REFERENCES:**


| | |
|---|---|
| 1 | *Golding E.W. and Widdis F.G.,* ***"Electrical Measurements and Measuring Instruments",*** *A.H. Wheeler & Co., Ahmedabad , 2003* |
| 2 | *A.D. Helfrick and W.D. Cooper,* ***"Modern Electronic Instrumentation and Measurement Techniques"****, Prentice Hall India Private Ltd., New Delhi, 2010* |
| 3 | *H.S. Kalsi,* ***"Electronic Instrumentation"****, Tata McGraw-Hill, New Delhi, 2010.* |
| 4 | *Jovitha Jerome* ***"Virtual Instrumentation Using LabVIEW"*** *PHI Learning Pvt. Ltd 1st Ed., 2010* |


| **COURSE OUTCOMES:**<br><br>Upon completion of the course, the students will be able to: | | **Bloom's Taxonomy Mapped** |
|---|---|---|
| CO1 | Understand the standards, characteristics and errors of measurements | K2 |
| CO2 | Demonstrate the operation of electrical and electronics measuring instruments | K3 |
| CO3 | Identify the kind of instrument for measurement of different quantities. | K3 |
| CO4 | Test and measure electrical and electronic parameters using instruments. | K4 |
| CO5 | Analyse and calculate all the parameters related to measurements | K4 |

**a) CO and PO Mapping**

| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | - | - | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | -0 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 1 | - | - | 1 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | - | 1 | 2 | 1 | - | - | 2 | 3 | 3 | 3 |
| **22EPC412** | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | 2 | 3 | 3 | 3 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| b) CO and Key Performance Indicators Mapping | | |
|---|---|---|
| CO1 | 1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.3,2.2.2,2.3.1,2.3.2,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.3,4.1.2,4.1.3,4.1.4,4.2.2,4.3.2,5.3.1,5.3.2,6.2.1,7.1.2,8.1.1,8.2.1,9.2.1,12.2.1,12.2.2,12.3.1,12.3.2 | |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.5,3.1.6,3.2.1,3.2.3,3.3.1,3.4.1,3.4.2,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,5.1.1,5.1.2,5.2.1,9.2.1, | |
| CO3 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.4,2.3.1,2.3.2,2.4.3,3.1.2,3.1.3,3.1.4,3.1.6,3.2.1,3.2.3,3.3.1,3.3.2,3.4.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,5.1.1,5.1.2,5.2.1,5.2.2,9.2.1,12.1.2 | |
| CO4 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,5.1.1,5.1.2,5.2.1,5.2.2,5.3.2,6.2.1,7.1.1,7.1.2,8.1.1,8.2.1,9.1.1,9.1.2,9.2.1,9.3.1,12.1.2,12.2.2,12.3.2 | |
| CO5 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,5.1.1,5.1.2,5.2.1,7.1.1,8.1.1,8.2.1,9.2.1,9.3.1,12.1.2,12.2.2,12.3.2 | |

| ASSESSMENT PATTERN – THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 10 | 40 | 30 | 20 | - | - | 100 |
| CAT2 | 10 | 40 | 30 | 20 | - | - | 100 |
| Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1 | - | 30 | 40 | 20 | 10 | - | 100 |
| Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2 | - | 30 | - | 40 | 30 | - | 100 |
| ESE | 10 | 40 | 30 | 20 | - | - | 100 |

| 22EES408 | ENGINEERING EXPLORATION | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | ES | 0 | 0 | 3 | 1.5 |

| | | |
|---|---|---|
| **Course Objectives** | The objective of the course is to provide an introduction to the engineering field. It is designed to help the student to learn about engineering and how it is useful in our everyday life. | |
| **UNIT – I** | **INTRODUCTION** | **(15 periods)** |
| Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes. | | |
| **UNIT – II** | **ENGINEERING DESIGN** | **(15 periods)** |
| Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements, Problem definition, Idea generation through brain storming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement. | | |
| **UNIT – III** | **ENGINEERING DISCIPLINES** | **(15 periods)** |
| Reading analog multimeter, measuring current, voltage and resistance, electricity from chemicals, solar cells, magnets. Ohms law and Watts law, circuit identification and circuit calculation, resister colour code, continuity. | | |
| **Contact Periods**:<br>**Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods** | | |

**REFERENCES :**


| | |
|---|---|
| 1 | *Ryan A Brown, Joshua W. Brown and Michael Berkihiser: "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.* |
| 2 | *Saeed Moaveni, "**Engineering Fundamentals: An Introducton to Engineering**", Cengage learning, Fourth Edition, 2011.* |


| COURSE OUTCOMES:<br>Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| CO1 | Explain technological and engineering development , change and impacts of engineering | K2 |
| CO2 | Complete initial steps ( Define a problem list criteria and constrains , Brainstorm potential solutions and document ideas) in engineering designs | K3 |
| CO3 | Communicate possible solutions through drawings and prepare project report. | K3 |
| CO4 | Draw sketches to a Design problem. | K3 |
| CO5 | Apply the concept of engineering fundamentals in Civil, Mechanical, Electrical and Computer Engineering. | K3 |

**COURSE ARTICULATION MATRIX**

**a)CO/PO Mapping**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| CO2 | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| CO3 | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | - |
| CO4 | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| CO5 | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| **22EES408** | 2 | - | 1 | 3 | 1 | 2 | - | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

**b) CO and Key Performance Indicators mapping**

| | |
|---|---|
| CO1 | 1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1 |
| CO2 | 1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1 |
| CO3 | 1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1 |
| CO4 | 1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1 |
| CO5 | 1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1 |

| 22EPC413 | ANALOG CIRCUITS AND DIGITAL IC LABORATORY | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| Electron Devices and circuits, Digital circuits | PC | 0 | 0 | 3 | 1.5 |

| Course Objectives | To illustrate the different electronic circuits and their application in practice. To get practice in doing projects related to analog and digital systems. |
|---|---|

**LIST OF EXPERIMENTS:**

1. Design of Rectifier for Filters.
2. Design of Oscillator circuits.
3. Design of Transistor amplifiers.
4. Instrumentation amplifier.
5. Applications of Operational Amplifiers.
6. Realization of a V-to-I & I-to-V converter using Op-Amps.
7. A/D and D/A Converters.
8. Study of VCO and PLL ICs.
9. Simulation of above circuits using software packages.
10. Design of Logic and Arithmetic Circuits.
11. Design of Registers ,Counters.
13. Multiplexer and Demultiplexer, Encoder and Decoder.
14. Synchronous / Asynchronous circuit design.
16. PAL / PLA implementation.
17. Design Entry and simulation of combinational and Sequential logic circuits (4 bit adders, Sequential Counter) using HDL.

**Contact Periods**:
**Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**

| COURSE OUTCOMES: Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| CO1 | Test various waveform generation circuits using Op Amps, Comparators and IC 's | K4 |
| CO2 | Realize the electronic circuit depends on applications | K3 |
| CO3 | Design and test various digital logic circuits. | K3 |
| CO4 | Build and debug analog and digital circuits implemented on breadboards | K4 |
| CO5 | Develop and demonstrate troubleshooting ability in real time applications | K5 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 3 | 3 | 2 | 3 | 3 | - | 1 | - | - | - | - | - | 3 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| **22EPC413** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 3 | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | |
|---|---|
| CO1 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,3.1.1,3.1.6,3.2.1,3.2.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.2.2,4.3.1,5.1.2,5.2.1,5.2.2,5.3.1,5.3.2,7.1.1 |
| CO2 | 1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.4,3.1.1,3.1.3,3.1.4,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.4,4.2.1,4.2.2,4.3.1,5.1.2,5.2.1,5.3.2,6.1.1,12.1.2,12.2.2,12.3.1 |
| CO3 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.4,3.1.1,3.1.3,3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.4,4.2.1,4.2.2,4.3.1,5.1.2,5.2.1,5.3.2,12.1.2,12.2.2,12.3.1 |
| CO4 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.4.2,2.4.3,3.1.1,3.1.3,3.1.5,3.1.6,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4,5.1.2,5.2.1,5.2.2,5.3.1 |
| CO5 | 1.1.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.4.2,2.4.3,3.1.1,3.1.3,3.1.5,3.1.6,3.2.3,3.3.1,3.3.2,3.4.2,4.1.1,4.1.2,4.1.3,4.2.1,4.3.1,4.3.2,4.3.4,5.1.2,5.2.1,5.2.2,5.3.1,6.1.1,7.1.1,7.2.1,12.1.2,12.2.2,12.3.1 |

| 22EPC414 | ELECTRICAL MACHINES LABORATORY – II | SEMESTER IV |
|---|---|---|

| PREREQUISITES | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|
| NIL | PC | 0 | 0 | 3 | 1.5 |

| Course Objectives | To provide hands-on training for evaluating the performance and characteristics of AC Machines and to identify the suitability of its applications. |
|---|---|

**LIST OF EXPERIMENTS:**

1. Regulation of Alternator by EMF and MMF Methods.
2. Load test on three phase Alternator.
3. Regulation of salient pole Alternator by Slip Test.
4. Regulation of Alternator by ZPF method.
5. V and Inverted V curves of Synchronous Motor.
6. Equivalent Circuit of three phase Induction Motor.
7. Load Test on three phase Induction Motor.
8. Load Test and V curves of Synchronous Induction motor.
9. Performance characteristics of three phase Induction Motor by Circle Diagram.
10. Load Test on single phase Induction Motor.
11. Speed control of Slip Ring Induction Motor.
12. Study of different types of starters for Induction Motors.
13. Load test on three phase induction motor with eddy current loading.
14. Analysis of electromagnet parameters such as Electromagnetic force and Electromagnetic Induction using simulation softwares.

**Contact Periods**:
**Lecture: 0 Periods Tutorial:0 Periods Practical: 45 Periods Total: 45 Periods**

| COURSE OUTCOMES: Upon completion of the course, the students will be able to: | | Bloom's Taxonomy Mapped |
|---|---|---|
| CO1 | Understand the performance characteristics of different types of AC Machines. | K2 |
| CO2 | Suggest suitable test for performance determination of Rotating AC Machines. | K3 |
| CO3 | Analyze and evaluate the performance of A.C. rotating machines. | K5 |
| CO4 | Identify suitable speed control methods for rotating machines. | K2 |
| CO5 | Evaluate the electrical apparatus to identify the suitability for different applications. | K5 |

**COURSE ARTICULATION MATRIX :**

| **a) CO and PO Mapping** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| CO1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | - | - | 2 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | - | 1 | - | - | 2 | 2 | 2 | 3 |
| CO3 | 2 | 2 | 2 | 2 | 2 | - | 2 | 1 | - | - | - | 1 | 2 | 3 | 2 |
| CO4 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | - | 1 | - | - | 2 | 1 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 1 | - | 3 | 1 | - | - | - | 1 | 2 | 3 | 2 |
| **22EPC414** | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | - | - | 2 | 2 | 3 | 3 |
| 1 – Slight, 2 – Moderate, 3 – Substantial | | | | | | | | | | | | | | | |

| **b) CO and Key Performance Indicators Mapping** | |
|---|---|
| CO1 | 1.1.1,1.3.1,2.1.2,2.2.1,2.2.4,2.3.1,2.4.2,2.4.4,3.1.1,3.1.3,3.1.5,3.2.1,3.2.2,3.2.3,3.3.2,4.1.1,4.2.1,4.3.1,4.3.2,4.3.3,5.1.1,5.2.2,6.2.1,7.1.2,8.1.1,9.2.2,12.1.1,12.2.1,12.3.1, |
| CO2 | 1.1.2,1.2.1,1.3.1,1.4.1,2.1.3,2.2.3,2.3.1,2.4.1,2.4.2,2.4.3,3.1.2,3.3.1,3.4.2,4.1.3,4.2.1,4.2.2,4.3.1,4.3.3,5.3.1,6.1.1,7.2.1,9.1.1,12.2.1,12.3.1,12.3.2, |
| CO3 | 1.1.1,1.3.1,2.1.1,2.2.1,2.2.2,2.4.2,2.4.4,3.1.1,3.1.4,3.1.6,3.2.2,3.3.2,3.4.1,4.1.1,4.1.4,4.3.1,4.3.4,5.1.2,5.2.2,5.3.2,7.1.2,7.2.1,8.1.1,12.1.2,12.2.2, |
| CO4 | 1.1.2,1.4.1,2.1.1,2.1.2,2.2.2,2.2.4,2.3.1,2.4.1,2.4.2,2.4.3,3.1.2,3.1.4,3.2.1,3.2.3,3.3.2,3.4.2,4.1.2,4.2.1,4.2.2,4.3.1,4.3.2,4.3.3,5.1.1,5.3.1,6.2.1,7.2.1,9.2.1,12.1.1,12.2.2,12.3.2, |
| CO5 | 1.1.1,1.2.1,1.3.1,1.4.1,2.1.2,2.2.1,2.2.2,2.2.3,2.3.1,2.3.2,2.4.2,2.4.4,3.1.2,3.1.4,3.1.5,3.2.1,3.3.1,3.4.1,4.1.4,4.2.2,4.3.3,5.2.1,5.3.2,7.1.1,7.2.1,7.2.2,8.2.1,12.1.1,12.3.1, |