# NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

**Curriculum and Syllabi**
**for**
**B.E – Electrical and Electronics Engineering [R17]**
**[CHOICE BASED CREDIT SYSTEM]**

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

**SEPTEMBER 2021**

**EEE Department PEO'S and PO'S**

**PROGRAMME EDUCATIONAL OBJECTIVES:**

**PEO1.** To provide fundamental knowledge to the students in Basic Sciences for the efficient practice of Engineering.

**PEO2.** To equip the students with the necessary subject knowledge in the design and analysis of Electrical and Electronic Systems.

**PEO3.** To prepare students for the modern work environment that emphasizes the need for lifelong learning so as to bring out innovative applications.

**PEO4.** To enrich the students with the necessary skills for prospective careers in the industry, government, pursuit of higher education and entrepreneurship.

**PEO5.** To enable students to communicate effectively, both individually and within teams, demonstrating ethical, respectful, and professional behavior so as to take up leadership positions in the society.

**PROGRAM OUTCOMES:**

The graduates of Electrical and Electronics Engineering will

| a-l | GRADUATE ATTRIBUTEs | PO No. | PROGRAMME OUTCOMEs |
|---|---|---|---|
| a | Engineering Knowledge | PO1 | Apply knowledge of mathematics, science and engineering to domain specific applications. |
| b | Problem Analysis | PO2 | Identify, analyze and formulate Electrical and Electronics Engineering problems based on the knowledge of basic sciences and engineering. |
| c | Design and Development of Solutions | PO3 | Design and develop Electrical and Electronic Engineering based solutions to meet the desired requirements. |
| d | Investigation of Complex Problems | PO4 | Investigate complex problems in the areas of power, control and energy to provide suitable solutions. |
| e | Modern Tool Usage | PO5 | Use the techniques, skills and modern engineering tools necessary for real world applications within realistic constraints. |
| f | The Engineer and Society | PO6 | Apply engineering solutions in societal and global contexts. |
| g | Environment and Sustainability | PO7 | Understand the impact of the solutions on the environment to ensure sustainability. |
| h | Ethics | PO8 | Understanding of professional and ethical responsibility. |
| i | Individual and Team Work. | PO9 | Function as an individual and as a part of multidisciplinary team to accomplish a common goal. |
| j | Communication | PO10 | Communicate effectively in both verbal and written forms. |
| k | Project Management and Finance | PO11 | Ability to use engineering and management principles, to manage projects and in multidisciplinary environments. |
| l | Lifelong Learning | PO12 | Recognition of the need for and ability to engage in lifelong learning. |

**PROGRAMME SPECIFIC OUTCOMES:**

**PSO 1:** Demonstrate knowledge and competence in the application of basic sciences, mathematics and fundamentals of electrical and electronics systems

**PSO 2:** Ability to explore complex engineering problems

**PSO 3:** Demonstrate the ability to communicate correctly, effectively work in a team and develop good personality

**PSO 4:** Apply appropriate techniques and modern engineering tools in core areas.

**Contribution** **1: Reasonable** **2: Significant** **3: Strong**

**MAPPING OF PROGRAMME EDUCATIONAL OUTCOMES WITH PROGRAMME OUTCOMES**

A broad relation between the programme objective and the outcomes is given in the following table

| PROGRAMME EDUCATIONAL OBJECTIVES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 |
| 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 3 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 3 |
| 4 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 2 |
| 5 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 |

**MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES**

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

| PROGRAM SPECIFIC OUTCOMES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 |
| 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 2 |
| 4 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 3 |

**NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052**

**REGULATIONS – 2017** **CHOICE BASED CREDIT SYSTEM**

**B.E. ELECTRICAL AND ELECTRONICS ENGINEERING**

**CURRICULUM: I-VIII SEMESTERS** **SYLLABUS: I &VIII SEMESTERS**

| SEMESTER: I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17EYA01 | Professional English- I | HS | - | 4 | 2 | 0 | 2 | 3 |
| 2. | 17MYB01 | Calculus and Solid Geometry | BS | - | 5 | 3 | 2 | 0 | 4 |
| 3. | 17PYB01 | Physics for Engineers | BS | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17CYBO2 | Applied Electrochemistry | BS | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17MEC01 | Engineering Graphics | ES | - | 4 | 2 | 2 | 0 | 3 |
| 6. | 17CSC02 | Python Programming | ES | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17CSP02 | Python Programming Laboratory | ES | - | 4 | 0 | 0 | 4 | 2 |
| 8. | 17GYP02 | Engineering Practices Laboratory | ES | - | 4 | 0 | 0 | 4 | 2 |
| 9. | 17GEP01 | Personal Values | HS | - | 2 | 0 | 0 | 2 | 0 |
| | | | | **TOTAL** | **32** | **16** | **4** | **12** | **23** |

| SEMESTER: II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17EYA02 | Professional English – II | HS | 17EYA01 | 4 | 2 | 0 | 2 | 3 |
| 2. | 17MYB02 | Complex Analysis and Laplace Transforms | BS | 17MYB01 | 5 | 3 | 2 | 0 | 4 |
| 3. | 17PYB05 | Physics of Solids | BS | 17PYB01 | 3 | 3 | 0 | 0 | 3 |
| 4. | 17CYB03 | Environmental Science | HS | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17GYC01 | Basics of Civil and Mechanical Engineering | ES | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEC02 | Electric Circuit Theory | PC | - | 5 | 3 | 2 | 0 | 4 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17GYP01 | Physics and Chemistry Laboratory | BS | - | 4 | 0 | 0 | 4 | 2 |
| 8. | 17EEP01 | Electric Circuit Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 9. | 17GEP02 | Inter personal Values | HS | 17GEP01 | 2 | 0 | 0 | 2 | 0 |
| | | | | **TOTAL** | **33** | **17** | **4** | **12** | **24** |

| SEMESTER: III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17MYB05 | Transforms and Partial Differential Equations | BS | 17MYB02 | 5 | 2 | 2 | 0 | 3 |
| 2. | 17EEC03 | Electronic Devices and Circuits | PC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEC04 | Electrical Machines-I | PC | 17EEC02 | 5 | 2 | 2 | 0 | 3 |
| 4. | 17EEC05 | Field Theory | PC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEC06 | Power Plant Engineering | ES | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17ITC03 | Data Structures and algorithms | ES | - | 5 | 2 | 0 | 2 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17EEP02 | Electronic Devices and Circuits Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 8. | 17EEP03 | Electrical Machines-I Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 9. | 17GED02 | Soft Skills- Reading and Writing | EEC | 17GED01 | 2 | 0 | 0 | 2 | 0 |
| | | | | **TOTAL** | **34** | **15** | **4** | **12** | **22** |

| SEMESTER: IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17MYB10 | Probability, Statistics & Numerical Methods | BS | 17MYB05 | 5 | 2 | 2 | 0 | 3 |
| 2. | 17EEC07 | Electrical Machines-II | PC | 17EEC04 | 5 | 2 | 2 | 0 | 3 |
| 3. | 17EEC08 | Linear Integrated Circuits | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 4. | 17EEC09 | Digital Logic Circuits | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEC10 | Transmission and Distribution | ES | 17EEC02 & 17EEC04 | 3 | 3 | 0 | 0 | 3 |
| 6. | E1 | Elective I (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17EEP04 | Electrical Machines-II | PC | 17EEP03 | 4 | 0 | 0 | 4 | 2 |
| 8. | 17EEP05 | Linear and Digital Integrated Circuits | PC | 17EEP02 | 4 | 0 | 0 | 4 | 2 |
| 9. | 17GED01 | Soft Skills- Listening and Speaking | EEC | - | 2 | 0 | 0 | 2 | 0 |
| 10. | 17GED03 | Personality and Character Development | EEC | - | 2 | 0 | 0 | 1 | 0 |
| | | | | **TOTAL** | **32** | **16** | **4** | **11** | **22** |

| SEMESTER:V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17GEA02 | Principles of Management | HS | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 17EEC11 | Measurements and Instrumentation | PC | 17EEC08 | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEC12 | Control Systems | PC | 17EEC04 & 17EEC07 | 5 | 3 | 2 | 0 | 4 |
| 4. | 17EEC13 | Power Electronics | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEC14 | Communication Engineering | ES | 17EEC09 | 3 | 3 | 0 | 0 | 3 |
| 6. | E2 | Elective II (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17EEP06 | Control and Instrumentation Laboratory | PC | 17EEP03 & 17EEP04 | 4 | 0 | 0 | 4 | 2 |
| 8. | 17EEP07 | Power Electronics Laboratory | PC | 17EEP02 | 4 | 0 | 0 | 4 | 2 |
| 9. | 17GED08 | Essence of Indian traditional knowledge | EEC | - | 2 | 2 | 0 | 0 | 0 |
| | | | | **TOTAL** | **30** | **20** | **2** | **8** | **23** |

| SEMESTER:VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17EEC15 | Power System Analysis | PC | 17EEC10 | 5 | 3 | 2 | 0 | 4 |
| 2. | 17EEC16 | Microprocessor and Microcontroller | PC | 17EEC09 | 3 | 3 | 0 | 0 | 3 |
| 3. | E3 | Elective III (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 4. | E4 | Elective IV (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 5. | E5 | Elective V (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 6. | E6 | Elective VI (PSE/OE) | PSE/OE | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7. | 17EEP08 | Microprocessor and Microcontroller Laboratory | PC | 17EEP05 | 4 | 0 | 0 | 4 | 2 |
| 8. | 17GED06 | Comprehension | EEC | - | 2 | 0 | 0 | 2 | 0 |
| 9. | 17GED07 | Constitution of India | EEC | - | 2 | 2 | 0 | 0 | 0 |
| | | | | **TOTAL** | **28** | **20** | **2** | **6** | **21** |

| SEMESTER: VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | 17EEC17 | Electric Drives and Control | PC | 17EEC04, 17EEC07 & 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 2. | 17EEC18 | Power System Protection and Switch Gear | PC | 17EEC04, 17EEC07 & 17EEC10 | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEC19 | Principles of Embedded Systems | ES | 17EEC16 | 3 | 3 | 0 | 0 | 3 |
| 4. | 17EEC20 | Power System Operation and Control | PC | 17EEC10, 17EEC15 | 3 | 3 | 0 | 0 | 3 |
| 5. | E7 | Elective VII (PSE/OE) | PSE/OE | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 6. | 17EEP09 | Power System Simulation Laboratory | PC | - | 2 | 0 | 0 | 4 | 2 |
| 7. | 17EED01 | Project Work I | EEC | - | 8 | 0 | 0 | 8 | 4 |
| | | | | **TOTAL** | **25** | **15** | **0** | **12** | **21** |

| SEMESTER: VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1. | E8 | Elective VIII (PSE) | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 2. | E9 | Elective IX (OE) | OE | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 3. | 17EED02 | Project Work II | EEC | 17EED01 | 16 | 0 | 0 | 16 | 8 |
| | | | | **TOTAL** | **22** | **6** | **0** | **16** | **14** |

**TOTAL NO. OF CREDITS: 170**

# NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE

**REGULATIONS – 2017** **CHOICE BASED CREDIT SYSTEM**

**B.E. ELECTRICAL AND ELECTRONICS ENGINEERING**

**(A) HS,BS, and ES Courses**

| (a) Humanities and Social Sciences (HS) | Credit Distribution:12-17 | AICTE Norm:5 to 10% |
|---|---|---|

| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 17EYA01 | Professional English- I | HS | - | 4 | 2 | 0 | 2 | 3 |
| 2. | 17GEP01 | Personal Values | HS | - | 2 | 0 | 0 | 2 | 0 |
| 3. | 17EYA02 | Professional English – II | HS | 17EYA01 | 4 | 2 | 0 | 2 | 3 |
| 4. | 17GEP02 | Inter personal Values | HS | 17GEP01 | 2 | 0 | 0 | 2 | 0 |
| 5. | 17CYB03 | Environmental Science | HS | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17GEA02 | Principles of Management | HS | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17GEA03 | Total Quality Management | HS | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 17GEA04 | Professional ethics and Human Values | HS | - | 3 | 3 | 0 | 0 | 3 |

| (b) Basic Sciences (BS) | Credit Distribution:17-21 | AICTE Norm:17 to 20% |
|---|---|---|

| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 17MYB01 | Calculus and Solid Geometry | BS | - | 5 | 3 | 2 | 0 | 4 |
| 2. | 17PYB01 | Physics for Engineers | BS | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17CYB01 | Applied Electrochemistry | BS | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17GYP01 | Physics and Chemistry Laboratory | BS | - | 4 | 0 | 0 | 4 | 2 |
| 5. | 17MYB02 | Complex Analysis and Laplace Transforms | BS | 17MYB01 | 5 | 3 | 2 | 0 | 4 |
| 6. | 17PYB05 | Physics of Solids | BS | 17PYB01 | 3 | 3 | 0 | 0 | 3 |
| 7. | 17MYB05 | Transforms and Partial Differential Equations | BS | 17MYB02 | 5 | 2 | 2 | 0 | 3 |
| 8. | 17MYB10 | Probability, Statistics and Numerical Methods | BS | 17MYB05 | 5 | 2 | 2 | 0 | 3 |

| (c) Engineering Sciences (ES) | Credit Distribution:17-21 | AICTE Norm:17 to 20% |
|---|---|---|

| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 17MEC01 | Engineering Graphics | ES | - | 4 | 2 | 2 | 0 | 3 |
| 2. | 17CSC02 | Python Programming | ES | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17CSP02 | Python Programming Laboratory | ES | - | 4 | 0 | 0 | 4 | 2 |
| 4. | 17GYP02 | Engineering Practices Laboratory | ES | - | 4 | 0 | 0 | 4 | 2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5. | 17GYC01 | Basics of Civil and Mechanical Engineering | ES | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEC06 | Power Plant Engineering | ES | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17ITC03 | Data Structures and Algorithms | ES | 17CSC02 | 3 | 2 | 0 | 2 | 3 |
| 8. | 17EEC10 | Transmission and Distribution | ES | 17EEC02 & 17EEC04 | 3 | 3 | 0 | 0 | 3 |
| 9. | 17EEC14 | Communication Engineering | ES | 17EEC09 | 3 | 3 | 0 | 0 | 3 |
| 10. | 17EEC19 | Principles of Embedded Systems | ES | 17EEC16 | 3 | 3 | 0 | 0 | 3 |

| **(B) Programme Core Courses (PC)** | | | Credit Distribution:63-72 | | AICTE Norm:30 to 40% | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 17EEC02 | Electric Circuit Theory | PC | - | 5 | 3 | 2 | 0 | 4 |
| 2. | 17EEP01 | Electric Circuits Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 3. | 17EEC03 | Electronic Devices and Circuits | PC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17EEC04 | Electrical Machines-I | PC | 17EEC02 | 5 | 2 | 2 | 0 | 3 |
| 5. | 17EEC05 | Field Theory | PC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEP02 | Electronic Devices and Circuits Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 7. | 17EEP03 | Electrical Machines-I Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |
| 8. | 17EEC07 | Electrical Machines-II | PC | 17EEC04 | 5 | 2 | 2 | 0 | 3 |
| 9. | 17EEC08 | Linear Integrated Circuits | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 10. | 17EEC09 | Digital Logic Circuits | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 11. | 17EEP04 | Electrical Machines-II Laboratory | PC | 17EEP03 | 4 | 0 | 0 | 4 | 2 |
| 12. | 17EEP05 | Linear and Digital Integrated Circuits Laboratory | PC | 17EEP02 | 4 | 0 | 0 | 4 | 2 |
| 13. | 17EEC11 | Measurements and Instrumentation | PC | 17EEC08 | 3 | 3 | 0 | 0 | 3 |
| 14. | 17EEC12 | Control Systems | PC | 17EEC04 & 17EEC07 | 3 | 3 | 0 | 0 | 3 |
| 15. | 17EEC13 | Power Electronics | PC | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 16. | 17EEP06 | Control and Instrumentation Laboratory | PC | 17EEP03 & 17EEP04 | 4 | 0 | 0 | 4 | 2 |
| 17. | 17EEP07 | Power Electronics Laboratory | PC | 17EEP02 | 4 | 0 | 0 | 4 | 2 |
| 18. | 17EEC15 | Power System Analysis | PC | 17EEC10 | 5 | 3 | 2 | 0 | 4 |
| 19. | 17EEC16 | Microprocessor and Microcontroller | PC | 17EEC09 | 3 | 3 | 0 | 0 | 3 |
| 20. | 17EEC17 | Electric Drives and Control | PC | 17EEC04, 17EEC07 & 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 21. | 17EEP08 | Microprocessor and Microcontroller Laboratory | PC | 17EEP05 | 4 | 0 | 0 | 4 | 2 |
| 22. | 17EEC18 | Power System Protection and Switch Gear | PC | 17EEC04, 17EEC07 & 17EEC10 | 3 | 3 | 0 | 0 | 3 |
| 23. | 17EEC19 | Principles of Embedded Systems | PC | 17EEC16 | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 24. | 17EEC20 | Power System Operation and Control | PC | 17EEC10, 17EEC15 | 3 | 3 | 0 | 0 | 3 |
| 25 | 17EEP09 | Power System Simulation Laboratory | PC | - | 4 | 0 | 0 | 4 | 2 |

| **(C) Elective Courses** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (a) Program Specific Electives(PSE) | | | Credit Distribution:18-21 | | AICTE Norm:10 to 17% | | | | |
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 17EEX01 | Fundamentals of Fiber Optics and Laser Instrumentation | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 17EEX02 | Energy Studies | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEX03 | Semiconducting Materials and Devices | PSE | 17EEC03 | 3 | 3 | 0 | 0 | 3 |
| 4. | 17ITC08 | Fundamentals of JAVA Programming | PSE | - | 3 | 2 | 0 | 2 | 3 |
| 5. | 17EEX04 | Network Theory | PSE | 17EEC02 | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEX05 | Computer Architecture and Organization | PSE | 17EEC09 | 3 | 3 | 0 | 0 | 3 |
| 7. | 17ITC12 | Database Systems Concepts | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 17EEX06 | Discrete Time Systems and Signal Processing | PSE | 17EEC09 & 17EEC12 | 3 | 3 | 0 | 0 | 3 |
| 9. | 17EEX07 | Design of Electrical Machines | PSE | 17EEC02, 17EEC04 & 17EEC07 | 3 | 3 | 0 | 0 | 3 |
| 10. | 17EEX08 | Energy Management and Auditing | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 11. | 17EEX09 | Computer Networks and protocols | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 12. | 17EEX10 | Special Electrical Machines | PSE | 17EEC04 & 17EEC07 | 3 | 3 | 0 | 0 | 3 |
| 13. | 17EEX11 | Bio Medical Instrumentation and its Applications | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 14. | 17EEX12 | Wind and Solar Electrical System | PSE | 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 15. | 17EEX13 | Power Electronics for Renewable Energy Systems | PSE | 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 16. | 17EEX14 | Computer Aided Design of Electrical Apparatus | PSE | 17EEC04 & 17EEC07 | 3 | 3 | 0 | 0 | 3 |
| 17. | 17EEX16 | High Voltage Engineering | PSE | 17EEC02 | 3 | 3 | 0 | 0 | 3 |
| 18. | 17EEX17 | Power Semiconductor Devices and Applications | PSE | 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 19. | 17EEX18 | Power Quality | PSE | 17EEC13 | 3 | 3 | 0 | 0 | 3 |
| 20. | 17ECX16 | Internet of Things and its applications | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 21. | 17GEA03 | Total Quality Management | PSE | - | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 22. | 17EEX19 | PLC and Automation | PSE | 17EEC03,04,07 | 3 | 3 | 0 | 0 | 3 |
| 23. | 17EEX20 | Flexible AC Transmission Systems | PSE | 17EEC10 & 17EEC15 | 3 | 3 | 0 | 0 | 3 |
| 24. | 17GEA04 | Professional Ethics and Human Values | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 25. | 17EEX21 | Power System Dynamics | PSE | 17EEC10 & 17EEC15 | 3 | 3 | 0 | 0 | 3 |
| 26. | 17EEX22 | Fundamentals of Electric Power Utilization | PSE | 17EEC04, 17EEC07 &17EEC17 | 3 | 3 | 0 | 0 | 3 |
| 27. | 17EEX23 | Engineering Automotive Electronic Systems | PSE | 17EEC03, 17EEC16 | 3 | 3 | 0 | 0 | 3 |
| 28. | 17EEX24 | Thermodynamics | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 29. | 17ITX26 | Problem Solving and Algorithmic Skills | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 30. | 17CSX31 | Problem Solving and Programming | PSE | - | 3 | 3 | 0 | 0 | 3 |
| 31. | 17EEX25 | Electric and Hybrid Vehicles | PSE | 17EEC04, 17EEC07, 17EEC17 | 3 | 3 | 0 | 0 | 3 |
| 32 | 17ITX37 | Problem solving using JAVA | PSE | | 3 | 3 | 0 | 0 | 3 |

| **(b)Open Electives** | | | **AICTE Credit Distribution Norm:18** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE – RQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** | P.S |
| 1. | 17AGZ01 | Baking and Confectionery Technology | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 2. | 17AGZ02 | Food safety and quality control system | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 3. | 17AGZ03 | Farm Mechanization | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 4. | 17AGZ04 | Processing of Fruits and Vegetables | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 5. | 17CHZ01 | Waste Water Treatment | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 6. | 17CHZ02 | Piping Engineering | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 7. | 17CHZ03 | Process Automation | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 8. | 17CHZ04 | Process Instrumentation | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 9. | 17CEZ01 | Energy conservation in buildings | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 10. | 17CEZ02 | Air Pollution Management | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 11. | 17CEZ03 | Building Services | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12. | 17CEZ04 | Road Safety Management | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 13 | 17CEZ05 | Waste Management | OE | - | 3 | 3 | 0 | 0 | 3 | VII/VIII |
| 14. | 17CSZ01 | Design Thinking | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 15. | 17CSZ02 | Digital Marketing | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 16. | 17CSZ03 | Software Engineering | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 17. | 17CSZ04 | Unified Functional Testing | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 18 | 17CSZ05 | C Programming | OE | - | 3 | 3 | 0 | 0 | 3 | VI |
| 19. | 17CSZ06 | Data Structures | OE | - | 3 | 3 | 0 | 0 | 3 | VI |
| 20. | 17CSZ07 | Web Services using Java | OE | - | 3 | 3 | 0 | 0 | 3 | VI |
| 21. | 17ECZ01 | Modern wireless communication system | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 22. | 17ECZ02 | Consumer Electronics | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 23. | 17ECZ03 | Automotive Electronics | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 24. | 17ECZ04 | Electronic Testing | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 25. | 17EEZ01 | Renewable Energy Technology | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 26. | 17EEZ02 | Smart Grid | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 27 | 17EEZ03 | Energy Auditing, Conservation and Management | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 28 | 17EEZ04 | Electrical Machines | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 29 | 17EIZ01 | Autotronix | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 30 | 17EIZ02 | Industrial Automation | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 31. | 17EIZ03 | Fiber Optic Sensors | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 32. | 17EIZ04 | Ultrasonic Instrumentation | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 33. | 17ITZ01 | Software Testing Tool | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 34. | 17ITZ02 | User Experience | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 35. | 17ITZ03 | Developing Mobile Apps | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 36. | 17ITZ04 | Software Project Management | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 37. | 17ITZ05 | Java Programming | OE | - | 3 | 3 | 0 | 0 | 3 | VII |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 38. | 17MEZ01 | Engineering Ergonomics | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 39. | 17MEZ02 | Energy Audit and Resource Management | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 40. | 17MEZ03 | Electric Vehicle Technology | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 41. | 17MEZ04 | Value Engineering | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 42. | 17MEZ05 | Smart Mobility | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 43. | 17MEZ06 | Smart Sensor Systems | OE | - | 3 | 3 | 0 | 0 | 3 | VII / VIII |
| 44. | 17MYZ01 | Mathematical Structures | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 45. | 17MYZ02 | Optimization Techniques | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 46. | 17MYZ03 | Statics for Engineers | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 47. | 17MYZ04 | Statistics for Engineers | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 48. | 17PYZ01 | Nanomaterials | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 49. | 17PYZ02 | Nuclear physics and Reactors | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 50.. | 17PYZ03 | Space science and technology | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 51 | 17CYZ01 | Chemistry for Every Day Life | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 52 | 17CYZ02 | E - Waste Management | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 53 | 17CYZ03 | Industrial Chemistry | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 54 | 17EYZ01 | Communicative Hindi | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 55 | 17EYZ02 | Fundamentals of German | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 56 | 17EYZ03 | Basics of Japanese | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 57 | 17EYZ04 | Employability Enhancement and Analytical Skills | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 58 | 17EYZ05 | Workplace Communication | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 59. | 17GYZ01 | Biology for Engineers | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 60. | 17BMZ01 | Health care technology | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 61. | 17BMZ02 | Telemedicine | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 62. | 17BMZ03 | Epidemiology and Pandemic Management | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 63 | 17BMZ04 | Medical Ethics | OE | - | 3 | 3 | 0 | 0 | 3 | VII |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 17EYX01 | Effective Communication | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 65 | 17AIZ01 | Fundamentals of artificial intelligence and machine learning | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 66 | 17AIZ02 | Data science fundamentals | OE | - | 3 | 3 | 0 | 0 | 3 | VII |
| 67 | 17AIZ03 | Introduction to Business analytics | OE | - | 3 | 3 | 0 | 0 | 3 | VIII |
| 68 | 17AIZ04 | Augmented reality/virtual reality technologies | OE | - | 3 | 3 | 0 | 0 | 3 | VII |

| **(D) Project** | | | Credit Distribution:12 | | AICTE Norm:7 to 12% | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 17EED01 | Project Work I | EEC | - | 8 | 0 | 0 | 8 | 4 |
| 2. | 17EED02 | Project Work II | EEC | 17EED01 | 16 | 0 | 0 | 16 | 8 |
| **(E) Skill/Proficiency based courses(Not to be included in CGPA)** | | | Credit Distribution: Non-Credit | | AICTE Norm:3% | | | | |
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PREREQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 17GED02 | Soft Skills- Reading and Writing | EEC | 17GED01 | 2 | 0 | 0 | 2 | 0 |
| 2. | 17GED01 | Soft Skills- Listening and Speaking | EEC | - | 2 | 0 | 0 | 2 | 0 |
| 3. | 17GED03 | Personality and Character Development | EEC | - | 2 | 0 | 0 | 1 | 0 |
| 4. | 17GED08 | Essence of Indian Traditional Knowledge | EEC | - | 2 | 2 | 0 | 0 | 0 |
| 5. | 17GED06 | Comprehension | EEC | - | 2 | 0 | 0 | 2 | 0 |
| 6. | 17GED07 | Constitution of India | EEC | - | 2 | 2 | 0 | 0 | 0 |

| Honor Degree Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **VERTICAL I – EMBEDDED SYSTEMS** | | | | | | | | |
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 17EEX26 | Embedded System design | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 17EEX27 | Embedded System for automotive applications | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEX28 | Signal Processing | - | 3 | 3 | 0 | 0 | 3 |
| 4 | 17EEX29 | Embedded control system | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEX30 | Embedded Processors | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEX31 | Embedded networking | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17EEX32 | VLSI Design techniques | - | 3 | 3 | 0 | 0 | 3 |
| 8 | 17EEX33 | Embedded IOT | - | 3 | 3 | 0 | 0 | 3 |

| VERTICAL II - ELECTRIC VEHICLE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 17EEX34 | Fundamentals of Electric Vehicles | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 17EEX35 | Battery pack modeling and Charging of Electric Vehicle | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEX36 | EV Design and Development | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17EEX37 | Hybrid Electric Vehicles | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEX38 | Testing and Electric Vehicle Policy | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEX39 | EV Intelligent System | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17EEX40 | Electrical Vehicles in Smart grid | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 17EEX41 | Design of motor and power converters for Electric Vehicles | - | 3 | 3 | 0 | 0 | 3 |

| Minor Degree Courses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ELECTRICAL SYSTEMS** | | | | | | | | |
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **PRERQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 17EEM01 | Electric Circuits | - | 3 | 2 | 1 | 0 | 3 |
| 2. | 17EEM02 | Solid State Devices | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17EEM03 | Power Semiconductor devices | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17EEM04 | Electrical measurements and Instruments | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17EEM05 | Basics of Electrical Machines. | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17EEM06 | Electric Drives | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17EEM07 | Power Systems | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 17EEM08 | Renewable Energy System | - | 3 | 3 | 0 | 0 | 3 |

| SUMMARY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No.** | **SUBJECT** | **CREDITS AS PER SEMESTER** | | | | | | | **CREDITS TOTAL** |
| | | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| **1.** | **HS** | **3** | **6** | **0** | **0** | **3** | **0** | **0** | **0** | **12** |
| **2.** | **BS** | **10** | **9** | **3** | **3** | **0** | **0** | **0** | **0** | **25** |
| **3.** | **ES** | **10** | **3** | **6** | **3** | **3** | **0** | **3** | **0** | **28** |
| **4.** | **PC** | **0** | **6** | **13** | **13** | **14** | **9** | **11** | **0** | **66** |
| **5.** | **PSE** | **0** | **0** | **0** | **3** | **3** | **12** | **0** | **3** | **21** |
| **6.** | **OE** | **0** | **0** | **0** | **0** | **0** | **0** | **3** | **3** | **6** |
| **7.** | **EEC** | **0** | **0** | **0** | **0** | **0** | **0** | **4** | **8** | **12** |
| **CREDITS TOTAL** | | **23** | **24** | **22** | **22** | **23** | **21** | **21** | **14** | **170** |

| 17EYA01– PROFESSIONAL ENGLISH – I<br>*(Common to All Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN: TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program Outcomes** |
| **1.0** | To articulate and enunciate words and sentences clearly and efficiently using grammatical structures. | **1.1** | The students will be able to construct clear, grammatically correct sentences using a variety of sentence structures and appropriate vocabulary. | | **h,i,j,l** |
| **2.0** | To acquire information through listening and apply it to persuade or articulate one's own point of view. | **2.1** | The students will be able to utilize listening skills to articulate one's own point of view in different circumstances. | | **e,h,i,j,l** |
| **3.0** | To enable students to express themselves fluently and appropriately in social and professional contexts. | **3.1** | The students will be able to apply appropriate communication skills across settings, purposes, and audiences. | | **e,h,i,j,l** |
| **4.0** | To summarize and paraphrase information in a text through reading skills. | **4.1** | The students will be able to distinguish main ideas and supporting details and employ active reading strategies to understand texts at the maximum level. | | **e,h,i,j,l** |
| **5.0** | To understand different techniques and contents based on the written communication. | **5.1** | The students will be able to equip themselves with writing skills needed for academic as well as workplace contexts. | | **e,h,i,j,l** |

| **UNIT I - FOCUS ON LANGUAGE** | **(6+6)** |
|---|---|
| Parts of Speech – Articles - Primary Auxiliaries – Modal Auxiliaries - Questions ('Yes/No' & 'Wh' Type) – Negatives - Prepositions – Conjunctions - Tenses (Simple, Continuous, Perfect, Perfect Continuous) - Vocabulary (Synonyms & Antonyms) - Homophones – Homonyms - One Word Substitution | |
| **UNIT II – LISTENING FOR EFFECTIVENESS** | **(6+6)** |
| Listening to Short Conversations or Monologues - Listening to Verbal and Non-Verbal Communication – Listening to Announcements - Listening and Note-taking – Listening to Telephonic Conversations – Listening to TED/ Ink talks- Intensive listening to fill in the gapped text | |
| **UNIT III – COMMUNICATION BOOSTERS** | **(6+6)** |
| Introducing Oneself – Exchanging Personal information (Likes & Dislikes) – Talking about Family & Friends - Asking about Routine Actions and Expressing Opinions - Participating in Short Conversations - Situational Talk | |
| **UNIT IV – PROFESSIONAL READING** | **(6+6)** |
| Skimming – Scanning (Short Texts and Longer Passages) – Inferring Technical Texts – Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting – Practicing Speed Reading - Reading Comprehension (Multiple choice / Short / Open ended Questions) - Gap Filling | |

| UNIT V – TECHNICAL CORRESPONDENCE | (6+6) |
|---|---|
| Seeking Permission for Industrial Visit & In-plant Training – Checklist – Instruction - E-mail Writing - Report Writing (Accident & Survey) | |

**LIST OF SKILLS ASSESSED IN THE LABORATORY**

1. Language Skills.
2. Listening Skills.
3. Speaking Skills.
4. Reading Skills
5. Writing Skills

**TOTAL (L:30, P:30) = 60 PERIODS**

**TEXT / REFERENCE BOOKS:**


1. Sudharshana, N.P and Saveetha.C. “English for Technical Communication”. New Delhi :Cambridge University Press, 2016.
2. Jackman, Vanessa and Russell, Whitehead. “Cambridge English Business Preliminary Practice Tests”. New Delhi: Oxford University Press, 2016.
3. Rizvi, Ashraf M. “Effective Technical Communication”. New Delhi: Tata McGRaw Hill Publishing Company Limited, 2006.
4. Hewings, M. “Advanced English Grammar”. Chennai: Cambridge University Press, 2000.


| 17MYB01 - CALCULUS AND SOLID GEOMETRY<br>*( Common to all Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **2** | **0** | **4** |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN: TYPE - 4** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program Outcomes** |
| **1.0** | To develop the use of matrix algebra techniques those are needed by engineers for practical applications. | **1.1** | The students will be able to apply the concept of orthogonal reduction to diagonalise the given matrix. | | **a,b,c,e,g,i,k** |
| **2.0** | Use the techniques, Skills and Engineering tools necessary for engineering practice, with Geometric concepts. | **2.1** | The students will be able to have knowledge about the geometrical aspects of sphere. | | **a,b,c,e,f,i,k** |
| **3.0** | To improve their ability in solving geometrical applications of differential calculus problems. | **3.1** | The students will be able to find the radius of curvature, circle of curvature and centre of curvature for a given curve. | | **a,b,c,i,k** |
| **4.0** | To learn the important role of Mathematical concepts in engineering applications with the functions of several variables. | **4.1** | The students will be able to classify the maxima and minima for a given function with several variables, through by finding stationary points. | | **a,b,c,d,k** |
| **5.0** | To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. | **5.1** | The students will be able to demonstrate the use of double and triple integrals to compute area and volume. | | **a,b,c,d,f,i,k** |

| **UNIT I - MATRICES** | **(9+6)** |
|---|---|
| Characteristic Equation-Eigen values and Eigen vectors of a matrix –Properties(statement only)- Cayley Hamilton Theorem and its applications- Orthogonal transformation of a symmetric matrix to a diagonal form - Quadratic form- Reduction of a Quadratic form to canonical form by orthogonal transformation. | |
| **UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS** | **(9+6)** |
| Equation of a Plane –Angle between two planes - Equation of straight lines-Coplanar lines- skew lines- Equation of a sphere – Orthogonal spheres. | |
| **UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS** | **(9+6)** |
| Curvature – Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes-Envelopes. | |
| **UNIT IV - FUNCTIONS OF SEVERAL VARIABLES** | **(9+6)** |
| Partial derivatives - Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of two variables-Constrained Maxima and Minima by Lagrange's multiplier method. | |

| UNIT V - MULTIPLE INTEGRALS | (9+6) |
|---|---|
| Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral- Triple integration in Cartesian Co-ordinates-Volume as triple integrals. | |
| | **TOTAL (L: 45+T:30) = 75 PERIODS** |

**Note : Simulation of Engineering Problems ( Qualitative Analysis) using open source software**

**TEXT BOOKS:**


1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & sons, 2013.
3. Veerarajan.T, "Engineering Mathematics for Semester I & II ", Third Edition, Tata McGraw Hill,2014.


**REFERENCES:**


1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Sem-II", 5th Edition, Laxmi Publications.2011.
2. Kandasamy .P, Thilagavathy .K , Gunavathy .K , "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7thEdition, Wiley India, (2007).


| 17PYB01- PHYSICS FOR ENGINEERS<br>*( Common to All Branches except CSE and IT)* | | | | |
|---|---|---|---|---|
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

| **PREREQUISITE : NIL** | **QUESTION PATTERN: TYPE - 1** |
|---|---|

**COURSE OBJECTIVES AND OUTCOMES:**

| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** |
|---|---|---|---|---|
| **1.0** | To provide the basic ideas in all the kinds of engineering branches | **1.1** | The students will be able to acquire knowledge regarding Acoustics and ultrasonic | **a** |
| **2.0** | To develop the skills of the students in physics under various applications | **2.1** | The students will be able to apply knowledge in the fields of optics & laser technology | **a,b** |
| **3.0** | To cultivate the censor designing ability of the students | **3.1** | The students will be able to design the sensors using the knowledge of fiber optics | **a** |
| **4.0** | To provide knowledge in wave and particle physics | **4.1** | The students will be able to gain the knowledge of wave, particle nature and matter waves | **a** |
| **5.0** | To provide the fundamental knowledge in basics of crystals | **5.1** | The students will be able to analyze the different kind of crystal structures and crystal growth | **a** |

| **UNIT I - ULTRASONICS & ACOUSTICS** | **(9)** |
|---|---|

Ultrasonics: Introduction - Properties of Ultrasonics- Magnetostriction and piezo electric methods. Measurement of velocity using acoustic grating- Ultrasonic A B C scan methods - Sonogram.

Acoustics: characteristics of musical sound – loudness – Weber – Fechner law – absorption coefficient – reverberation – reverberation time –Factors affecting acoustics of buildings and their remedies.

| **UNIT II – OPTICS & LASER TECHNOLOGY** | **(9)** |
|---|---|

Interference: Air wedge – theory – uses – testing of flat surfaces – determination of thickness of a thin wire.

Types of lasers – Nd – YAG laser – CO2 laser – semiconductor laser (homojunction & hetrojuction). Applications: Determination of particle size using laser - Holography – construction – reconstruction – Lasers in industry (Material Processing) and Medical field (Surgery)

| **UNIT III - FIBER OPTICS AND SENSORS** | **(9)** |
|---|---|

Principle of light transmission through fiber - expression for acceptance angle and numerical aperture – Fabrication of optical fibers- Double crucible method - types of optical fibers (material, refractive Index profile and mode) fiber optic communication system. Splicing – Applications of optical fiber - Sensors- temperature- pressure sensor and displacement sensor Medical Endoscope.

| UNIT IV – WAVE AND PARTICLE PHYSICS | (9) |
|---|---|
| Development of quantum theory – de Broglie wavelength – properties of matter waves - G.P Thomson experiment - Schrödinger's wave equation – time dependent – time independent wave equations – physical significance – applications – particle in a one dimensional potential box - Compton Effect – theory and experimental verification. | |
| **UNIT V - CRYSTALLOGRAPHY** | **(9)** |
| Lattice – unit cell – Bravais lattices – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques- solution, melt (Czochralski) and vapour growth techniques(qualitative) | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**


1. V. Rajendran, "Engineering Physics", Tata McGraw-Hill, New Delhi, 2011.
2. G Senthilkumar. "Engineering Physics" VRB Publishers, 2011


**REFERENCES:**


1. P. K. Palanisami, "Physics for Engineers", Vol. 1, Scitech Pub. (India) Pvt. Ltd., Chennai, 2002.
2. M. N. Avadhanulu and P. G. Kshirsagar, "A Textbook of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2005
3. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2006.


| 17CYB02 – APPIED ELECTRO CHEMISTRY<br>*(Common to ECE,EEE , EIE & BME Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN: TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand the principles of water characterization and treatment methods | **1.1** | The students will be able to apply knowledge of fundamental principles of chemistry | | **a, f** |
| **2.0** | To introduce the basic concepts of electrode potential and batteries | **2.1** | The students will be able to define and solve engineering problems, including the utilization of creative and innovative skills | | **a, g** |
| **3.0** | To understand the principles and applications of corrosion | **3.1** | The students will be able to gain practical experience with chemical process equipment as well as to analyze and interpret data | | **a, c** |
| **4.0** | To provide the knowledge polymer chemistry and nanomaterials. | **4.1** | The students will be able to understand the impact of engineering solutions in a global, economic, environmental and societal content | | **a, c, f** |
| **5.0** | To study about the alloys and phase rule. | **5.1** | The students will be able to understand the management of electronic waste | | **a, f** |

| **UNIT I - WATER TECHNOLOGY** | **(9)** |
|---|---|
| Hardness - types - estimation by EDTA method - Domestic water treatment - disinfection methods (chlorination, ozonation and UV treatment) - Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) -Internal conditioning(carbonate, phosphate and calgon) - External conditioning - demineralization process - desalination - reverse osmosis method. | |
| **UNIT II - ELECTROCHEMISTRY** | **(9)** |
| Electrochemistry - electrode potential - Nernst equation and problems - Reference electrode - standard hydrogen electrode - calomel electrode - potentiometric titration (redox) - conductometric titration (strong acid – strong base) - Batteries - types - lead acid battery – fuel cell – hydrogen and oxygen fuel cell. | |
| **UNIT III - CORROSION SCIENCE** | **(9)** |
| Corrosion - definition – types - chemical and electrochemical corrosion (mechanism) – Galvanic corrosion – Differential aeration corrosion - Pitting corrosion – Factors influencing corrosion- Corrosion control - sacrificial anode method. | |
| **UNIT IV - POLYMERS AND NANOMATERIALS** | **(9)** |
| Polymers - classification, addition, condensation and co polymerization - Plastics - thermoplastics and thermosetting plastics - Engineering plastics - preparation , properties and uses of PVC, teflon, PET and nylon - Polymer processing - compression and injection moulding techniques - Nanomaterials - carbon nanotubes - synthesis and their applications. | |

| UNIT V - PHASE RULE AND ALLOYS | (9) |
|---|---|
| Phase rule: Introduction, definition of terms with examples, one component system – water system – reduced phase rule – thermal analysis and cooling curves – two component systems – lead silver system – Pattinson process.<br>Alloys : Introduction – Definition – importance and purpose of making of alloys – Ferrous alloys – Nichrome and AlNiCo – heat treatment of steel. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. Dr.Ravikrishnan.A, "Engineering chemistry I & Engineering Chemistry II, Sri Krishna Hitech Publishing chem Co. Pvt Ltd., 13th ed., Chennai, 2014.
2. P.C. Jain.and Monica Jain, "Engineering Chemistry",Vol I & II, Dhanpat Rai Pub,Co., New Delhi,15th ed., 2015.


**REFERENCES:**


1. S.S. Dara, "A Text book of Engineering Chemistry", S.Chand & Co. Ltd., New Delhi, 2014.
2. J. Glynn Henry and Gary W.Heinke ,"Environmental Science and Engineering," pretice Hall of India,2014
3. Electroplating, Anodizing and Metal treatment", Hand book, NIIR board, Delhi, 2004.


**17MEC01- ENGINEERING GRAPHICS**
***(Common to All Branches except CSE and IT)***

| L | T | P | C |
|---|---|---|---|
| 2 | 2 | 0 | 3 |

| **PREREQUISITE : NIL** | **QUESTION PATTERN: TYPE - 2** |
|---|---|

**COURSE OBJECTIVES AND OUTCOMES:**

| | Course Objectives | | Course Outcomes | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To gain knowledge about conic sections and plane curves | **1.1** | The students will be able to construct conic sections and special curves of required specifications | **a, c, d, e, i, k, l** |
| **2.0** | To learn the concept of first angle projection of points, lines and plane | **2.1** | The students will be able to apply the concept of first angle projection to create project of straight lines, planes, solids and section of solids | **a, c, d, i, k, l** |
| **3.0** | To understand and familiarize with the projection of solids | **3.1** | The students will be able to develop a surface drawing of a solid model with given dimensions | **a, c, d, e, i, k, l** |
| **4.0** | To learn the concept of sectioning of solids and developing the surfaces | **4.1** | The students will be able to build orthographic, isometric projections of a three dimensional object | **a, c, d, i, k, l** |
| **5.0** | To understand the orthographic, isometric and perspective projections of three dimensional objects | **5.1** | The students will be able to make use of the knowledge of engineering drawing to create physical models | **a, c, d, i, k, l** |

**CONCEPTS AND CONVENTIONS:**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning – Scales.

**UNIT I - PLANE CURVES AND FREE HANDSKETCHING** **(6+6)**

Basic Geometrical constructions, Curves used in engineering practices - Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves - Theory of Projection - Principle of Multi-view Orthographic projection - First and Third Angle Projections - Profile plane and Side views - Multiple views - Representation of Three Dimensional objects - Layout of views.

**UNIT II - FIRST ANGLE PROJECTION OF POINTS, LINES AND PLANE** **(6+6)**

Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method - Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

| UNIT III - PROJECTION OF SOLIDS | (6+6) |
|---|---|
| Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method | |
| **UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** | **(6+6)** |
| Sectioning of solids (Prism, Cube, Pyramid, Cylinder and Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes. | |
| **UNIT V - ISOMETRIC, ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS** | **(6+6)** |
| Principles of isometric projection - Isometric scale - Isometric projections of lines, plane figures, simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Free hand sketching of Orthographic views from Isometric views of objects. Perspective projection of simple solids - Cube, Prisms and pyramids by visual ray method | |
| **TOTAL (L:30+T:30) : 60 PERIODS** | |

**TEXT BOOKS:**

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2013.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

**REFERENCES:**

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) Subhas Stores, Bangalore, 2007
3. K. V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
4. Dr. M. Saravanan, Dr. M. ArockiaJaswin and J. Bensam Raj, "Engineering Graphics", Tri Sea Publications.
5. Luzzader, Warren.J., and Duff, John M,''Fundamentals of Engineering Drawingwith an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
6. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009

**INSTRUMENT:** ***Use of Mini drafter is compulsory***

**Special points applicable to End Semester Examinations on Engineering Graphics:**

1. The answer paper shall be of A3 size drawing sheets.
2. Minimum one question and not more than two questions from a unit.
3. Question paper consists of Part A and Part B.
4. Part A: One compulsory question carries 20 marks from any one of five units.
5. Part B: 4 out of 8 open choice questions carry 20 marks each.

| 17CSC02 - PYTHON PROGRAMMING<br>*(Common to CSE,ECE,EEE,EIE ,IT & BME Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN: TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To gain knowledge about the basics of computer to solve problems | **1.1** | The students will be able to understand the working of computers | **a,c,j,k** | |
| **2.0** | To impart the fundamental concepts of Python Programming | **2.1** | The students will be able to understand the basics of Python Programming constructs | **a,c,j,k** | |
| **3.0** | To gain exposure about string manipulation, list, and tuples | **3.1** | The students will be able to realize the need of strings, list, and tuples | **a,b,c,j,k** | |
| **4.0** | To get knowledge about dictionaries, function and modules | **4.1** | The students will be able to design programs involving dictionaries and function | **a,b,c,k** | |
| **5.0** | To learn about exception handling. | **5.1** | The students will be able to develop simple programs using file concept and modules | **a,b,c,k** | |

| **UNIT I - BASICS OF COMPUTERS & PROBLEM SOLVING** | **(9)** |
|---|---|
| Computer Basics - Computer organization - Computer Software- Types of software - Software Development steps - Algorithms - Flowchart. | |
| **UNIT II - INTRODUCTION TO PYTHON** | **(9)** |
| History – Features – Execution of python program – Flavors of Python – Comments - Data Types - Built-in data types– Sequences - Literals– Operators – Input and Output Statements - Conditional Statements : if – if-else – Nested if-else – For – While – Nested loops – Break – Continue - pass - assert – return | |
| **UNIT III - STRINGS, LISTS AND TUPLES** | **(9)** |
| Strings and Characters: Creating – Length – Indexing – Slicing – Repeating – Concatenation – Comparing - Removing Spaces - Finding Sub Strings - Counting Substrings in a String - Strings are Immutable - Replacing a String with another String - Splitting and Joining Strings - Changing Case of a String - Checking Starting and Ending of a String - Formatting the Strings - Working with Characters - Sorting Strings - Searching - Finding Number. Lists: Creating Lists – Updating - Concatenation - Repetition - Methods – Sorting. Tuples: Creating - Accessing – Operations – Functions - Nested Tuples - Inserting Elements, Modifying Elements, Deleting Elements from a Tuple. | |
| **UNIT IV - DICTIONARIES AND FUNCTIONS** | **(9)** |
| Dictionaries: Operations – Methods - Using for Loop with Dictionaries – Sorting the Elements of a Dictionary using Lambdas - Converting Lists and Strings into Dictionary - Passing Dictionaries to Functions - Ordered Dictionaries.<br>Functions: Defining – Calling – Returning - Pass by Object Reference – Formal, Actual, Positional, Keyword, Default & Variable Length Arguments - Local and Global Variables - Recursive Functions - Lambdas - Function Decorators. | |

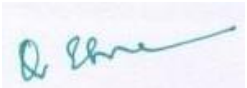
| UNIT V - FILES AND MODULES | (9) |
|---|---|
| Files - Types of Files - Opening & Closing a File - Working with Text Files Containing Strings - Working with Binary Files - The with Statement - The seek() and tell() Methods - Random Accessing of Binary Files - Random Accessing of Binary Files using mmap - Zipping and Unzipping Files - Working with Directories. - Modules: Importing module – Features – Built in functions. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOK:**

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, 2017 Edition

**REFERENCES:**

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.
2. Wesley J. Chun, "Core Python Programming", Pearson Education, 2nd ed., 2010.



**17CSP02 -PYTHON PROGRAMMING LABORATORY**

***(Common to CSE,ECE,EEE,EIE,IT & BME Branches)***

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**PRE REQUISITE : NIL**

**COURSE OBJECTIVES AND OUTCOMES:**

| | Course Objectives | | Course Outcomes | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To impart the fundamental concepts of Python Programming | **1.1** | The students will be able to understand the basics of Python Programming constructs | **a,c,j** |
| **2.0** | To learn the operator concepts of Python Programming | **2.1** | The students will be able to understand the various operators of Python Programming. | **a,b,k** |
| **3.0** | To gain exposure about string manipulation, list, and tuples | **3.1** | The students will be able to realize the need of string manipulation, list, and tuples | **a,b,c,i,k** |
| **4.0** | To get knowledge about dictionaries, function and modules | **4.1** | The students will be able to design programs involving dictionaries, function and modules | **a,b,c,i,k** |
| **5.0** | To learn about exception handling | **5.1** | The students will be able to develop simple programs with exception handling | **a,b,e,i** |

**Python-Programming**

1. Program using Operators
2. Program using Conditional Statements
3. Program using Looping
4. Program using Strings
5. Program using Lists
6. Program using Dictionaries
7. Program using Tuples
8. Program using Functions
9. Program using File handling
10. Program using Modules

**HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS**

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos, Printers – 3 Nos.

Software:

- OS – Windows / UNIX Clone
- Open Source Software – Python

**TOTAL (P:60) = 60 PERIODS**

| 17GYP02 - ENGINEERING PRACTICES LABORATORY<br>*(Common to All Branches)* | | | | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** |
| | | | **0** | **0** | **4** | **2** |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program Outcomes** | |
| **1.0** | To provide hands on training on various basic engineering practices in Civil Engineering | **1.1** | The students will be able to understand various civil engineering practices like plumbing, carpentry and relevant tools | **a, d, f, i, k, l** | |
| **2.0** | To provide hands on training on various basic engineering practices in Mechanical Engineering | **2.1** | The students will be able to understand various manufacturing processes like welding, machining and sheet metal work | **a, d, f, i, k, l** | |
| **3.0** | To understand the basic working principle of electric components | **3.1** | The students will be able to do residential house wiring and Measure energy and resistance to earth of an electrical equipment | **a,e,f,h** | |
| **4.0** | To understand the basic working principle of electronic components | **4.1** | The students will be able to perform the assembling and testing of the PCB based electronic circuits. | **a,j,k,l** | |
| **5.0** | To develop the skill to make / operate/utilize the simple engineering components | **5.1** | The students will be able to make / operate / utilize the simple engineering components | **e, j** | |

**GROUP-A (MECHANICAL AND CIVIL ENGINEERING)**

**I - CIVIL ENGINEERING PRACTICE** **(15)**

**Buildings:**

a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects

**Plumbing Works:**

a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings
b. Study of pipe connections requirements for pumps and turbines
c. Preparation of plumbing line sketches for water supply and sewage works
d. Hands-on-exercise:

Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components

Demonstration of plumbing requirements of high-rise buildings

**Carpentry using Power Tools only:**

a. Study of the joints in roofs, doors, windows and furniture
b. Hands-on-exercise: Planning, Tee joints

| II - MECHANICAL ENGINEERING PRACTICE | (15) |
|---|---|

**Welding:**

a. Preparation of edges for welding and study of welding symbols
b. Arc welding- butt joints, lap joints and tee joints
c. Gas welding
d. Study of standard size of bars, rods, sections, sheet metals
e. Study of work piece types and parameters of welding such as welding current, air gap, filler metal

**Basic Machining:**

a. Facing & Plain turning
b. Drilling Practice
c. Study of different types of screw drivers, screws, bolts and nuts

**Sheet Metal Work:**

a. Model making using bending and forming - Trays, cone
b. Study of thickness gauges, wire gauges

**GROUP - B (ELECTRICAL AND ELECTRONICS)**

| I - ELECTRICAL ENGINEERING PRACTICE | (15) |
|---|---|

a. Residential house wiring using switches, fuse, indicator, lamp and energy meter
b. Fluorescent lamp wiring
c. Stair case wiring
d. Measurement of electrical quantities - voltage, current, power& power factor in RLC circuit
e. Measurement of energy using single phase energy meter
f. Measurement of resistance to earth of electrical equipment.

| II - ELECTRONICS ENGINEERING PRACTICE | (15) |
|---|---|

a. Study of Electronic components - Resistor (Colour coding), Inductor, Capacitor.
b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
c. Study of logic gates AND, OR, XOR and NOT.
d. Study of Clock Signal.
e. Soldering practice -Components Devices and Circuits - Using general purpose PCB.
f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR).
g. Study of Telephone, FM Radio and Cell Phone.

**TOTAL(P:60): 60 PERIODS**

| 17GEP01 - PERSONAL VALUES<br>*(Common to All Branches)* | | | | |
|---|---|---|---|---|
| **L** | **T** | **P** | **C** |
| **0** | **0** | **2** | **0** |

**PREREQUISITE : NIL**

**COURSE OBJECTIVES AND OUTCOMES**

| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** |
|---|---|---|---|---|
| **1.0** | To make students to learn individual in knowing them self | **1.1** | Become an individual in knowing the self | **a, f** |
| **2.0** | To enable the student to understand Gratitude, Truthfulness, Punctuality, Cleanliness & fitness. | **2.1** | Acquire and express Gratitude, Truthfulness, Punctuality, Cleanliness &fitness. | **a, g** |
| **3.0** | To enable the student to understand physical exercise and breathing techniques | **3.1** | Practice simple physical exercise and breathing techniques | **a, c** |
| **4.0** | To make the students to Yoga asana which will enhance the quality of life. | **4.1** | Practice Yoga asana which will enhance the quality of life. | **a, c, f** |
| **5.0** | To motivate the students to Practice Meditation and get benefited | **5.1** | Practice Meditation and get benefited. | **a, f** |

**VALUES THROUGH PRACTICAL ACTIVITIES:**

**1.KNOWING THE SELF**

Introduction to value education - Need & importance of Value education – Knowing the self – realization of human life – animal instinct vs sixth sense.

**2. MENTAL HEALTH**

Evolution of senses – functioning steps of human mind – Body and Mind coordination - Analysis of thoughts – moralization of desires– autosuggestions – power of positive affirmations. – Meditation and its benefits.

**3.PHYSICAL HEALTH**

Physical body constitution– Types of food - effects of food on body and mind – healthy eating habits – food as medicine– self healing techniques.

**4.CORE VALUE SELF LOVE& SELF CARE**

Gratitude - Happiness - Optimistic –Enthusiasm – Simplicity – Punctual - Self Control - Cleanliness & personal hygiene - Freedom from belief systems.

**5.FITNESS**

Simplified physical exercises – Sun salutation - Lung strengthening practices: Naadi suddhi pranayama – Silent sitting and listening to nature – Meditation.

**TOTAL(P:30) = 30 PERIODS**

**REFERENCES:**


1. Know Yourself — Socrates – pdf format at www.au.af.mil/au/awc/awcgate/army/rotc_self-aware.pdf.
2. Steps to Knowledge: the book of Inner Knowing – pdf format at www.newmessage.org/wp content/uploads/pdfs/books/stk_nkl_v1.5.pdf.

3. Promoting Mental Health - World Health Organization – pdf.
4. www.who.int/mental_health/evidence/mh_promotion_book.pdf
5. Learning to be: A Holistic and Integrated Approach to Values – UNESCO pdf format at www.unesdoc.unesco.org/ images/ 0012/001279/127914e.pdf
6. Personality Development by Swami Vivekananda -www.estudantedavedanta.net/personality- development.pdf

| 17EYA02 – PROFESSIONAL ENGLISH – II<br>*(Common to All Branches)* | | | | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** |
| | | | **2** | **0** | **2** | **3** |
| **PREREQUISITE : 17EYA01** | | **QUESTION PATTERN : TYPE - 1** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program Outcomes |
|---|---|---|---|---|
| **1.0** | To enable students to get familiar with words, phrases and sentences relevant to the immediate communication tasks. | **1.1** | The students will be able to communicate using a variety of sentence structures and appropriate vocabulary. | **h,i,j,l** |
| **2.0** | To help students to develop their listening skills and comprehend them by asking questions. | **2.1** | The students will be able to comprehend conversations and short talks delivered in English and respond accordingly. | **e,h,i,j,l** |
| **3.0** | To enhance students' speaking skills by making them to participate in Technical Presentation, Group Discussion, etc. | **3.1** | The students will be able to speak appropriately and effectively in various situations. | **e,h,i,j,l** |
| **4.0** | To inculcate reading habit and to develop effective reading skills. | **4.1** | The students will be able to employ active reading strategies to understand texts at the maximum level. | **e,h,i,j,l** |
| **5.0** | To foster the ability to write convincing Job Application and effective Formal Letters. | **5.1** | The students will be able to equip themselves with writing formal letters and winning Job Application. | **e,h,i,j,l** |

| | |
|---|---|
| **UNIT I - LANGUAGE DEVELOPMENT** | **(6+6)** |
| Vocabulary (Prefixes & Suffixes) - Active Voice and Passive Voice - Impersonal Passive Voice – Conditional Clauses – Subject - Verb Agreement - Direct and Indirect Speech - Idioms and Phrases - Discourse Markers - Error Spotting | |
| **UNIT II – LISTENING COMPREHENSION** | **(6+6)** |
| Listening for Specific Information and Match / Choose / Fill in the texts - Short Films, News, Biographies, Roles and Responsibilities in Corporate, Funny Shows – Listening to Iconic Speeches and making notes – Listening to Interviews | |
| **UNIT III – ACQUISITION OF ORAL SKILLS** | **(6+6)** |
| Describing a Person - Making Plans – Asking for and Giving Directions - Talking about Places - Talking over Phone – Narrating Incidents – Introduction to Technical Presentation - Story Telling – Group Discussion | |
| **UNIT IV – READING NUANCES** | **(6+6)** |
| Intensive Reading – Extensive Reading – Finding key information in a given text - Reading and Understanding Technical Articles - Reading and Interpreting Visual Materials | |
| **UNIT V – EXTENDED WRITING** | **(6+6)** |
| Job Application with Resume – Recommendation – Inviting Dignitaries - Accepting & Declining Invitation - Paragraph Writing (Topics and Images) | |

**LIST OF SKILLS ASSESSED IN THE LABORATORY**

1. Language Skills.
2. Listening Skills.
3. Speaking Skills.
4. Reading Skills
5. Writing Skills

**TOTAL (L:30, P:30) = 60 PERIODS**

**TEXT / REFERENCE BOOKS:**


1. Kumar, Suresh. E. "Engineering English". Orient Blackswan : Hyderabad, 2015.
2. Raman, Meenakshi and Sangeetha Sharma. "Technical Communication Principles and Practice". Oxford University Press: New Delhi, 2014.
3. Board of Editors. "Fluency in English – A Course Book for Engineering and Technology". Orient Blackswan: Hyderabad, 2016.
4. Comfort, Jeremy, et al. "Speaking Effectively: Developing Speaking Skills for Business English". Cambridge University Press: Cambridge, 2011.


| 17MYB02 - COMPLEX ANALYSIS AND LAPLACE TRANSFORMS<br>*(Common to All branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **2** | **0** | **4** |
| **PREREQUISITE : 17MYB01** | | **QUESTION PATTERN : TYPE - 4** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To expose the concepts of differential equations. | **1.1** | The students will be able to predict the suitable method to solve second and higher order differential equations | | **a,b,c,d,f,i,k** |
| **2.0** | To communicate the problem solutions using correct Mathematical terminology of vector calculus. | **2.1** | The students will be able to apply the concepts of Differentiation and Integration to Vectors. | | **a,b,c,f,g,k** |
| **3.0** | Apply rigorous and analytic approach to analyse the conformal mapping. | **3.1** | The students will be able to compute an analytic function, when its real or imaginary part is known. | | **a,b,c,d,e,i,k** |
| **4.0** | Acquiring the knowledge of evaluating contour integrals using residue theorem. | **4.1** | The students will be able to identify the Singularities and its corresponding Residues for the given function. | | **a,b,c,d,e,k** |
| **5.0** | Apply the concepts of Laplace transforms & its applications to various problems related to Engineering. | **5.1** | The students will be able to predict a suitable method to evaluate the Contour integration. | | **a,b,c,d,e,f,i,k** |

| **UNIT I - ORDINARY DIFFERENTIAL EQUATIONS** | **(9+6)** |
|---|---|
| Higher order linear differential equations with constant coefficients - method of variation of parameters - Cauchy's and Legendre's linear equations | |
| **UNIT II - VECTOR CALCULUS** | **(9+6)** |
| Gradient and Directional derivative -Divergence and Curl – Irrotational,solenoidal and scalar potential –Line integral over a plane curve-Surface Integral and Volume Integral-Green's theorem in a plane-Gauss divergence theorem and Stokes Theorem (Excluding Proofs )-Simple Applications Involving Square, Rectangles, Cube and Parallelopiped. | |
| **UNIT III - ANALYTIC FUNCTIONS** | **(9+6)** |
| Functions of a complex variable-Analytic functions– Necessary and sufficient conditions of Cauchy's -Riemann Equations in Cartesian Coordinates (Excluding Proofs) – Properties of Analytic Functions – Harmonic conjugate – Construction of an analytic function by Milne's Thomson Method– Conformal mapping :w = c+z , cz, 1/z and Bilinear Transformation | |
| **UNIT IV - COMPLEX INTEGRATION** | **(9+6)** |
| Statement and Simple applications of Cauchy's integral theorem and Cauchy's integral formula(Excluding Proofs) – Taylor's and Laurent's Series Expansions - Singularities - Residues – Cauchy's Residue theorem (Statement only) – Evaluation of contour integration over unit circle and semi circle (Excluding poles on Real axis). | |
| **UNIT V - LAPLACE TRANSFORM** | **(9+6)** |
| Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems (Statement only) –Transforms of derivatives and integrals- Transform of periodic functions - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Statement only) –Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms. | |
| **TOTAL (L:45 + T:30) = 75 PERIODS** | |

**Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software**

**TEXTBOOKS:**


1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd ed., Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th ed., John Wiley and sons, 2013
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd ed., Tata McGraw Hill, 2014


**REFERENCES:**


1. N.P.Bali and Manish Goyal, "A text book of Engineering Mathematics : Semester-II", 5th ed., Laxmi Publications, 2011
2. Kandasamy .P, Thilagavathy .K and Gunavathy .K, "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand and Co Ltd, 2013
3. Glyn James, "Advanced Engineering Mathematics", 7th ed., Wiley India, 2007


| 17PYB05 – PHYSICS OF SOLIDS<br>*( Common to EEE, ECE, EIE & BME branches )* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE: 17PYB01** | | **QUESTION PATTERN : TYPE -1** | | | |

**COURSE OBJECTIVES AND OUTCOMES**

| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** |
|---|---|---|---|---|
| **1.0** | To provide the basic ideas in electrical conduction, conductors, semiconductors, dielectrics and nano technology | **1.1** | The students will be able to acquire knowledge about conductors, semiconductors and super conductors | **a,b,d** |
| **2.0** | To understand the fundamental concepts on solid state physics | **2.1** | The students will be able to distinguish between conductors, semiconductors and super conductors | **a,b,d** |
| **3.0** | To provide the basic knowledge in dielectric materials and fabrication of integrated circuits | **3.1** | The students will be able to understand the dielectrics and its applications | **a,d** |
| **4.0** | To update the recent development in modern engineering materials | **4.1** | The students will be able to get the knowledge about fabrication of integrated circuits | **a** |
| **5.0** | To update the recent development in modern engineering materials | **5.1** | The students will be able to know of recent trends in nanotechnology | **a,e** |

| **UNIT I - CONDUCTING MATERIALS** | **(9)** |
|---|---|
| Electron theories of conductivity - postulates of classical free electron theory- derivation of electrical conductivity of metals (Drude- Lorentz theory) - merits and demerits. Derivation of thermal conductivity – Weidman-Franz law- verification. Fermi energy - Importance of fermi energy - Fermi-Dirac distribution function and its variation with temperature - density of energy states- calculation of density of electron. | |
| **UNIT II - SEMICONDUCTING MATERIALS & SUPERCONDUCTING MATERIALS** | **(9)** |
| **SEMICONDUCTORS**: Elemental and compound semiconductors - Intrinsic semiconductor – carrier concentration derivation – variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors (qualitative) – variation of Fermi level with temperature and impurity concentration – Hall effect – determination of Hall coefficient – Applications.<br>**SUPERCONDUCTIVITY:** Properties - Types of super conductors – BCS theory of superconductivity – Applications of superconductors – SQUID, cryotron, magnetic levitation. | |
| **UNIT III -DIELECTRIC MATERIALS** | **(9)** |
| Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications. | |
| **UNIT IV -FABRICATION PROCESS USING SEMICONDUCTOR AND DIELECTRICS** | **(9)** |
| Bulk crystal growth-Epitaxial growth- masking and etching-diffusion of impurities-selective diffusion-formation of PN junction- resistors- capacitors-inductors-isolation methods-metal semiconductor contact. Introduction to integrated circuit, monolithic and hybrid circuits, thin film and thick film technology. Definition of LSI, MSI, VLSI circuits. | |

| UNIT V -MODERN ENGINEERING MATERIALS &NANOTECHNOLOGY | (9) |
|---|---|
| Metallic glasses: preparation, properties and applications. Shape Memory Mlloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA. Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol gel – electrodeposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: fabrication – arc method – pulsed laser deposition –structure – properties and application. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. V.Rajendran, "Engineering Physics", Tata McGraw-Hill. New Delhi.2011
2. P.K.Palanisami, "Physics for Engineers-Volume I", Scitech publications (India) Pvt.Ltd, Chennai, 2002


**REFERENCES:**


1. Jacob Millman, Charistos C Halkilas, SatyabrataJit "Electronic Devices & Circuits", Tata McGraw Hill Education Private Limited, 2010, Third Edition.
2. Ben G.Streetman, Sanjay Banerjee, "Solid State Electronic Devices", Pearson Education, 2006, Fifth Edition.
3. G.Senthil Kumar, N.Iyandurai, "Physics-II", VRB Publishers, 2005-2006, Revised Edition.
4. S.O. Pillai, "Solid State Physics", New Age International Publications, New Delhi, 2010.
5. Avadhanulu.M.N, Kshirsagar.P.G, "A Text book of Engineering Physics", S.Chand, 2011.


| 17CYB03 ENVIRONMENTAL SCIENCE<br>*(Common to All Branches)* | | | | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** |
| | | | **3** | **0** | **0** | **3** |
| **PREREQUISITE: NIL** | | **QUESTION PATTERN : TYPE - 3** | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** | |
| **1.0** | To understand the constitutes of the environment | **1.1** | The students will be able to design a system, component, or process to meet desired needs. | | **c, g** | |
| **2.0** | The students should be conversant with valuable resources | **2.1** | The students will be able to identify, formulate, and solve environmental engineering problems | | **a, c, g** | |
| **3.0** | To know about the role of a human being in maintaining a clean environment. | **3.1** | The students will be able to understand the professional and ethical responsibility as related to the practice of environmental engineering and the impact of engineering solutions in a global context. | | **c, f, g** | |
| **4.0** | To maintain ecological balance and preserve bio-diversity. | **4.1** | The students will be able to use the techniques, skills, and modern engineering tools necessary for environmental engineering practice. | | **a, c** | |
| **5.0** | To get knowledge about the conservation of environment for the future generation. | **5.1** | The students will be able to acquire the knowledge of information technology in environmental science. | | **a, f, g** | |

| **UNIT I - INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES** | **(9)** |
|---|---|
| Environment: Scope – importance - need for public awareness - Forest resources - Use-over exploitation-deforestation - Water resources - use-over utilization of surface and ground water - conflicts over water - Mineral resources - use-exploitation-environmental effects of extracting and using mineral resources - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resources - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources. | |
| **UNIT II - ECOSYSTEMS AND BIODIVERSITY** | **(9)** |
| Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social values - ethical values - aesthetic values - Hotspots of biodiversity -Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts- Conservation of biodiversity - In-situ and Ex-situ conservation of biodiversity. | |
| **UNIT III - ENVIRONMENTAL POLLUTION** | **(9)** |
| Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides. | |

| UNIT IV - SOCIAL ISSUES AND THE ENVIRONMENT | (9) |
|---|---|
| Water conservation - rain water harvesting - global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – Principle of Green chemistry – Application of Green chemistry. | |
| **UNIT V - HUMAN POPULATION AND THE ENVIRONMENT** | **(9)** |
| Population growth - variation among nations - Population explosion - Family welfare programme - Human rights - HIV/AIDS – Human health and environment - women and child welfare - Role of information technology in environment and human health. | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**


1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015)
2. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th Edition (2016)


**REFERENCES:**


1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Second Edition, Pearson Education, New Delhi (2012).
2. Santosh Kumar Garg, Rajeshwari garg, smf Ranjni Garg "Ecological and Environmental Studies" Khanna Publishers, Nai Sarak, Delhi (2014).
3. Miller T.G. Jr., "Environmental Science", Tenth Edition, Wadsworth Publishing Co. (2015).


| 17GYC01 – BASICS OF CIVIL AND MECHANICAL ENGINEERING<br>*(Common to EEE & EIE Branches)* | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PREREQUISITES : NIL** | | **QUESTION PATTERN : TYPE – 3** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To give exposure in the basics of civil engineering areas like construction materials and surveying. | **1.1** | The students will be able to identify the usage of construction material and proper selection of construction materials | **c,d,e,g, h,i** |
| **2.0** | To know about engineering aspects related to buildings. | **1.2** | The students will be able to express building components and methods applicable to various structures. | **c,e,f,g** |
| **3.0** | To know about the Conventional and Non-Conventional sources of energy | **1.3** | The students will be able to identify the sources of energy and their conversion techniques. | **a, b, c, h, i** |
| **4.0** | To gain knowledge on the IC engines and fuels | **1.4** | The students will be able to explain the components of IC engines, fuel supply, cooling and lubricating systems | **a, b, f, h, i, k, l** |
| **5.0** | To know about the Refrigeration and Air Conditioning systems | **1.5** | The students will be able to demonstrate the working principles of Refrigeration and Air conditioning systems | **a, b, c, f, k, l** |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Surveying: Objects - types - classification - principles - measurements of distances - angles -leveling - determination of areas - illustrative examples. Civil Engineering Materials: Bricks -stones - sand - cement - concrete - steel. | |
| **UNIT II - BUILDING COMPONENTS** | **(9)** |
| Foundations: Types, Bearing capacity -Requirement of good foundations. Superstructure: Brick masonry -stone masonry -beams -columns -lintels -roof -flooring –plastering. | |
| **UNIT III - SOURCES OF ENERGY** | **(9)** |
| Conventional and Non-Conventional Sources of Energy, Comparison of sources of Energy. Working principle of power plants-Thermal, Nuclear, Diesel and Hydro Electrical power plant, Non-Conventional Power Generation Systems-Solar, Wind, Tidal, Geothermal Power Plant. | |
| **UNIT IV - INTERNAL COMBUSTION ENGINE** | **(9)** |
| Heat Engine-Classification of I.C Engines, Components of IC Engine, Four stroke petrol and Diesel Engine, Two stroke petrol and Diesel Engine, Comparison of four stroke and two stroke cycle Engines. Fuel supply system in petrol and diesel Engines. Cooling system and lubrication system of I.C Engines. | |
| **UNIT V - REFRIGERATION AND AIR CONDITIONING SYSTEM** | **(9)** |
| Principle of Refrigeration: Properties of Refrigerants, List of commonly used Refrigerants-Terminology. Principle of vapour compression and absorption system – Principle of Air Conditioning– Window and Split type room Air conditioner, Inverter type Air conditioner. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Venugopal K. and Prabhu Raja V., "Basic Civil and Mechanical Engineering", 3rd edition, Anuradha Publications, 2010.
2. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 2009.

**REFERENCE:**

1. Ramesh Babu.V, “Text book on Basic Civil & Mechanical Engineering”, VRP publication, 2009.

| 17EEC02 - ELECTRIC CIRCUIT THEORY<br>*(Common to EEE & EIE Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **2** | **0** | **4** |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE -1** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To educate the analysis of electric circuits | **1.1** | The students will be able to design electric circuits by using mesh and nodal methods. | **a,b,c,d** |
| **2.0** | To motivate the students for solving circuit in DC circuits using network theorems | **2.1** | The students will be able to find different circuit parameters using DC network theorems | **a,b,d** |
| **3.0** | To make the student s to understand circuit laws, waveform and network theorems in AC circuits | **3.1** | The students will be able to measure voltage, current, power and phase shift in AC power circuits | **a,f** |
| **4.0** | To get an insight into analysis of resonance and coupled circuits | **4.1** | The students will be able to design resonance and coupled circuits. | **a,c,d** |
| **5.0** | To gain the knowledge about the three phase circuits and power measurement | **5.1** | The students will be able to examine 3-phase circuits for impedance, voltage, current, power, phase shift and power factor. | **a,b,c,d,f** |

| **UNIT I -BASIC CIRCUITS ANALYSIS** | **(12)** |
|---|---|
| Types of sources- Relationship between voltage and current in network elements-Ohm's law – Kirchhoff's laws – Resistors in series and parallel circuits – Voltage and Current division- Mesh current and Node voltage method of analysis for D.C circuits | |
| **UNIT II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC CIRCUITS** | **(12)** |
| Network reduction: Source transformation, Star delta transformation.<br>Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem. | |
| **UNIT III – AC CIRCUITS** | **(12)** |
| Phasors and Complex representation ,RMS value, Average value, Form Factor, Peak Factor-Power ,power factor and energy – AC signals solution of RLC circuits-Network theorems: Thevenin's, Norton's, Maximum power transfer theorem. | |
| **UNIT IV - RESONANCE AND COUPLED CIRCUITS** | **(12)** |
| Types of resonance- Frequency response, quality factor and bandwidth - Coupled Circuits: Self and mutual inductance, Co-efficient of coupling –Single tuned circuits. | |

| UNIT V - THREE PHASE CIRCUITS | (12) |
|---|---|
| Analysis of three phase 3-wire, 4-wire circuits with star and delta connected loads– Phasor diagram of voltages and currents – Power and power factor measurements in three phase circuits. | |
| | **TOTAL (L: 60) = 60 PERIODS** |

**TEXT BOOKS:**


1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis,” 8th edition., Tata McGraw Hill publishers, New Delhi, 2013.
2. David Bell, “Fundamentals of Electric circuits”, Oxford University Press, 7th ed., 2009


**REFERENCES:**


1. S.R. Paranjothi, "Electric Circuits Analysis," New Age International Ltd., New Delhi, 4th ed., 2014.
2. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis,” Tata McGraw Hill, 2015.
3. Charles K. Alexander and Mathew N.O. Sadiku, “Fundamentals of Electric Circuits", 2nd ed., Tata McGraw Hill publishers, 2013.
4. Nageswara Rao.T, “Circuit Theory”, A.R. Publications, Chennai, 2014.


| 17GYP01 - PHYSICS AND CHEMISTRY LABORATORY<br>*(Common to All Branches Except CSE and IT)* | | | | |
|---|---|---|---|---|
| **L** | **T** | **P** | **C** |
| **0** | **0** | **4** | **2** |

**PREREQUISITES: NIL**

**COURSE OBJECTIVES AND OUTCOMES**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To provide the basic practical exposure to all the engineering and technological streams in the field of physics. | **1.1** | The students will be able to acquire the fundamental knowledge in optics such as interference, Diffraction and Understand about the spectral instruments etc | **a,b,d,g,l** |
| **2.0** | To provide the basic practical exposure to all the engineering and technological streams in the field of chemistry | **2.1** | The students will be able to gain the basic knowledge about handling the laser light and Identify the basic parameters of an optical fibre | **a,b,d,g** |
| **3.0** | The students are able to know about the water containing impurities and some physical parameters | **3.1** | The students will be able to analyze the properties of matter with sound waves | **a,b,d** |
| **4.0** | To gain the knowledge about light, sound, laser, fiber optics and magnetism | **4.1** | The students will be able to apply knowledge of measurement of hardness producing ions, chloride, alkalinity, DO, conductance, EMF and pH | **a,b,d,g** |
| **5.0** | To develop the knowledge of conductometric titration and viscometry | **5.1** | The students will be able to understand the impact of water quality and solve engineering problems | **a,b,d,g** |

**Physics Laboratory (Any Five – Branch specific)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**Chemistry Laboratory (Any Five)**

1 Determination of total, temporary & permanent hardness of water by EDTA method.
2 Determination of alkalinity in water sample.
3 Determination of chloride content of water sample by argentometric method.
4 Conductometric titration of strong acid vs strong base.
5 Estimation of iron content of the given solution using potentiometer.
6 Determination of strength of given hydrochloric acid using pH meter
7 Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8 Estimation of iron content of the water sample using spectrophotometer

**Total Hours = 30**

| 17EEP01 - ELECTRIC CIRCUIT LABORATORY<br>*(Common to EEE & EIE Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **4** | **2** |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To provide fundamentals concepts of electric circuits. | **1.1** | The students will be able to analyze the electrical circuits using various circuit laws | | **a,b,f,i,k** |
| **2.0** | To understand and analyze the basic theorems of Circuit theory | **2.1** | The students will be able to examine the network theorems and operation of typical electrical circuits. | | **a,c,f,j** |
| **3.0** | To understand the concept of resonance in series circuit. | **3.1** | The students will be able to design an electric circuits under resonance to meet desired needs within realistic constraints | | **a,d,i,k** |
| **4.0** | To get an insight into solution of three phase power measurements. | **4.1** | The students will be able to find power and power factor in three phase circuits using two wattmeter method. | | **a,b,f,k** |
| **5.0** | To understand the concept of basic theorems using digital simulation. | **5.1** | The students will be able to design and find the accurate values for basic theorem using MATLAB. | | |

**LIST OF EXPERIMENTS:**

1. Experimental verification of Ohm's law & Kirchhoff's voltage and current laws
2. Experimental verification of Superposition theorem
3. Experimental verification of Thevenin's theorem
4. Experimental verification of Norton's theorem
5. Experimental verification of Maximum power transfer theorem
6. Experimental verification of Reciprocity theorem
7. Verification of KVL and KCL by using digital simulation
8. Verification of Superposition theorem & Thevenin's theorem by using digital simulation
9. Verification of Reciprocity theorem & Maximum power transfer theorem by using digital simulation
10. RLC series resonance circuits by using digital simulation

**ADDITIONAL EXPERIMENTS:**

11. Study of CRO and measurement of sinusoidal voltage, frequency and power factor
12. Experimental determination of power in three phase circuits by two-watt meter method

**TOTAL (P:60) = 60 PERIODS**

| 17GEP02- INTERPERSONAL VALUES<br>*(Common to All Branches)* | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 0 | 0 | 2 | 0 |
| **PREREQUISITE: 17GEP01** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To know interpersonal values | **1.1** | Develop a healthy relationship & harmony with others | | **a, f** |
| **2.0** | To train the students to maneuver their temperaments. | **2.1** | Practice respecting every human being | | **a, g** |
| **3.0** | To achieve the mentality of appreciating core values of a person. | **3.1** | Practice to eradicate negative temperaments | | **a, c** |
| **4.0** | To analyze the roots of problems and develop a positive attitude about the life. | **4.1** | Acquire Respect, Honesty, Empathy, Forgiveness and Equality | | **a, c, f** |
| **5.0** | To understand the effects of physical activities on mental health. | **5.1** | Practice Exercises and Meditation to lead a healthy life and Manage the cognitive abilities of an Individual | | **a, f** |

| | |
|---|---|
| **UNIT II – INTRODUCTION** | **(9)** |
| Introduction to interpersonal values – Developing harmony with others –Healthy relationship – Need & importance of interpersonal values for dealing with others and team - Effective communication with others. | |
| **UNIT II - MANEUVERING THE TEMPERAMENTS** | **(9)** |
| From Greed To Contentment - Anger To Tolerance -Miserliness To Charity – Ego To Equality - Vengeance To Forgiveness. | |
| **UNIT III - CORE VALUE** | **(9)** |
| Truthfulness **-** Honesty –Helping–Friendship – Brotherhood – Tolerance –Caring & Sharing – Forgiveness – Charity – Sympathy — Generosity – Brotherhood -Adaptability. | |
| **UNIT IV – PATHWAY TO BLISSFUL LIFE** | **(9)** |
| Signs of anger – Root cause – Chain reaction – Evil effects on Body and Mind – Analyzing roots of worries – Techniques to eradicate worries. | |
| **UNIT V - THERAPEUTIC MEASURES** | **(9)** |
| Spine strengthening exercises - Nero muscular breathing exercises - Laughing therapy - Mindfulness meditation. | |
| **TOTAL(P:30): 30 PERIODS** | |


1. Interpersonal Skills Tutorial (Pdf Version) – TutorialsPoint www.tutorialspoint.com/interpersonal_skills/interpersonal_skills_tutorial.pdf
2. Interpersonal Relationships At Work - Ki Open Archive - Karolinska www.publications.ki.se/xmlui/bitstream/handle/10616/39545/thesis.pdf?sequence=1
3. Values Education For Peace, Human Rights, Democracy – UNESCO. www.unesdoc.unesco.org/images/0011/001143/114357eo.pdf
4. Maneuvering Of Six Temperaments - Vethathiri Maharishi. www.ijhssi.org/papers/v5(5)/F0505034036.pdf
5. The Bliss of Inner Fire: Heart Practice of The Six. – Wisdom Publications - www.wisdompubs.org/sites/.../Bliss%20of%20Inner%20Fire%20Book%20Preview.pd


| 17MYB05-TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (*Common to BME, EEE,ECE and E&I Branches)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **2** | **2** | **0** | **3** |
| **PREREQUISITE : 17MYB02** | **QUESTION PATTERN : TYPE -4** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To understand the concept of Fourier Series and enhance the problem solving skill. | **1.1** | The students will be able to solve the Engineering problems in terms of Fourier analysis | **a,b** |
| **2.0** | To develop the skills of the students in the areas of Transforms and Partial Differential Equations | **2.1** | The students will be able to know the formation of partial differential equations. | **a,b,c** |
| **3.0** | To introduce the effective mathematical tools for the solutions of partial differential equations. | **3.1** | The students will be able to apply the partial differential equations to solve the various electrical and electronics application. | **b,g** |
| **4.0** | To acquaint the student with Fourier transform techniques used in wide variety of situations | **4.1** | The students will be able to solve the problems using Fourier integral theorem and convolution theorem technique. | **a,c,g** |
| **5.0** | To develop Z transform techniques for discrete time Systems. | **5.1** | The students will be able to formulate the difference equations and solve them using Z-transform techniques | **a,b,g** |

| | |
|---|---|
| **UNIT I - FOURIER SERIES** | **(6+6)** |
| Dirichlet's conditions – Fourier series – Odd and even functions – Half range sine series – Half range cosine series - Parseval's identity – RMS value - Harmonic Analysis. | |
| **UNIT II - PARTIAL DIFFERENTIAL EQUATIONS** | **(6+6)** |
| Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the type f(p,q)=0,Clairut's form – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous types. | |
| **UNIT III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** | **(6+6)** |
| Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation (Zero and Non-zero Velocity) – One dimensional heat equation (Temperature Reduced to zero and Non-zero boundary conditions) – Steady state solution of two-dimensional heat equation (Finite and Infinite Plate). | |
| **UNIT IV - FOURIER TRANSFORMS** | **(6+6)** |
| Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's Identity (Excluding proof) | |
| **UNIT V - Z -TRANSFORM AND DIFFERENCE EQUATIONS** | **(6+6)** |
| Z transforms -Elementary properties – Inverse Z transform (Partial fraction method and Residue method) – Convolution theorem (Excluding proof) –Formation of difference equations – Solution of difference equations using Z transform. | |
| **TOTAL (L: 30+T:30) = 60 PERIODS** | |

**TEXT BOOKS:**


1. Veerarajan,T. "Engineering mathematics (for III Semester)", 3rd ed., Tata Mc Graw Hill, New Delhi, 2005.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics; Volume III", S. Chand & Co Ltd., 2008.


**REFERENCES:**


1. Goyal. Manish and Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.
4. Singaravelu.A, "Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamil Nadu.


| 17EEC03-ELECTRONIC DEVICES AND CIRCUITS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To motivate the students to learn about unipolar and bipolar devices | **1.1** | The students will be able to learn about the various types of diodes | **a,b,f,i,k** | |
| **2.0** | To educate about current controlled devices | **2.1** | The students will be able to acquire knowledge about current controlled device | **a,b,c,f,j** | |
| **3.0** | To learn about various BJT amplifiers | **3.1** | The students will be able to analyze various configurations of BJT Amplifiers | **a,d,i,k** | |
| **4.0** | To educate about voltage controlled devices | **4.1** | The students will be able to study the voltage controlled devices and its applications | **a,b,,i,f,k** | |
| **5.0** | To learn about various FET amplifiers | **5.1** | The students will be able to analyze various configurations of FET Amplifiers | **a,b,c,i,l** | |

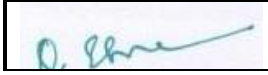
| | |
|---|---|
| **UNIT I - DIODE CIRCUITS** | **(9)** |
| Diodes - Rectifier circuits - Zener diode circuits - Clipper and Clamper circuits - schotty diode and special diodes - Photodiode and LED Circuits | |
| **UNIT II - THE BIPOLAR JUNCTION TRANSISTOR** | **(9)** |
| Basic bipolar junction transistor - DC analysis of transistor circuits - Basic transistor applications - Bipolar transistor biasing- UJT and its characteristics | |
| **UNIT III - BASIC BJT AMPLIFIERS** | **(9)** |
| Analog signals and linear amplifiers - Bipolar linear amplifier - Basic transistor amplifier configurations: CE amplifiers - AC load line analysis - CC (Emitter Follower) amplifier - CB amplifier - Summary and comparison of the three basic amplifiers. | |
| **UNIT IV - THE FIELD EFFECT TRANSISTOR** | **(9)** |
| MOS Field Effect Transistor - MOSFET DC circuit analysis - MOSFET applications –Junction Field Effect Transistor: types, operation- MOSFET logic configurations: NMOS, PMOS, CMOS and BiCMOS. | |
| **UNIT V - BASIC FET AMPLIFIERS** | **(9)** |
| MOSFET amplifier - Basic transistor amplifier configuration: Common source amplifier - Source follower amplifier - Common gate configuration - Three basic amplifier configurations: Summary and comparison. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. S.Salivahanan and N.Suresh Kumar, “Electron Devices and Electronic Circuits”, Tata McGraw-Hill, New Delhi, 2011.
2. R. L. Boylestad and L. Nashelsky “Electronic Devices and Circuit Theory”, 9th ed., Pearson Education, Delhi, 2007.


**REFERENCES:**


1. D. A. Bell, “Electronic Devices and Circuits”, Prentice Hall of India, New Delhi, 2003.
2. T. F. Boghert, “Electronic Devices and Circuits”, Pearson Education, 6th ed., Delhi, 2003.
3. B. G. Streetman and S. Banerjee, “Solid State Electronic Devices”, Pearson Education, Delhi, 2002.
4. D. A. Neamen, “Electronic Circuit Analysis and Design”, 2nd ed., Tata McGraw-Hill, New Delhi, 2002.

| 17EEC04 - ELECTRICAL MACHINES – I | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 2 | 0 | 3 |
| **PREREQUISITE :17EEC02** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To Understand the concepts of field energy, co energy, mechanical force and production of torque and EMF. | **1.1** | The students will be able to understand the generation of EMF and Torque in rotating Machines. | **a, b, c, d, g,h,k,l** | |
| **2.0** | To know the construction, operation and characteristics of various types of DC Generators. | **2.1** | The students will be able to illustrate the construction and principle of operation and characteristics of DC machines. | **a,b,c,d,e,f,g,k,l** | |
| **3.0** | To learn starting, starters and methods of speed control of DC motors. | **3.1** | The students will be able to select appropriate DC motor as well as to choose an appropriate method of Speed control for any industrial application. | **a,b,c,d,e,f,g,k,l** | |
| **4.0** | To understand different types of Transformer construction, working principle and their performance. | **4.1** | The students will be able to identify the transformer parameters from the equivalent circuit | **a,b,c,d,e,f,g,k,l** | |
| **5.0** | To analyze the various losses and efficiency taking place in DC Machines and transformers. | **5.1** | The students will be able to evaluate the performance of DC machines and transformers | **a,b,c,d,f,g,h,k,l** | |

| | |
|---|---|
| **UNIT I - BASIC CONCEPTS OF ROTATING MACHINES** | **(12)** |
| Principles of electro mechanical energy conversion- Single and multiple excited systems- Concepts of co-energy- Generated voltage- Torque in DC Machines. | |
| **UNIT II - DC GENERATORS** | **(12)** |
| Constructional details- emf equation- Methods of excitation- Self and separately excited generators- Characteristics of series, shunt and compound generators- Armature reaction and commutation- Parallel operation of DC shunt and compound generators – Applications. | |
| **UNIT III - DC MOTORS** | (**12**) |
| Principle of operation- Back emf and torque equation- Characteristics of series, shunt and compound motor- Starting of DC motors- Types of starters- Speed control of DC shunt motors – Applications. | |
| **UNIT IV – TRANSFORMERS** | **(12)** |
| Constructional details of core and shell type transformers- Types of windings- Principle of operation- emf equation- Transformation ratio- Transformer on no load- Parameters referred to HV/LV windings- Equivalent circuit- Transformer on load- Regulation- Parallel operation of single phase transformers- Auto transformer- Three phase transformer- Vector group. | |
| **UNIT V - TESTING OF DC MACHINES AND TRANSFORMERS** | **(12)** |
| Losses and efficiency in DC machines and transformers- Condition for maximum efficiency- Testing of DC machines- Brake test, Swinburne's test, Retardation test and Hopkinson's test- Testing of transformers- Polarity test, Load test, open circuit and short circuit tests- All day efficiency. | |
| **TOTAL: 60 PERIODS** | |

**TEXT BOOK:**

1. A.E.Fitzgerald, C.Kingsly and S.D.Umans, "Electrical Machinery", 7th ed., McGraw Hill International Edition, New York, 2020.

**REFERENCES:**

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 5th edition, 2017.
2. H .Cotton, "Advanced Electrical Technology", CBS Publishers and distributors, 1967.

| 17EEC05 - FIELD THEORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand basics of vector algebra and its applications. | **1.1** | The students will be able to learn the fundamentals of vector algebra and electromagnetic fields. | **c,d,e,g,h** | |
| **2.0** | To analyze fields a potential due to static charges. | **2.1** | The students will be able to acquire knowledge about electrostatics, electrical potential, energy density and their applications. | **b,e,g,h** | |
| **3.0** | To evaluate static magnetic fields. | **3.1** | The students will be able to get a wide knowledge about concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications. | **e,g,h** | |
| **4.0** | To understand the relation between the fields under time varying situations. | **4.1** | The students will be able to emphasize the ideas about faradays laws, induced emf and their applications. | **b,d,e,g,h** | |
| **5.0** | To understand principles of propagation of uniform plane waves. | **5.1** | The students will be able to understand the concepts of electromagnetic waves and poynting vector. | **b,d,g,k** | |

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|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Sources and effects of electromagnetic fields – Introduction to vector algebra – Co-ordinate systems – Vector calculus: Gradient, divergence and curl – Divergence theorem – Stoke's theorem. | |
| **UNIT II - ELECTROSTATICS** | **(9)** |
| Coulombs law – Electric field intensity –Charge distribution – Electric Field due to straight conductor and circular disc – Electric flux density – Gauss's law and its applications –Electric Potential – Electric dipole –Boundary conditions at the interface of conductor and dielectric – Poisson's and laplace's equation – Capacitors | |
| **UNIT III – MAGNETOSTATICS** | **(9)** |
| Biot-Savart's law – Ampere's circuital law –Magnetic flux and magnetic flux density – Scalar and vector magnetic potentials –Magnetic materials – Magnetic boundary conditions – Self and mutual inductance – Inductance of solenoid and toroid. | |
| **UNIT IV - ELECTROMAGNETIC FIELDS** | **(9)** |
| Faraday's laws – Transformer and motional emf –Maxwell's equation in point form and integral form. | |
| **UNIT V - ELECTROMAGNETIC WAVES AND ITS APPLICATIONS** | **(9)** |
| Introduction – Electromagnetic wave equation – Wave equation for free space – Poynting theorem – Standing wave ratio – Antenna and its types – Antenna measurements. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Mathew O Sadiku, “Elements of Electromagnetics”, Oxford University press, New York, 6th ed.,2014.
2. William H Hayt, “Engineering Electromagnetics”, Tata McGraw Hill, New Delhi, 7th ed., 2011.

**REFERENCES:**


1. David J Griffith, “Introduction to Electrodynamics”, Pearson Education, 4th ed., 2012.
2. Hayt, W.H and Buck, John A, “Engineering Electromagnetics”, 7th ed., Tata McGraw- Hill, New Delhi, 2009.
3. Ashutosh Pramanik, “Electromagnetism – Theory and Applications”, Prentice-Hall of India Private Limited, New Delhi, 2006.
4. Fawwaz. T.Ulaby, “Electromagnetics for Engineers”, Pearson Education, 2005.


| 17EEC06-POWER PLANT ENGINEERING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate on power plant operation and its types. | **1.1** | The students will be able to understand concepts of thermal power plants. | **a,c,f,g,i** | |
| **2.0** | To motivate the students for analyze the issues related with power plants. | **2.1** | The students will be able to analyze the issues related with power plants. | **b,c,f,g** | |
| **3.0** | To make the student to understand nuclear power plant process. | **3.1** | The students will be able to acquire knowledge about nuclear power plants. | **c,f,g,h** | |
| **4.0** | To understand about the various renewable energy sources. | **4.1** | The students will be able to analyze the operation of various renewable energy sources. | **a,c,f,g** | |
| **5.0** | To stimulate the students about tariff structure and Environmental issues. | **5.1** | The students will be able to know about tariff structure and Environmental issues. | **a,c,f,h,i** | |

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| **UNIT I - THERMAL POWER PLANTS** | **(9)** |
| Basic thermodynamic cycles- Various components of steam power plant – Layout - Pulverized coal burners- Fluidized bed combustion - Coal handling systems - Ash handling systems - Forced draft and induced draft fans – Boilers - Feed pumps - Super heater- Regenerator - Condenser- Dearearators - Cooling tower. | |
| **UNIT II - GAS AND DIESEL POWER PLANTS** | **(9)** |
| Open and closed cycle gas turbine: work output & thermal efficiency, methods to improve performance -reheating, inter cooling, regeneration - Advantage and disadvantages. Diesel engine power plant - Component and layout. | |
| **UNIT III - NUCLEAR POWER PLANTS** | **(9)** |
| Principles of nuclear energy- Fission reactions - Nuclear reactor: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors - Safety measures for Nuclear Power plants. | |
| **UNIT IV - POWER FROM RENEWABLE ENERGY** | **(9)** |
| Hydro Electric Power Plants: Classification, Layout including Turbines - Principle, Construction and working of Wind, Tidal and Solar Power systems. | |
| **UNIT V - ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS** | **(9)** |
| Power tariff types - Load distribution parameters - Load curve - Comparison of site selection criteria - Capital & operating Cost of different power plants - Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants. | |
| **TOTAL = 45 PERIODS** | |
| **TEXT BOOKS:**<br>1. Nag P.K., "Power Plant Engineering",Tata-McGraw Hill, 4th ed.,2014.<br>2. El-Wakil M.M. " Power Plant Technology", Tata Mc-Graw Hill, 2nd ed., New Delhi, 2011. | |

**REFERENCES:**


1. R.K.Rajput, “Power Plant Engineering”, Laxmi Publications, 2013.
2. G.D.Rai, “Introduction to Power Plant Technology”, Khanna Publishers, New Delhi, 2013.
3. G.R.Nagpal, “Power Plant Engineering”, Khanna Publishers, 16th ed., New Delhi, 2012.


| 17ITC03 - DATA STRUCTURES AND ALGORITHMS<br>*(Common to BME, EEE,ECE and E&I branches)* | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 0 | 2 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE – 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To enable the student to understand the Abstract Data Types | **1.1** | The students will be able to understand and apply the concept of abstract data type to represent and implement heterogeneous data structures. | **a,c,j,k** | |
| **2.0** | To make the students to Learn about implementation of stack and queue. | **2.1** | The students will be able to exemplify and implement how Stack ADT & Queue ADT can be implemented to manage the memory using static and dynamic allocations. | **a,c,j,k** | |
| **3.0** | .To enable the student to Understand the concepts of Trees. | **3.1** | The students will be able to compare and contrast various techniques in Hashing and Trees. | **a,b,c,d** | |
| **4.0** | To make the students to Understand the concepts of Graphs | **4.1** | The students will be able to understand the various types of shorting algorithms. | **a,b,c,d** | |
| **5.0** | To enable the student to Understand the concepts of Sorting& Searching. | **5.1** | The students will be able to analyze and implement different types of sorting and searching algorithms. | **a,b,c,i** | |

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|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Data structures – Types of Data Structures - Abstract Data Type (ADT) – List ADT: Singly linked list – Doubly linked list – Circular linked list – Cursor based liked list - Applications of linked list: Addition of two polynomials – Multiplication of two polynomials. | |
| **UNIT II - STACK AND QUEUE** | **(9)** |
| Stack ADT – Stack model – Operations on stack – Implementation and applications. Queue ADT – Queue model – Operations on queue - Implementation and applications of PriorityQueues. | |
| **UNIT III - HASHING AND TREES** | **(9)** |
| Introduction – Separate chaining – Open addressing - Rehashing - Extendible hashing. Binary Tree – Representation of a binary tree – Expression tree – Search tree ADT – Tree traversal – AVL tree – Single rotation – Double rotation. | |
| **UNIT IV – GRAPHS** | **(9)** |
| Basic terminologies – Representation of graph – Topological sort – Graph traversal - Breadth first traversal – Depth first traversal. Shortest path algorithm – Unweighted shortest path algorithm – Weighted shortest path algorithm – Minimum spanning tree – Prim's algorithm – Kruskal's algorithm. | |
| **UNIT V – SORTING** | **(9)** |
| Introduction – Insertion sort – Shell sort – Heap sort – Merge sort – Quick sort – Radix sort. External sorting – Two way merge – Multi way merge – polyphase merge. Searching – Linear search – Binary search. | |
| **TOTAL (L:30:T30) =60 PERIODS** | |

**List of Experiments:**

1. Implementing Stack ADT in Python.
2. Implementing unordered list using Linked list (ADT).
3. Implementing Queue ADT in Python.
4. Implement Binary Search Tree using Python.
5. Implementation of BFS and DFS Graph Traversal using Python.

**HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS**

Hardware

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos,Printers – 3 Nos.

Software

- OS – Windows
- Python 3.2/ Python IDE

**TEXT BOOKS:**

1. Mark Allen Weiss" Data structures and algorithm analysis in C" Pearson Education, 2015/PHI.
2. Dr. R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2017 Edition.

**REFERENCE:**

1. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", 2013 edition .

| 17EEP02-ELECTRONIC DEVICES AND CIRCUITS LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To provide fundamentals concepts of unipolar and bipolar devices. | **1.1** | The students will be able to build different characteristics of unipolar and bipolar devices | **a,c,d,l** | |
| **2.0** | To understand and analyze the basic concepts of diode. | **2.1** | The students will be able to know the applications of Diode | **a,b,c,d,l** | |
| **3.0** | To understand the concept of bipolar devices. | **3.1** | The students will be able to acquire knowledge about the various configuration of BJT | **a,c,d,h** | |
| **4.0** | To get an insight into solution of single phase rectifiers. | **4.1** | The students will be able to build different types of rectifiers and filter circuits. | **a,b,c** | |
| **5.0** | To understand the concept of unipolar devices and use of regulator. | **5.1** | The students will be able to attain information about regulators. | **a,c,d,l** | |

**LIST OF EXPERIMENTS:**

1. Characteristics of PN Junction Diode
2. Characteristics of Zener Diode
3. Verify a Clipper and Clamper Circuits With its Characteristics
4. Verify a Single Phase Half Wave & Full Wave Rectifiers With and Without Filters
5. Verify a Shunt Voltage Regulator
6. Characteristics of Common Emitter Configuration
7. Characteristics of Common Base Configuration
8. Characteristics of Common Collector Configuration
9. Characteristics of JFET
10. Characteristics of MOSFET

**ADDITIONAL EXPERIMENTS:**

1. Characteristics of Photo diode and phototransistor
2. Design UJT relaxation Oscillators.

**TOTAL = 60 PERIODS**

| 17EEP03-ELECTRICAL MACHINES - I LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To get a basic practical knowledge on DC generators and DC motors | **1.1** | The students will be able to acquire knowledge on load characteristics of DC Generators and DC motors | **a,c,d,f,l** | |
| **2.0** | To understand and analyze the uniqueness of each kind of DC machine | **2.1** | The students will be able to know the characteristics of the DC machines independently | **a,b,c,d,l** | |
| **3.0** | To understand the concept of loads and speed control techniques | **3.1** | The students will be able to familiar to control and test the speed of DC motor under various loads | **a,c,d,f** | |
| **4.0** | To get an insight into working and operation of a transformer under load condition | **4.1** | The students will be able to analyze the performance of single phase transformer under load condition | **a,b,c,g** | |
| **5.0** | To understand the concept of withstanding capacity and rating of transformer using tests | **5.1** | The students will be able to understand the various tests performed on transformer to acquire its efficiency | **a,b,c,g** | |

**LIST OF EXPERIMENTS:**

1. Open circuit characteristics of DC separately excited generator
2. Load characteristics of DC compound generators
3. Load characteristics of DC shunt motors
4. Load characteristics of DC series motors
5. Speed control of DC shunt motors
6. Swinburnes test. Load test on single phase transformer.
8. Open circuit and short circuit test on single phase transformer
9. Parallel operation of single phase transformer
10. Study of Scott connection of transformer

**ADDITIONAL EXPERIMENTS:**

1. Polarity test on single phase transformer
2. Separation of no load losses in a single phase transformer

**TOTAL = 60 PERIODS**

| 17GED02 – SOFT SKILLS – READING AND WRITING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To recollect the functional understanding of parts of speech and basic grammar | **1.1** | The students will be able to apply the knowledge to identify the parts of speech and construct the sentences | **h,i,j,l** | |
| **2.0** | To acquire the reading skills through cloze texts, matching and multiple choice modes | **2.1** | The students will be able to develop the reading skills through cloze texts, matching and multiple choice modes | **h,i,j,l** | |
| **3.0** | To enhance the writing skills for a variety of purposes | **3.1** | The students will be able to interpret effectively through writing for a variety of purposes | **h,i,j,l** | |

| | |
|---|---|
| **UNIT I – GRAMMAR** | **(10)** |
| Articles - Adjectives - Conjunctions - Prepositions - Idioms & Phrases | |
| **UNIT II – READING** | **(10)** |
| Part I : Matching 7 sentences to four short texts<br>Part II: Text with sentences missing<br>Part III: Text with multiple choice questions<br>Part IV: Text with multiple choice gaps<br>Part V: Identification of additional unnecessary words in text | |
| **UNIT III -WRITING** | **(10)** |
| Part I : E-mail writing, Writing short notes, Memo, Agenda & Minutes<br>Part II: Report Writing, Complaint Letter, Writing Proposals | |
| **TOTAL (P:30) : 30 PERIODS** | |

**REFERENCES:**


1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007.
2. Whitby, Norman, "Business Benchmark Pre - Intermediate to Intermediate Preliminary", 2nd ed., Cambridge University Press, 2013


| 17MYB10- PROBABILITY, STATISTICS AND NUMERICAL METHODS (*Common to EEE and E&I Branches)* | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 2 | 0 | 3 |
| **PREREQUISITE : 17MYB05** | | **QUESTION PATTERN : TYPE - 4** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | Enable students to understand the concepts of probability, conditional probability and independence. | **1.1** | The students will be able to have a fundamental knowledge of the basic probability concepts. | **a,b,k,l** | |
| **2.0** | Identify unethical behavior in terms of hypothesis testing. | **2.1** | The students will be able to select a hypothesis testing method for the given numerical set of data to analyze the significance. | **a,e,l** | |
| **3.0** | Find numerical approximations to the roots of an equation by Newton method, numerical solution to a system of linear equations by Gaussian Elimination and Gauss-Seidel. | **3.1** | The students will be able to acquainted with the basic concepts in numerical methods and their uses. | **a,c,d,l** | |
| **4.0** | Find the Lagrange Interpolation Polynomial for any given set of points. | **4.1** | When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values. | **a,e,l** | |
| **5.0** | Apply several methods of numerical differentiation and integration, including Romberg integration. | **5.1** | The students will be able to explain the consequences of finite precision and the inherent limits of the numerical methods considered. | **a,b,l** | |

| | |
|---|---|
| **UNIT I - PROBABILITY AND RANDOM VARIABLES** | **(6+6)** |
| Random variable-Probability mass function – Probability density functions – Properties - Moments –Moment generating functions and their properties. | |
| **UNIT II - TESTING OF HYPOTHESIS** | **(6+6)** |
| Sampling Distributions-Testing of hypothesis for mean - t - distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit. | |
| **UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS** | **(6+6)** |
| Solution of equation – Method of criteria for convergence - Iteration method : x = g(x)method – Newton Raphson method – Solution of linear system by Gaussian elimination and Gauss – Jordon method – Iterative methods: Gauss-Seidel method – Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method for symmetric matrix. | |
| **UNIT IV - INTERPOLATION AND APPROXIMATION** | **(6+6)** |
| Divided differences in unequal intervals - Interpolating with a cubic spline – Lagrangian Polynomials — Newton's forward and backward difference formulas for equal intervals. | |

| UNITV - NUMERICAL DIFFERENTIATION AND INTEGRATION | (6+6) |
|---|---|
| Numerical Differentiation using interpolation formulae –Numerical integration by Trapezoidal and Simpson's 1/3 rule and 3/8 rule – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpson's rules. | |
| **TOTAL (L: 30+T:30) = 60 PERIODS** | |

**TEXT BOOKS:**


1. T. Veerarajan. and T. Ramachandran, "Numerical Methods with programming in C" 2nd ed., Tata McGraw-Hill, 2006 , First reprint 2007.
2. Veerarajan.T, "Probability, Statistics and Random Processes with Queuing Theory and Queuing Networks", Fourth Edition ,Tata McGraw-Hill, New Delhi 2016.


**REFERENCES:**


1. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill, New Delhi, 1999, 25th reprint 2008.
2. M.K Venkatraman, "Numerical Methods" National Publication, New Delhi, 2000, Reprint 2005.
3. B.S.Grewal, "Numerical Methods in Engineering & Science" ,Khanna publishers ,New Delhi,2012.
4. P. Kandasamy, K.Thilagavathy and K. Gunavathy, "Numerical Methods – Vol: IV", S.Chand& Co. Ltd. New Delhi, 2003, reprint 2007.


| 17EEC07-ELECTRICAL MACHINES - II | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 2 | 0 | 3 |
| **PREREQUISITE : 17EEC04** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand the working principle, performance characteristics of alternator and Synchronous motor | **1.1** | The students will be able to analyze the performance of synchronous generator and compute EMF equation and voltage regulation by using different methods | | **a, b, c, d** |
| **2.0** | To motivate the students to acquire knowledge on synchronous motor | **2.1** | The students will be able to elucidate the characteristics of synchronous motor and analyze its performance | | **a, b, c, d** |
| **3.0** | To understand the different types of induction motor, working principle and their performance | **3.1** | The students will be able to analyze the characteristics, equivalent circuit and circle diagram of three phase induction motor and induction generator | | **a, b, c, d** |
| **4.0** | To select the appropriate machine from the knowledge of starting and speed control of three- phase induction motors | **4.1** | The students will be able to apply suitable starting and speed control methods to enhance the performance of three phase induction motors | | **a, b, c, d** |
| **5.0** | To convey the concepts and technical details of single phase induction motor and application specific special machines | **5.1** | The students will be able to apply the double revolving field theory to develop equivalent circuit of single phase induction motor and examine the performance of special machines | | **a, b, c, d,e** |

| **UNIT I - SYNCHRONOUS GENERATOR** | **(12)** |
|---|---|
| Constructional details – Types of rotors – Winding factors - EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF and ZPF methods - Synchronizing and parallel operation –Synchronizing torque – Two reaction theory – Slip test - Capability Curves. | |
| **UNIT II - SYNCHRONOUS MOTOR** | **(12)** |
| Constructional details - Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Input and output power equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed - Synchronous condenser. | |
| **UNIT III – THREE PHASE INDUCTION MOTOR** | (**12**) |
| Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses –Double cage induction motors –Induction generators | |
| **UNIT IV - STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR** | **(12)** |
| Need for starters – Types of starters – DOL, Star-delta, Auto transformer and Rotor resistance starters – Speed control – Voltage control, Frequency control, Pole changing, V/f control and Rotor resistance control – Cascaded connection- – Slip power recovery scheme. | |

| UNIT V - SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES | (12) |
|---|---|
| Constructional details of single phase induction motor – Double field revolving theory and operation –Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods – Shaded pole induction motor – Repulsion motor - Universal motor - Switched Reluctance Motor – BLDC Motors. | |
| **TOTAL :60 PERIODS** | |

**TEXT BOOKS:**


1. Gupta. J.B., "Electrical Machines (AC & DC Machines)", 4th ed., S K Kataria & Sons, New Delhi, 2012.
2. Rajput. R.K., "Electrical Machines", 5th Edition, Laxmi Publications, New Delhi, 2008.


**REFERENCES:**


1. .Kothari D.P.,Nagrath I.J, "Electric Machines", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
2. Fitzgerald, A.E., Kingsley, Charles and Umans, Stephen. D., "Electric Machinery", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
3. Langsde of, Alexander S., "Theory of Alternating Current Machinery", 2nd ed., Tata McGraw Hill Publishing Company, New Delhi, 2004.


| 17EEC08-LINEAR INTEGRATED CIRCUITS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC03** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the function and fabrication process of ICs | **1.1** | The students will be able to Know about IC fabrication procedure | **a,b,d,e,i** | |
| **2.0** | To provide in-depth instructions on the characteristics of operational amplifiers | **2.1** | The students will be able to impart knowledge on characteristics of OP-AMP | **a,c,d,e,i** | |
| **3.0** | To understand the applications of operational amplifiers | **3.1** | The students will be able to get adequate knowledge on OP-AMP application | **a,b,c,e,g** | |
| **4.0** | To make the student to understand about unique IC and applications of ICs | **4.1** | The students will be able to analyze and construct various application circuits using 555 timer. | **a,b,d,k** | |
| **5.0** | Develop a strong basis of oscillator | **5.1** | The students will be able to recognize about the Oscillators and types | **a,b,c,d,j,l** | |

| | |
|---|---|
| **UNIT I - IC FABRICATION** | **(9)** |
| 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. | |
| **UNIT II – CHARACTERISTICS OF OPAMP** | **(9)** |
| Ideal OP -AMP characteristics: DC characteristics, AC characteristics -Differential amplifier - Basic applications of op-amp –Inverting and Non-inverting Amplifiers -V/I & I/V converters –Summer -Differentiator and integrator. | |
| **UNIT III – APPLICATIONS OF OPAMP** | **(9)** |
| Instrumentation amplifier -Comparators – Multivibrators - Clippers – Clampers - D/A converter (R-2R ladder and weighted resistor types) - A/D converters using op amps. | |
| **UNIT IV - UNIQUE ICs AND APPLICATIONS OF ICs** | **(9)** |
| Functional block, characteristics & application circuits with 555 Timer –IC 566 voltage controlled oscillator - IC 565 phase lock loop - 723 Variable voltage regulators - LM 380 power amplifier. | |
| **UNIT V -OSCILLATORS** | **(9)** |
| Oscillators – Barkhausen criterion for oscillation – Hartley & Colpitt's oscillators – phase shift, Wien bridge and crystal oscillators - Clapp oscillator. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. D. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuits” , Fourth Edition New Age International,4th ed., 2011.
2. Gayakwad R.A., 'Op-amps & Linear Integrated Circuits', Prentice Hall of India, New Delhi, 4 th Edition, 2009.


**REFERENCE:**


1. Jacob Millman, Christos C.Halkias, “Integrated Electronics - Analog and Digital Circuits System”,McGraw Hill Education, 2nd ed., 2011.


| 17EEC09-DIGITAL LOGIC CIRCUITS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE :17EEC03** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate about the fundamentals of Boolean functions | **1.1** | The students will be able to study number systems and to simplify the mathematical expressions using Boolean functions | **a,b,d,e,i** | |
| **2.0** | To motivate the students to design combinational logic circuits | **2.1** | The students will be able to design combinational logic circuits | **a,c,d,e,i** | |
| **3.0** | To make the student to understand about the concepts of synchronous circuits | **3.1** | The students will be able to analyze and design various synchronous circuits | **a,b,c,e,g** | |
| **4.0** | To encourage the students to implement asynchronous circuits | **4.1** | The students will be able to implement the asynchronous circuits | **a,b,d,k** | |
| **5.0** | To motivate the students to know about logic families | **5.1** | The students will be able to expose the concept of memory devices and logic families | **a,b,c,d,j,l** | |

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|---|---|
| **UNIT I - INTRODUCTION TO BOOLEAN ALGEBRA** | **(9)** |
| Number systems-Binary arithmetic– Logic gates- Binary codes–Boolean algebra and theorems-Boolean functions–Canonical and standard forms -Simplifications of boolean functions using Karnaugh map and Quine Mc-Clusky methods. | |
| **UNIT II - COMBINATIONAL LOGIC CIRCUITS AND ITS APPLICATIONS** | **(9)** |
| Introduction- Adder and subtractor circuits – Code converters(Binary to Gray, BCD to Excess 3,Gray to Binary) - Decoders and encoders -Multiplexers and demultiplexers. | |
| **UNIT III - SEQUENTIAL LOGIC CIRCUITS** | **(9)** |
| Synchronous sequential circuits – Flip flops – Shift registers – Counters - Analysis and design Procedures - State reduction and state assignment. | |
| **UNIT IV - ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS** | **(9)** |
| Introduction to asynchronous sequential circuits-Analysis and Design procedure-Reduction of state flow table-Hazards-Race free statement. | |
| **UNIT V -PROGRAMMABLE LOGIC DEVICES AND MEMORIES** | **(9)** |
| Programmable logic devices: PLA, PAL and FPGA –Memories: RAM organization, ROM organization, PROM, EPROM, EEPROM- Logic families: RTL, DTL and TTL logic. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. M.Morris Mano, "Digital Design", 3rd ed., Pearson Education, 2013.
2. Raj Kamal A **"**Digital Systems Principles and Design**",** Pearson Education, Anna Univ.Edition, 2012.

**REFERENCES:**


1. Charles H.Roth Jr , Larry L. Kinney, “Fundamentals of Logic Design” ,7th ed.,Thomson Learning, 2014.
2. Charles H. Roth, Jr.,Lizy Kurian John, “Digital System Design using VHDL”, CL Engineering/Cengage Learning India ,2012.
3. Nripendra N Biswas, “Logic Design Theory”, PHI Learning, 2010.


| 17EEC10-TRANSMISSION AND DISTRIBUTION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC02 and 17EEC04** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To Provide the knowledge on the basics of Transmission and distribution of electrical power | **1.1** | The students will be able to acquire knowledge about HVAC, HVDC, ac and dc distributors. | | **a,b,c,d** |
| **2.0** | To understand the concept of transmission line parameters | **2.1** | The students will be able to analyze line parameters using symmetrical and unsymmetrical spacing conductors. | | **a,c,d,e** |
| **3.0** | To get the knowledge about transmission line based on distance and operating voltage. | **3.1** | The students will be able to design equivalent line parameters to obtain transmission efficiency and voltage regulation. | | **a,b,c,e,g** |
| **4.0** | To get the knowledge about the types of Insulators and cables | **4.1** | The students will be able to analyze the voltage distribution in insulator string, cables and method to improve the same. | | **a,b,d,k** |
| **5.0** | To give exposure to calculate sag and tension of transmission line, grounding concepts. | **5.1** | The students will be able to design a transmission line and tower structure ,modern substation layout with grounding techniques | | **a,b,c,d,j,l** |

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|---|---|
| **UNIT I - STRUCTURE OF POWER SYSTEM** | **(9)** |
| Structure of electric power system – Transmission and distribution – Introduction to HVAC and HVDC transmission - Comparison between HVAC and HVDC – Distributed and Concentrated loads – High tension and Low tension. | |
| **UNIT II - TRANSMISSION LINE PARAMETERS** | **(9)** |
| Parameters of transmission lines –Types of conductors – Resistance, inductance and capacitance of single phase, three phase, Symmetrical and unsymmetrical transposed conductors – Self and mutual GMD - Skin and proximity effects - Interference with neighboring communication circuits – Corona discharges. | |
| **UNIT III - MODELLING AND PERFORMANCE OF TRANSMISSION LINES** | **(9)** |
| Classification of lines – Short line, medium line and long line - Equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance -Transmission efficiency and voltage regulation – Voltage control - Ferranti effect. | |
| **UNIT IV - INSULATORS AND CABLES** | **(9)** |
| Insulators - Types, voltage distribution in insulator string, improvement of string efficiency – Underground cables – Types of cables – Capacitance of Single-core cable and 3- core belted cable –Grading of cable – Power factor and heating of cables. | |
| **UNIT V - MECHANICAL DESIGN OF LINES AND GROUNDING** | **(9)** |
| Mechanical design of transmission line – Sag and tension calculations for different weather conditions – Tower spotting– Types of towers – Substation Layout (AIS, GIS) – Methods of grounding | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. B.R.Gupta, S.Chand, "Power System Analysis and Design", New Delhi, 7th ed.., 2014.
2. S.N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, 2nd ed., 2011.

**REFERENCES:**


1. G.Ramamurthy, "Handbook of Electrical power Distribution", Universities Press, 2013.
2. TorenGonen, "Electrical Power Distribution", CBC, 2010.
3. D.P.Kothari, I.J. Nagarath, "Power System Engineering", Tata McGraw-Hill Publishing Company limited, New Delhi, 2nd ed., 2008.
4. V.K.Mehta, Rohit Mehta, "Principles of Power System", S.Chand Publication, 2005.


| 17EEP04-ELECTRICAL MACHINES II LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEP03** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand different methods to find regulation of the alternator. | **1.1** | The students will be able to analyze performance of alternator by EMF, MMF, and ZPF Methods. | **a,b,c,e,f,g,i,l** | |
| **2.0** | To provide the knowledge of three phase synchronous motor under different load condition | **2.1** | The students will be able to control the speed of three phase synchronous motor under various load conditions. | **a,b,c,f,k,l** | |
| **3.0** | To develop knowledge on the types of three phase induction motor by conducting load test. | **3.1** | The students will be able to acquire knowledge of load characteristic of induction motor | **a,b,c,d,e,g,i,l** | |
| **4.0** | To get knowledge about the losses of three phase induction motor. | **4.1** | The students will be able to analyze the performance of induction motor under loaded and unloaded condition to find the losses of induction motor. | **d,e,g,l** | |
| **5.0** | To Acquire knowledge on single phase induction motor under loaded condition | **5.1** | The students will be able to analyze the load characteristics of single phase induction motor. | **a,c,d,e,g,h,j,l** | |

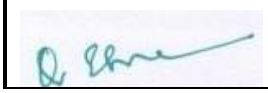
**LIST OF EXPERIMENTS:**

1. Regulation of Alternator by EMF and MMF Methods.
2. Regulation of Alternator by ZPF Method.
3. Regulation of Salient Pole Alternator.
4. Load Test on three phase alternator.
5. V and inverted V curve of three phase synchronous motor.
6. Load Test on three phase Squirrel cage induction motor.
7. Load Test on three phase Slip ring induction motor.
8. Performance evaluation of three phase induction motor from circle diagram.
9. Separation of no load losses of three phase induction motor.
10. Load Test on single phase induction motors.

**ADDITIONAL EXPERIMENTS:**

1.Study of AC Starters
2. Synchronization of alternators by using dark and bright lamp method.

**TOTAL (P:60) = 60 PERIODS**



| 17EEP05-LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEP02** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To implement the basic circuits using OP-AMP. | **1.1** | The students will be able to analyze about the characteristics of OP-AMP | | **a,c,d,l** |
| **2.0** | To implement the timer IC application. | **2.1** | The students will be able to know the applications of OP-AMP and 555 IC | | **a,b,c,d,l** |
| **3.0** | To verify the expressions using Boolean functions | **3.1** | The students will be able to acquire knowledge about the various types of logic gates | | **a,c,d,h** |
| **4.0** | To verify the Combinational circuits | **4.1** | The students will be able to understand about the code converters | | **a,b,c** |
| **5.0** | To understand the concept of conversions in various applications. | **5.1** | The students will be able to acquire knowledge about checker and generator | | **a,c,d,l** |

**LIST OF EXPERIMENTS:**

1. Implementation of Inverting and Non-Inverting amplifier using OP-AMP
2. Implementation of Differentiator and integrator using OP-AMP
3. Implementation of Monostable multivibrator using 555 IC
4. Implementation of Astable multivibrator using 555 IC
5. Verification of logic gates
6. Verification of Half subtractor and Half adder
7. Verification of binary to gray code and gray to binary code converter
8. Verification of Multiplexer and Demultiplexer
9. Verification of encoder and decoder
10. Verification of Parity checker and Parity generator

**ADDITIONAL EXPERIMENTS:**

1. Design and implementation of synchronous and asynchronous counters and shift registers using flipflops.
2. Precision Half and Full Wave rectifier using OP-AMP.

**TOTAL= 60 PERIODS**

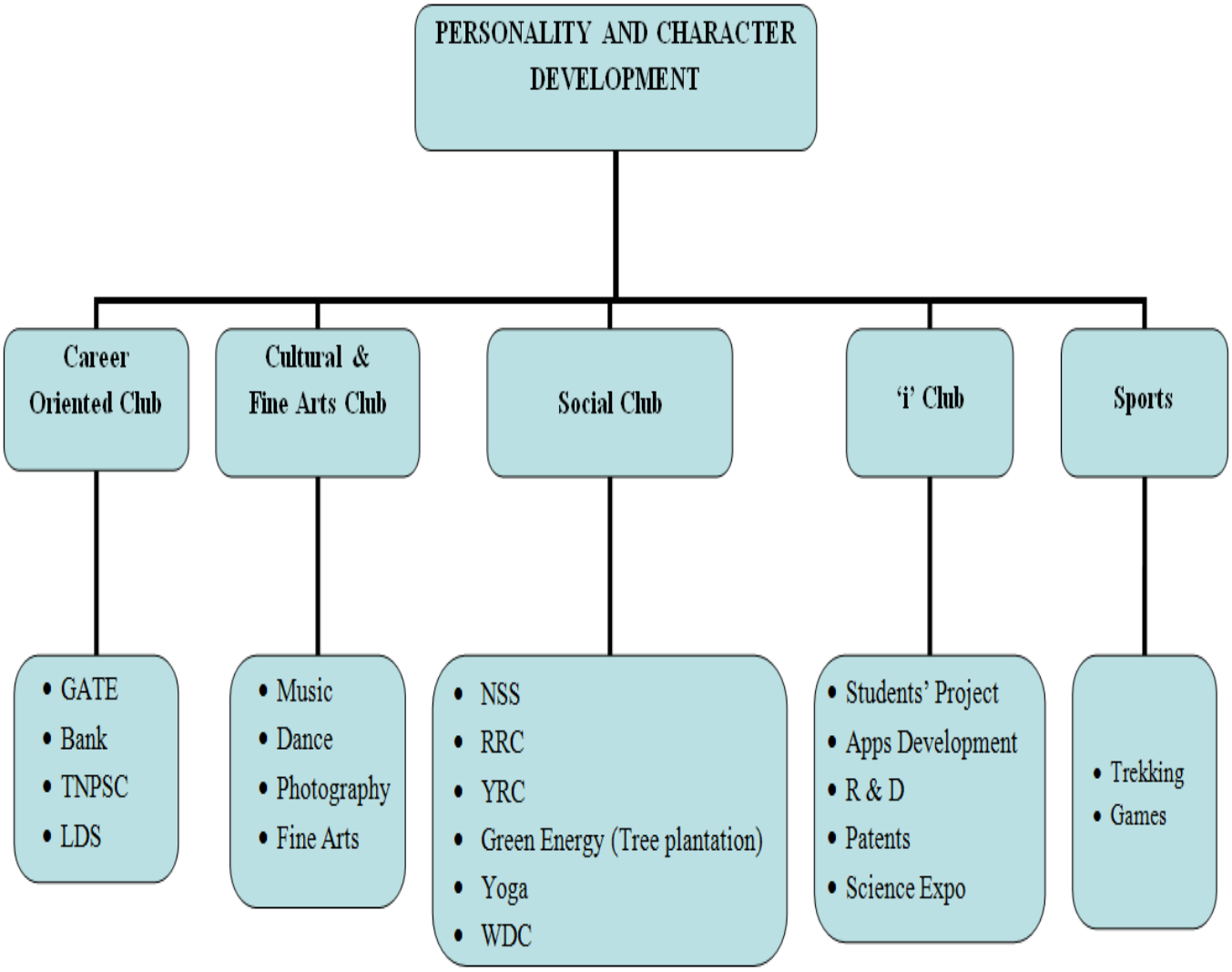
| 17GED01 – SOFT SKILLS – LISTENING AND SPEAKING | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To recollect the functional understanding of basic grammar and its structure | **1.1** | The students will be able to apply the knowledge of basic grammar to classify the types of verbs and questions and to construct the sentences | **h,i,j,l** | |
| **2.0** | To acquire the listening skills through note completion, matching and multiple choice modes | **2.1** | The students will be able to develop the listening skills through note completion, matching and multiple choice modes | **h,i,j,l** | |
| **3.0** | To develop speaking skills through self introduction, short talk and topic discussion | **3.1** | The students will be able to organize a presentation on the given topic | **h,i,j,l** | |

| | |
|---|---|
| **UNIT I - GRAMMAR** | **(10)** |
| Tenses - Verb (Auxiliary and Modal) - 'Yes/No' Type Questions - Reported Speech - Gerund - Phrasal Verbs | |
| **UNIT II – LISTENING** | **(10)** |
| Part I : Note completion<br>Part II: Matching<br>Part III: Multiple Choice | |
| **UNIT III - SPEAKING** | **(10)** |
| Part I : Self Introduction<br>Part II: Short talk on business topics<br>Part III: Discussion in pairs | |
| **TOTAL (P:30) : 30 PERIODS** | |


1. Murphy, Raymond, "Essential Grammar in Use", Cambridge University Press, UK, 2007
2. Whitby, Norman ,"Business Benchmark Pre- Intermediate to Intermediate Preliminary, 2nd ed., Cambridge University Press, 2013.


**17GED03 - PERSONALITY A ID CHARACTER DEVELOPMENT**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 1 | 0 |




***LDS - Leadership Development Skills**

| **OBJECTIVES :** | | | | |
|---|---|---|---|---|
| **Career Oriented Club** | **Cultural & Fine Arts Club** | **Social Club** | **'i' club** | **Sports** |
| •To provide support for identifying specific career field of interests and career path<br>•To provide support for preparing for competitive exams | •To bring out the hidden talent of students in music, dance and other fine arts.<br>•To promote photography skill among the students<br>•To develop and enhance the performance of students by participating in various events<br>•To inculcate managerial capabilities such as event management and stage organization | •To create social awareness and develop a sense of social and civic responsibility<br>•To inculcate socially and environmentally sound practices and be aware of the benefits<br>•To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community. | •To inculcate the basic concepts of innovation<br>•To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities<br>•To enrich the academic experience, build competencies and relationships beyond the classroom | •To provide opportunities to excel at sports<br>•To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation.<br>•To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities.<br>•To develop leadership skills and nurture the team building qualities.<br>**<u>Trekking:</u>**<br>•To provide opportunities to explore nature and educating about the purity of nature<br>•To improve physical and mental health. |

| **OUTCOMES :** At the end of this course, the students will be able to | | | | |
|---|---|---|---|---|
| •Find a better career of their interest.<br>•Make use of their knowledge during competitive exams and interviews. | •Take part in various events<br>•Develop team spirit, leadership and managerial qualities | •Develop socially responsive qualities by applying acquired knowledge<br>•Build character, social consciousness, commitment and discipline | •Apply the acquired knowledge in creating better solutions that meet new requirements and market needs<br>•Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team | •Demonstrate positive leadership skills that contribute to the organizational effectiveness<br>•Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle<br>•Create inclination towards outdoor activity like nature study and Adventure. |

**TOTAL [2 x (P: 15)]: 30 PERIODS**

**(Cumulatively for Two Semesters)**

| 17GEA02 – PRINCIPLES OF MANAGEMENT | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To study the importance and functions of management in an organization. | **1.1** | The students will be able to acquire comprehensive knowledge on management concepts. | **g, h, i** | |
| **2.0** | To study the importance of planning and also the different types of plan. | **2.1** | The students will be able to understand and apply planning concepts at different conditions and situations. | **c, d, g, i** | |
| **3.0** | To understand the different types of organization structure in management | **3.1** | The students will be able to accomplish organizational structures and understand the staffing process. | **c. d, f, i** | |
| **4.0** | To understand the basis and importance of directing in management | **4.1** | The students will be able to employees motivation and project managements in working environments. | **d, f, j, k** | |
| **5.0** | To understand the importance of control techniques | **5.1** | The students will be able to do the budgetary and non-budgetary control of projects. | **c, e, g, k** | |

| **UNIT I - OVERVIEW OF MANAGEMENT** | **(9)** |
|---|---|
| Definition of management – Science & Art – Management & Administration - Role of managers – Evolution of Management thoughts – Contribution of Taylor and Fayol – Functions of management – Strategies for International business. | |
| **UNIT II - PLANNING** | **(9)** |
| Nature and purpose of planning - Planning process - Types of plans – Objectives – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions. | |
| **UNIT III - ORGANIZING** | **(9)** |
| Nature and purpose of organizing - Organization structure - Formal and informal organization - Line and Staff authority- Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing – Selection and Recruitment - Orientation -Career Development - Career stages – Training - Performance Appraisal. | |
| **UNIT IV - DIRECTING** | **(9)** |
| Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership – Types of Leadership – Job enrichment - Communication - hurdles to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity. | |
| **UNIT V - CONTROLLING** | **(9)** |
| System and Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control – Quality Control - Planning operations. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOK:**

1. Harold Koontz, Heinz Weihrich , “Essentials of Management”, Tata McGrawHill, 8th edition Second Reprint 2010.

**REFERENCES:**

1. Andrew J. Dubrin, “Essentials of Management”, Thomson Southwestern, 9th ed., 2012.
2. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall of India, 10th Edition, 2010.
3. Charles W L Hill, Steven L Mc Shane, “Principles of Management”, Mc Graw Hill Education, Special Indian Edition, 2008.
4. Hellriegel, Slocum & Jackson, “Management - A Competency Based Approach”, Thomson South Western, 10th edition, 2007.
5. Harold Koontz, Heinz Weihrich and Mark V Cannice, “Management - A global & Entrepreneurial Perspective”, Tata Mc Graw Hill, 12th ed., 2007.

| 17EEC11-MEASUREMENTS AND INSTRUMENTATION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC08** | **QUESTION PATTERN : TYPE - 3** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To introduce the basic functional elements of instrumentation | **1.1** | The students will be able to apply the basic laws governing the operation of the instruments | **a,b,f,i,k** |
| **2.0** | To introduce various electrical measuring instruments | **2.1** | The students will be able to calibrate measuring instruments. | **a,c,f,j** |
| **3.0** | To educate on the comparison between various measurement techniques | **3.1** | The students will be able to apply analog and digital techniques to measure electrical quantities. | **a,d,i,k** |
| **4.0** | To introduce the fundamentals of electrical and electronic instruments | **4.1** | The students will be able to demonstrate about storage & display devices. | **a,b,f,k** |
| **5.0** | To introduce various transducers and the data acquisition systems | **5.1** | The students will be able to use various transducers and data acquisition system. | **a,b,c,i,l** |

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|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of digital voltmeters, ammeters. | |
| **UNIT II - ELECTRICAL AND ELECTRONIC INSTRUMENTS** | **(9)** |
| Principle and types of multi meters – Single phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency. | |
| **UNIT III - COMPARATIVE METHODS OF MEASUREMENTS** | **(9)** |
| D.C Bridges: Wheatstone Bridge, Kelvin's double bridge- A.C bridges: Maxwell bridge, Anderson bridge, Schering bridge. | |
| **UNIT IV - STORAGE AND DISPLAY DEVICES** | **(9)** |
| Magnetic disk and tape – Recorders, digital plotters and printers, digital CRO, LED, & Dot matrix display – Data Loggers. – Smart Meters. | |
| **UNIT V - TRANSDUCERS AND DATA ACQUISITION SYSTEMS** | **(9)** |
| Classification of transducers – Selection of transducers – Resistive (Thermistors & Thermocouples), capacitive & inductive Transducers (LVDT) – Piezoelectric and Hall effect transducer – Elements of data acquisition system. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. Sawhney A K, “A Course in Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai & Sons, New Delhi, 18th Edition, 2012.
2. Gupta J.B., “A Course in Electronic and Electrical Measurements”, S. K. Kataria & Sons, Delhi, 2009.


**REFERENCES:**


1. Kalsi H.S, “Electronic Instrumentation”, McGraw Hill Education India, 3rd Edition, 2010.
2. Prithwiraj Purkait, Budhaditya Biswas, Chiranjib Koley “Electrical and Electronics Measurements and Instrumentation”, McGraw Hill Education India, First Edition, 2013.
3. Patranabi.D, “Sensors And Transducers”, PHI Learning Pvt. Ltd., 2003.


| 17EEC12-CONTROL SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 2 | 0 | 4 |
| **PREREQUISITE : 17EEC04 AND 17EEC07** | | **QUESTION PATTERN :TYPE-3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To introduce the basic concepts of physical systems and modeling. | **1.1** | The students will be able to understand the use of transfer function models for analysis physical systems and introduce the control system | **a,b,c,e,i,k** | |
| **2.0** | To impart in-depth analysis of system dynamics in time-domain using classical techniques. | **2.1** | The students will be able to provide adequate knowledge in the time response of systems and steady state error analysis. | **a,b,e,i** | |
| **3.0** | To impart in-depth analysis of system dynamics in frequency domain using classical techniques. | **3.1** | The students will be able to accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems. | **a,b,c,f,i** | |
| **4.0** | To learn about the basic idea of stability analysis | **4.1** | The students will be able to introduce stability analysis and design of compensators. | **a,c,e,f,i** | |
| **5.0** | To acquire knowledge on in-depth analysis of physical system dynamics using state-space models | **5.1** | The students will be able to introduce state variable representation of physical systems and study the effect of state feedback | **b,c,e,l,k** | |

| **UNIT I -SYSTEMS AND THEIR REPRESENTATIONS** | **(12)** |
|---|---|
| Basic elements of control systems – Classification of control systems-Open loop and closed loop control systems-Transfer functions of mechanical, electrical and Electromechanical systems – Block diagram s –Signal flow graphs – Mason's gain formula-Control System Components | |
| **UNIT II - TIME DOMAIN ANALYSIS** | **(12)** |
| Typical test signals- Time domain specifications – Characteristic equation-Transient response of second order systems – Steady state response-Steady state errors-Static and dynamic error coefficient – Root locus. | |
| **UNIT III - FREQUENCY DOMAIN ANALYSIS AND DESIGN** | **(12)** |
| Frequency domain specifications –Bode plot – Polar plot – Nyquist stability criterion. Correlation between frequency domain and time domain specifications. | |
| **UNIT IV- STABILITY AND COMPENSATOR DESIGN** | **(12)** |
| Stability of linear control systems – Stability and location of the roots of the Characteristic equation – Routh Hurwitz criterion - Design of lag, lead, lag-lead series networks Lag/Lead compensator design using bode plots construction –Introduction to P, PI, PID controllers-Effects of P, PI, PID modes of feedback control. | |

| UNIT V -STATE SPACE ANALYSIS | (12) |
|---|---|
| Introduction-Concepts of state, state variables and state model-Physical ,phase and canonical variables-State equation – Solutions – Realization – Controllability – Observability – State space to transfer function conversion – Pole placement. | |
| **TOTAL = 60 PERIODS** | |

**TEXT BOOKS:**


1. Gopal M, "Control Systems – Principles and Design" 4 th ed,Tata McGraw-Hill, New Delhi, 2012.
2. Nagrath I J and Gopal M, "Control System Engineering", 6th ed ,New Age International, New Delhi, 2017.


**REFERENCES:**


1. Norman S Nise, "Control System Engineering ", John Wiley & Sons, 6th ed, New Delhi, 2012.
2. Farid Golnaraghi and Benjamin C Kuo, "Automatic Control Systems", 10th ed, McGraw-Hill, New Delhi ,2017.
3. Ogata K, "Modern Control Engineering", Prentice Hall of India, New Delhi, 2012.


| 17EEC13-POWER ELECTRONICS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC03** | | **QUESTION PATTERN : TYPE - 1** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To realize the characteristics of important power semiconductor devices and converters | **1.1** | The students will be able to remember the characteristics and the turn on methods of power devices. | **a,b,c,d,e,f,g,h,i,k,l** |
| **2.0** | To analyze the concepts of various converters. | **2.1** | The students will be able to understand the operation of rectifier circuits. | **a,b,c,d,e,f,g,h,i,k,l** |
| **3.0** | To work in teams and independently for the design, development and testing of power electronics. | **3.1** | The students will be able to understand the working principle of DC choppers. | **a,b,c,d,e,f,g,h,i,k,l** |
| **4.0** | To understand the basic requirements of industrial power electronics by using the concept of inverters | **4.1** | The students will be able to understand the operation of inverter circuits. | **a,b,c,d,e,f,g,h,i,k,l** |
| **5.0** | To model and simulate the various types of AC-AC converters. | **5.1** | The students will be able to understand the working principle of AC-AC Converter. | **a,b,c,d,e,f,g,h,i,k,l** |

| | |
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| **UNIT I - POWER SEMI-CONDUCTOR DEVICES** | **(9)** |
| Structure, operation and characteristics of power electronic devices: SCR, TRIAC, GTO – Dynamic characteristics of BJT, MOSFET and IGBT – Safe operating area of BJT – Triggering and commutation circuit for SCR – Design of driver and snubber, isolation circuits. | |
| **UNIT II - PHASE-CONTROLLED CONVERTERS** | **(9)** |
| 2-pulse, 3-pulse and 6-pulse converters – Performance parameters – Effect of source inductance – Gate circuit schemes for phase control – Single phase and three phase dual converters. | |
| **UNIT III – DC TO DC CONVERTERS** | **(9)** |
| Step-down and step-up chopper – Control strategy – Time ratio control and current limit control – Switched mode regulators: Buck, Boost, Cuk, Buck- Boost converter – Operation of four Quadrant chopper – SMPS. | |
| **UNIT IV – INVERTERS** | **(9)** |
| Single phase bridge inverter- Three phase voltage source inverter (both $120^0$ mode and $180^0$ mode) – Voltage control using PWM techniques: Single PWM, Sinusoidal PWM, Modified sinusoidal PWM and Multiple PWM – Harmonic reduction - Introduction of Current source inverter and Z-Source Inverter. | |
| **UNIT V - AC TO AC CONVERTERS** | **(9)** |
| Single phase AC voltage controller with RL load – Three phase AC voltage controller with R load (only Quantitative analysis) – Control strategy – Single phase and three phase Cycloconverter. | |
| | **TOTAL: 45 PEROIDS** |

**TEXT BOOKS:**


1. P.S.Bimbra, "Power Electronics", 3rd ed., Khanna Publishers, 2012.
2. Muhammad H.Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd ed., Prentice Hall of India, New Delhi, 2008.

**REFERENCES:**


1. M.D. Singh and K.B. Khanchandani, “Power Electronics”, Tata Mc Graw Hill, India, 2013.
2. Bimal K.Bose, “Modern Power Electronics and AC Drives”, Pearson Education, 2003.
3. Ned Mohan, Tore. M. Undel and William. P. Robbins, “Power Electronics: Converters, Applications and Design”, 3rd ed., John Wiley and sons, 2003.

| 17EEC14-COMMUNICATION ENGINEERING | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC09** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To introduce different methods of analog communication and their significance | **1.1** | The students will be able to learn the different methods of analog communication and their significance | **a,b,f,e,** |
| **2.0** | To introduce Digital Communication methods for high bit rate transmission | **2.1** | The students will be able to understand the digital Communication methods for high bit rate transmission | **a,c,f,j** |
| **3.0** | To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission. | **3.1** | The students will be able to realize the concepts of source and line coding techniques for enhancing the transmission rate | **a,d,i,k** |
| **4.0** | To introduce MAC used in communication systems for enhancing the number of users. | **4.1** | The students will be able to know various MAC protocols used in communication systems for enhancing the number of users | **a,b,f,k** |
| **5.0** | To introduce various media for digital communication | **5.1** | The students will be able to examine the various media for digital communication | **a,b,c,i,** |

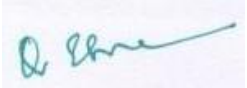
| | |
|---|---|
| **UNIT I - ANALOG COMMUNICATION** | **(9)** |
| Amplitude modulation: Frequency spectrum – vector representation – power relations – generation of AM – SB, SB/SC, SSB; AM transmitter: Low level and high level transmitter, AM receiver : Super heterodyne Receiver. Power relation between FM and PM, Generation (Armstrong method) and detection (Foster Seely Discriminator) of FM and PM. | |
| **UNIT II - DIGITAL COMMUNICATION** | **(9)** |
| Concept of sampling and sampling theorems, Pulse modulation techniques: PAM, PWM, PCM, DM, Adaptive delta modulation, Keying techniques: ASK, FSK and PSK – Introduction to smart communication devices: IoT and Zigbee. | |
| **UNIT III - SOURCE CODES, LINE CODES & ERROR CONTROL** | **(9)** |
| Source codes: Shaum codes, Huffman codes, Line Codes: NRZ and RZ, Error control codes : Linear block codes – Hamming codes, convolutions & block codes. | |
| **UNIT IV - SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES** | **(9)** |
| Spread Spectrum techniques: DSSS & FHSS techniques. Multiple Access techniques: FDMA, TDMA, CDMA, SDMA. | |
| **UNIT V - SATELLITE AND OPTICAL FIBER COMMUNICATION** | **(9)** |
| Satellite communication: Types of satellites, Satellite orbits, INTELSAT and INSAT - Optical fiber communication: Technology - Single mode and Multimode fibers. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Taub & Schiling “Principles of Communication Systems” Tata McGraw Hill 2007.
2. J.Das “Principles of Digital Communication” New Age International, 1986.

**REFERENCES:**


1. G.Kennedy,”Electronic Communication Systems”, Mcgraw Hill, 4th ed., 2002.
2. Miller, “Modern Electronic Communication”, Prentice Hall of India, 2003.
3. Gerd Keiser, “Optical Fiber Communications”, McGraw Hill Education (India) Private Limited, 2013.

| 17EEP06-CONTROL AND INSTRUMENTATION LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEC03 AND 17EEC04** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To provide knowledge on analysis and design of control system along with basics of instrumentation | **1.1** | The students will be able to find the performance of first and second order systems | **a,b,f,i,k** |
| **2.0** | To conduct experiments for determining the transfer function model of electro mechanical system. | **2.1** | The students will be able to examine the model for electromechanical systems. | **a,c,f,j** |
| **3.0** | To provide practical knowledge on application of various types of bridges. | **3.1** | The students will be able to select and design suitable bridges for measuring R,L and C. | **a,d,i,k** |
| **4.0** | To study the procedure of transducers, calibration. | **4.1** | The students will be able to identify the process of calibration. | **a,b,f,k** |

**LIST OF EXPERIMENTS:**

1. Digital Simulation of First-Order Systems using MATLAB.
2. Digital Simulation of Second-order Systems using MATLAB.
3. Transfer Function of Separately Excited D.C Generator.
4. Transfer Function of Armature Controlled D.C Motor.
5. Digital simulation of P, PI and PID controllers using MATLAB.
6. Measurement of Medium resistance using Wheatstone bridge.
7. Measurement of Low resistance using Kelvin's double bridge.
8. Measurement of inductance using Anderson bridge.
9. Measurement of capacitance using Schering bridge.
10. Measurement of displacement using LVDT.

**ADDITIONAL EXPERIMENTS:**

1. Study of pressure transducers.
2. Calibration of single phase energy meter.

**TOTAL = 60 PERIODS**

| 17EEP07-POWER ELECTRONICS LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEP02** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand the various characteristics of SCR, TRIAC, MOSFET and IGBT | **1.1** | The students will be able to examine the working and characteristics of transistor & thyristor. | | **a,c,d,l** |
| **2.0** | To analyze the switching characteristics of SCR and MOSFET | **2.1** | The students will be able to know the working operation of single phase converter. | | **a,b,c,d,l** |
| **3.0** | To design and generate the gate pulses for converter circuits | **3.1** | The students will be able to observe the working operation of Three phase AC voltage controller. | | **a,c,d,h** |
| **4.0** | To verify the step up and step down operation of DC –DC chopper | **4.1** | The students will be able to examine the working of Chopper. | | **a,b,c** |
| **5.0** | To simulate the various electronics circuits using power electronics devices | **5.1** | The students will be able to identify the operation of single phase Cyclo-converter. | | **a,c,d,l** |

**LIST OF EXPERIMENTS:**

1. Experimental verification of static characteristics of SCR.
2. Experimental verification of VI characteristics of TRIAC.
3. Experimental verification of dynamic characteristics of SCR and MOSFET.
4. Experimental verification of Single-phase half and fully controlled Rectifiers with R and RL load.
5. Formation of buck and boost converter circuit using power MOSFET.
6. Formation of single phase IGBT based PWM Inverter.
7. Design and implementation of single-phase AC voltage controller.
8. Design and implementation of single-phase cycloconverter.
9. Simulation of Single-phase half and fully controlled rectifier using R, RL and RLE load.
10. Simulation of three phase inverter with R load.

**ADDITIONAL EXPERIMENTS:**

1. SCR Based Voltage and Current Commutated Chopper
2. Pulse Generation using bread board connection

**TOTAL = 60 PERIODS**

| 17GED08 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 0 | 0 | 0 |
| **PREREQUISITE : Nil** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To Understand the basics of Indian tradition and Indian traditional knowledge systems | **1.1** | The students will be able to Gain Knowledge about of Indian tradition and Indian traditional knowledge systems | a,f,h | |
| **2.0** | To know about basics of technologies and its scientific perspectives. | **2.1** | The students will be able to Understand basics of technologies and its scientific perspectives. | a, f | |
| **3.0** | To study the basics of Indian traditional health care , | **3.1** | The students will be able to **study the** basics of Indian traditional health care | a,f,l | |
| **4.0** | To know the basics of Indian artistic tradition knowledge | **4.1** | The students will be able to **know the** basics of Indian artistic tradition | a,f,l | |
| **5.0** | To develop the basics of linguistic tradition | **5.1** | The students will be able To develop the basics of linguistic tradition | a,f,h | |

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|---|---|
| **UNIT I - INDIAN TRADITION** | **(6)** |
| Fundamental unity of India, India's heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values. | |
| **UNIT II - INDIAN KNOWLEDGE SYSTEM AND MODERN SCIENCE** | **(6)** |
| Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists | |
| **UNIT III - INDIAN TRADITIONAL HEALTH CARE** | **(6)** |
| Importance and Practice of Yoga, Pranayam and other prevailing health care techniques | |
| **UNIT IV - INDIAN ARTISTIC TRADITION** | **(6)** |
| Introduction and overview of significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc | |
| **UNIT V - INDIAN LINGUISTIC TRADITION** | **(6)** |
| Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics | |
| **TOTAL = 30 PERIODS** | |

**Text Books:**


1. Sivaramakrishnan, V., *Cultural Heritage of India- Course Material*, Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014
2. Swami Jitatmananda, *Modern Physics and Vedanta*, Bharatiya Vidya Bhavan, 2004.
3. Raman V.V., *Glimpses of Indian Heritage,* Popular Prakashan,1993
4. Jha V.N., *Language, Thought and Reality*
5. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987


| 17EEC15-POWER SYSTEM ANALYSIS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 2 | 0 | 4 |
| **PREREQUISITE : 17EEC10** | | **QUESTION PATTERN : TYPE - 3** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To learn the power system modeling and algorithms for the analysis of electrical power systems. | **1.1** | The students will be able to describe the concept of power system | **a,b,c,e,i,k** |
| **2.0** | To know the recent developments in power flow analysis. | **2.1** | The students will be able to Infer about Power flow analysis | **a,b,e,i** |
| **3.0** | To give exposure to understand the basics concept of symmetrical faults. | **3.1** | The students will be able to analyze various types of symmetrical faults. | **a,b,c,f,i** |
| **4.0** | To learn about the basic idea of unsymmetrical faults | **4.1** | The students will be able to interpret the various types of unsymmetrical faults | **a,c,e,f,i** |
| **5.0** | To acquire knowledge on stability of the power system. | **5.1** | The students will be able to analyze the stability of the power system | **b,c,e,l,k** |

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| **UNIT I - INTRODUCTION** | **(12)** |
| Need for system planning and operational studies – Structure of a power system.- Single line diagram –per unit analysis– Generator – transformer – transmission line and load representation for different power system studies.- construction of Y-bus using inspection and singular transformation methods . | |
| **UNIT II - POWER FLOW ANALYSIS** | **(12)** |
| Introduction and standard to power flow analysis - classification of buses – development of power flow model in complex variables form – solution of power flow equation using Gauss-Seidel method –Introduction to Newton Raphson method and Fast decoupled method. | |
| **UNIT III - FAULT ANALYSIS – SYMMETRICAL FAULT ANALYSIS** | **(12)** |
| Importance of short circuit study –IEEE standards for short circuit studies-assumptions in fault analysis – analysis using Thevenin's theorem – computation of short circuit capacity, post fault voltage and currents. | |
| **UNIT IV - FAULT ANALYSIS – UNSYMMETRICAL FAULT ANALYSIS** | **(12)** |
| Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines – sequence networks- Analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem. | |
| **UNIT V - STABILITY ANALYSIS** | **(12)** |
| Importance of stability analysis in power system planning and operation –classification of power system stability – voltage stability –Development of swing equation – equal area criterion – determination of critical clearing angle and time – solution of swing equation by modified Euler method and Runge-Kutta method. | |
| | **TOTAL = 60 PERIODS** |

**TEXT BOOKS:**


1. Nagrath I.J. and Kothari D.P., „Modern Power System Analysis", Tata McGraw-Hill, 4th ed., 2011.
2. John J. Grainger and W.D. Stevenson Jr., „Power System Analysis, Tata McGraw-Hill, 6th reprint, 2010.


**REFERENCES:**


1. Hadi Saadat, „Power System Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. C.L.Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., 2010
3. Olle. I. Elgerd, „Electric Energy Systems Theory – An Introduction", Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2012.


| 17EEC16-MICROPROCESSOR AND MICROCONTROLLER | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC09** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To impart knowledge on basic functional blocks of 8085 microprocessor | **1.1** | The students will be able to understand the internal operations of 8085 processor | **a,e,f,i** | |
| **2.0** | To motivate the students to acquire knowledge on addressing modes and instruction sets of 8085 processor | **2.1** | The students will be able to develop skills in writing assembly language program | **a,b,c,e,f** | |
| **3.0** | To make the student to understand the interfacing of application devices | **3.1** | The students will be able to recognize the knowledge on interfacing the external devices to the processor according to the user requirements | **a,c,e,g** | |
| **4.0** | To impart knowledge on basic functional blocks and operations of 8051 microcontroller | **4.1** | The students will be able to understand the internal structure and instruction set of 8051 controller | **a,e,f,i** | |
| **5.0** | To convey the skills to know about PIC microcontroller | **5.1** | The students will be able to develop PWM outputs using PIC microcontroller. | **b,c,f,k,l** | |

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| **UNIT I - 8085 PROCESSOR** | **(9)** |
| Functional Building Blocks – Signals – I/O & data transfer concepts – Timing Diagram – Interrupts. | |
| **UNIT II - PROGRAMMING OF 8085 PROCESSOR** | **(9)** |
| Instruction format – Addressing modes – Instruction set – Need for assembly language – Development of assembly language programs – Introduction to ARM processor. | |
| **UNIT III - PERIPHERAL INTERFACING** | **(9)** |
| Architecture and interfacing: 8255, 8259, 8253, 8251- A/D and D/A converters – Interfacing with 8085. | |
| **UNIT IV - 8051 MICRO CONTROLLER** | **(9)** |
| Architecture – Memory Organization – I/O ports – Addressing modes – Instruction set – Interrupt structure - Simple programming exercises - Stepper motor control - Washing Machine Control. | |
| **UNIT V - PIC MICROCONTROLLER – PERIPHERALS** | **(9)** |
| PIC Microcontroller - Peripherals Timer 0 – Timer 1 - Compare and Capture mode — Timer 2 – PWM outputs – $I^2C$ operation – ADC – UART | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096", 2nd ed., Prentice Hall of India, 2014.
2. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Education, 2013.

**REFERENCES:**


1. Muhammad Ali Mazidi,J.G.Mazidi,R.D.Mckinlay, "The 8051 Microcontroller and Embedded Systems", 2nd ed.,Prentice Hall, 2007.
2. R.S. Gaonkar, „Microprocessor Architecture Programming and Applications with the 8085", 5th ed., Wiley Eastern Ltd., New Delhi, 2013.


| 17EEP08- MICROPROCESSOR AND MICROCONTROLLER LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEP05** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the basic programming of Microprocessor and microcontroller. | **1.1** | The students will be able to apply fundamental of assembly language programming for microprocessor and microcontroller | **a,c,e** | |
| **2.0** | To inscribe the interfacing of assembly language programs | **2.1** | The students will be able to apply computing platform for various engineering applications | **a,e** | |
| **3.0** | To provide solid foundation on interfacing the external devices to the processor according to the user requirements | **3.1** | The students will be able to work with standard microprocessor real time interfaces including serial ports, digital-to-analog converters and analog-to-digital converters | **a,c,e** | |
| **4.0** | To develop the quality of assessing and analyzing the obtained data | **4.1** | The students will be able to design circuits for various applications using microcontroller and microprocessor | **a,c,e** | |

**LIST OF EXPERIMENTS:**

1. Simple arithmetic operations: addition / subtraction / multiplication / division using 8085
2. Programming with control instructions using 8085 (i) Ascending / Descending order, Maximum / Minimum of numbers (ii) Programs using Rotate instructions (iii) Hex / ASCII / BCD code conversions
3. Interface Experiments using 8085
   i)ADC and DAC interfacing
   ii) square wave generation using 8253
   iii) terfacing of key board and display
   iv) Parallel Communication Interface using 8255
4. Simple arithmetic operations like addition, subtraction using 8051 Microcontroller
5. Interfacing of Stepper Motor using 8051

**ADDITIONAL EXPERIMENTS:**

1. Parallel port programming with 8051 using port 1 facility
2. Rolling display and flashing display

**TOTAL = 60 PERIODS**

| 17GED06 – COMPREHENSION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 2 | 0 |
| **PREREQUISITE : ALL CORE SUBJECT** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise. | **1.1** | The Student will be to understand and comprehend any given problem related to Electrical and Electronics Engineering field. | **a,b** | |

| **METHOD OF EVALUATION:** | **(30)** |
|---|---|
| The student will be assessed for his understanding of the basic principles of the core engineering subjects. The internal assessment for a total of 50 marks will be evaluated by a committee comprising of the faculty members of the department. The committee will conduct three written examinations of objective question type from the subjects (Test1-Electronic Devices, Digital Logic Circuits, Linear Integrated Circuits and Power Electronics; Test 2- Electrical Machines I, Electrical Machines II and Control Systems; Test 3- Field Theory, Transmission and Distribution, Power System Analysis and Microprocessors and Microcontrollers ). The end semester examination, which carries a total of 50 marks, will be an objective question type examination conducted by a committee of one internal examiner appointed by the COE of our college. | |
| **TOTAL (P: 30) = 30 PERIODS** | |

| 17GED07- CONSTITUTION OF INDIA | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 0 | 0 | 0 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate about the Constitutional Law of India | **1.1** | The students will be able to Gain Knowledge about the Constitutional Law | f, h, l | |
| **2.0** | To motivate students to Understand the Fundamental Rights and Duties of a citizen | **2.1** | The students will be able to Understand the Fundamental Rights and Duties of a citizen | f, g, h | |
| **3.0** | To make students to understand about Federal structure of Indian Government | **3.1** | The students will be able to Apply the concept of Federal structure of Indian Government | f, g, h | |
| **4.0** | To understand about Amendments and Emergency provisions in the Constitution | **4.1** | The students will be able to Analyze the Amendments and Emergency provisions in the Constitution | f, g, h | |
| **5.0** | To educate a holistic approach in their life as a Citizen of India | **5.1** | The students will be able Develop a holistic approach in their life as a Citizen | f, h, l | |

| | |
|---|---|
| **UNIT I - Introduction to Indian Constitution** | **(6)** |
| Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution - Salient features and characteristics of the Constitution of India | |
| **UNIT II - Fundamental Rights** | **(6)** |
| Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - 102 Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation | |
| **UNIT III - Federal Structure** | **(6)** |
| Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India | |
| **UNIT IV - Amendment to Constitution** | **(6)** |
| Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India | |
| **UNIT V - Emergency Provisions** | **(6)** |
| National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India | |
| **TOTAL = 30 PERIODS** | |

**REFERENCES:**


1. Constitution of India - Ministry of Law & Justice – PDF format awmin.nic.in/coi/coiason29july08.pdf
2. . Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material - www.constitution.org/cons/india/const.html


| 17EEC17 - ELECTRIC DRIVES AND CONTROL | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC04,17EEC07 & 17EEC13** | | **QUESTION PATTERN: TYPE – 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To provide knowledge on the process of learning fundamental concept of electrical drive systems and drive motor characteristics. | **1.1** | The students will be able to know the fundamental concept electrical drive, the selection process involved in drives and drive motor characteristics. | **a,b,c,e,i,k** | |
| **2.0** | To know the fundamental of DC motor drives | **2.1** | The students will be able to understand the operation of the converter, chopper fed dc drive and solve simple problems | **a,b,c,f,i** | |
| **3.0** | To give exposure to understand and analyze the various speed control of induction motor drives. | **3.1** | The students will be able to study and analyze the speed control of induction motor drive. | **a,b,c,f,i** | |
| **4.0** | To acquire knowledge on digital control techniques used for speed control of dives | **4.1** | The students will be able to use recent microcontroller for motor control and PLC based control of drives. | **b,c,e,f,i,k,l** | |
| **5.0** | To learn about the design of different controllers for drives | **5.1** | The students will be able analyze and design various controllers for drives | **a,b,c,e,i** | |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Basic elements – Types of Electric Drives – Factors influencing the choice of electrical drives –Multi quadrant operation- heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors –Drive motor characteristics - Braking of electrical motors | |
| **UNIT II - CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF DC DRIVES** | **(9)** |
| Speed control of DC series and shunt motors – Armature and field control- Ward-Leonard control system: Intermittent load application – Steady state analysis of the single and three phase converter fed separately excited DC motor drive –4 quadrant operations of converter / chopper fed drive. | |
| **UNIT III - CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF AC DRIVES** | **(9)** |
| Speed control of three phase induction motor – Voltage control- voltage / frequency control – Constant airgap flux – Field weakening mode –AC voltage Regulator- Voltage / current fed inverter – Rotor control – Rotor resistance control and slip power recovery schemes- principle of vector control. | |
| **UNIT IV - DIGITAL CONTROL TECHNIQUES FOR SPEED CONTROL OF DRIVES** | **(9)** |
| Digital techniques in speed control - Advantages and limitations– Microprocessor based control of drives- Microcontroller based control of drives -PLC Based drives. | |
| **UNIT V - DESIGN OF CONTROLLERS FOR DRIVES** | **(9)** |
| Introduction-Transfer function for DC motor / load and converter – Closed loop control with Current and speed feedback–Armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- Converter selection and characteristics. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2015.
2. Bose, B.K., ―Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2010

**REFERENCES:**

1. Vedam Subramanyam, ― Electric Drives: Concepts and Applicationsll, Tata McGraw hill Pvt. Ltd, New Delhi, 2011.
2. Krishnan R, ― Electric Motor Drives: Modeling, Analysis and Controlll, Prentice Hall of India, Pvt. Ltd, New Delhi,2010
3. S.K.Pillai, "A First Course on Electrical Drives", II Edition, New Age International Publishers, 2010.

| 17EEC18- POWER SYSTEM PROTECTION AND SWITCH GEAR | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| PREREQUISITE: 17EEC04,17EEC07 & 17EEC10 | | QUESTION PATTERN: TYPE 1 | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| 1.0 | To educate about the layout of power system | 1.1 | The students will be able to know the layout of a typical substation | a,b,f,i,k |
| 2.0 | To motivate students to learn about Fuses and circuit breakers | 2.1 | The students will be able to Select Fuses and Circuit breakers for a given situation | a,c,f,j |
| 3.0 | To make students to understand about relays | 3.1 | The students will be able to acquire knowledge to understand the principles of different types of protective relays | a,d,f,i,k |
| 4.0 | To understand about apparatus protection | 4.1 | The students will be able to gain adequate knowledge in selection of different types of protective schemes | a,b,f,k |
| 5.0 | To educate about various protective schemes | 5.1 | The students will be able to know the causes of abnormal operating conditions | a,b,f,i,l |

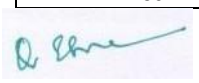
| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Switchgear - Essential features - Substations – Equipment - Layout of a typical substation - Current and Voltage transformers for protection. | |
| **UNIT II - FUSES AND CIRCUIT BREAKER** | **(9)** |
| Fuses -Types - HRC Fuses – Characteristics and Applications. Circuit Breakers - Arc phenomenon – Re-striking and Recovery voltage – Resistance switching - Types – Air, oil, $SF_6$ and Vacuum circuit breakers. | |
| **UNIT III – RELAYS** | **(9)** |
| Operating principles of relays - The Universal torque equation – Electromagnetic Relays-Over current, Directional, Distance, Differential, Negative sequence and Under Frequency relays – Numerical Relays. | |
| **UNIT IV - EQUIPMENTS PROTECTION** | **(9)** |
| Transformer protection: Differential protection and Buchholz's relay. Alternator protection: Differential protection, Earth fault protection and Negative sequence protection. Bus bars protection: Frame leakage protection and Differential circulating current protection. Transmission line protection: Distance and Differential protection, Carrier protection. | |
| **UNIT V - PROTECTION SCHEMES** | **(9)** |
| Principles and need for protective schemes – Nature and causes of faults – Types of faults-Protection against overvoltage due to lightning - Types of grounding - Petersen coil – DC Protection | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**


1. Badri Ram and D.N. Vishwakarma, "Power System Protection and Switch Gear", Tata McGraw Hill 2nd ed., 2013.
2. Sunil S. Rao, "Protection and Switch Gear", Khanna Publishers 13th edition, New Delhi, 2017.


**REFERENCES:**


1. Uppal, "Electrical Power" Khanna Publisher, 13th ed., 2001.
2. Y.G Paithankar and S.R Bhide, "Fundamentals of power system protection", Prentice Hall of India, 2nd ed., Learning private limited, 2010.

| 17EEC19-PRINCIPLES OF EMBEDDED SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE :17EEC16** | **QUESTION PATTERN: TYPE - 3** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To introduce the building blocks of Embedded Systems. | **1.1** | The students will be able to understand the concept of composition, design and implementation of embedded systems. | **a,b,c,d,e,k,l** |
| **2.0** | To familiarize the bus communication in processors, Input/output interfacing. | **2.1** | The students will be able to learn the interfacing techniques between processors and peripheral devices related to embedded system. | **a,b,c,d,e,f,g,k,l** |
| **3.0** | To know the uses of various protocols and their functionalities. | **3.1** | The students will be able to know the concept of communication protocols and apply advanced technical knowledge in multiple contexts | **a,b,c,d,f,g,k,l** |
| **4.0** | To understand the concepts of real time operating systems and its functions. | **4.1** | The students will be able to acquire the basic concepts of system programming like operating system, assembler, compliers and to understand the management tasks needed for developing embedded system. | **a,c,e,k,l** |
| **5.0** | To impart the basics of Real time operating system and its tools | **5.1** | The students will be able to use various testing tools for hardware- software debugging and learn its applications | **a,b,e,k,l** |

| **UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS** | **(9)** |
|---|---|
| Embedded systems – Classification – Characteristics and components of embedded system – Functional building blocks of embedded system – Challenges in embedded system – Embedded system design process – Applications of embedded systems. | |
| **UNIT II - PROCESSOR AND MEMORY ORGANIZATION** | **(9)** |
| Structural units in a processor – Selection of processor for embedded system – Interrupts, Memory – Segments and blocks – Direct Memory Access, Interfacing with I/O Devices. | |
| **UNIT III – COMMUNICATION PROTOCOLS** | **(9)** |
| Introduction to Serial/Parallel Communication protocols – Serial communication protocols; Inter Integrated Circuits, Controller Area Network, Universal Serial Bus, RS232 standard, RS485 standard, Fire-wire – Parallel communication protocols: ISA, PCI - ARM bus, Wireless protocols, Bluetooth. | |
| **UNIT IV - RTOS FOR EMBEDDED SYSTEMS** | **(9)** |
| Introduction to RTOS - Tasks and Task States - Interrupt Service Routines – Semaphores – Mutex – Message Queues – Mailboxes – Pipes - Scheduling policies - Inter process communication. | |

| UNIT V - REAL TIME OPERATING SYSTEM TOOLS AND CASE STUDIES | (9) |
|---|---|
| Introduction to µCOS – II and VX Works – Comparison of µCOS – II and VX works – Case study of coding for an automatic chocolate vending machine – Case study of an embedded system for an adaptive cruise control system in a car – Case study of an embedded system for a smart card. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. Rajkamal, "Embedded Systems- Architecture, Programming, Design", Mc Graw Hill,3rd ed., 2017.
2. Peckol, "Embedded system Design", John Wiley & Sons, 2010.
3. Daniel W. Lewis, "Fundamentals of Embedded Software", Prentice Hall of India, 2004.


**REFERENCES:**


1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2009.
2. Elicia White, " Making Embedded Systems", O' Reilly Series,SPD, 2011.


| 17EEC20-POWER SYSTEM OPERATION AND CONTROL | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC10 & 17EEC15** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To apply the tools like load curve, load duration curve and load factor to estimate the future demand and to predict the reserve capacity. | **1.1** | The students will be able to determine the future load demand and predict the reserve capacity | **a,b,f,g,l** | |
| **2.0** | To deduce the state variable model of frequency control loop in isolated and grid connected generating units. | **2.1** | The students will be able to construct the state variable model of frequency control loop in isolated and grid connected generating units. | **a,b,c,f** | |
| **3.0** | To compose the transfer function model of excitation system and to classify the three major system level control schemes. | **3.1** | The students will be able to analyze the transfer function model of excitation system and classify the system level control schemes. | **a,b,c,d,f** | |
| **4.0** | To prepare an economic load sharing schedule for a given demand based on generating unit's cost characteristics. | **4.1** | The students will be able to prepare an economic load sharing schedule for a given demand based on generating units cost characteristics | **a,b,c,d,e** | |
| **5.0** | To explain the hardware components required to design a SCADA system for power system monitoring and control. | **5.1** | The students will be able to explain the layout of SCADA system for power system monitoring and control | **a,e,f,g,i** | |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| System load variation: System load characteristics, load curves, Load-duration curve, load factor and diversity factor – Reserve requirements: Installed reserves, spinning reserves, cold reserves and hot reserves – Overview of system operation: Load forecasting, unit commitment and load dispatching – Overview of system control – Need for voltage and frequency regulation in power system – Plant level and System level controls (block diagram approach only) | |
| **UNIT II - REAL POWER – FREQUENCY CONTROL** | **(9)** |
| Basics of speed governing mechanism and modeling – Speed-load characteristics – Load sharing in parallel operation – Control area concept – LFC control of a single-area system – Static and dynamic analysis of uncontrolled and controlled cases – Case study | |
| **UNIT III - REACTIVE POWER–VOLTAGE CONTROL** | **(9)** |
| Automatic Voltage Regulator (AVR) – Generation and absorption of reactive power – Basics of reactive power control – Excitation systems – Modeling – Static and dynamic analysis – Stability compensation – Methods of voltage control: tap changing transformer – Tap setting of OLTC transformer, SVC (TCR + TSC) – Case study | |

| UNIT IV - UNIT COMMITMENT AND ECONOMIC DISPATCH | (9) |
|---|---|
| Statement of unit commitment problem – Constraints – Priority-list method – Forward dynamic programming, Formulation of economic dispatch problem – I/O cost characterization – Incremental cost curve – Coordination equations without and with loss (No derivation of loss coefficients) – Solution by direct method and λ-iteration method | |
| **UNIT V - COMPUTER CONTROL OF POWER SYSTEMS** | **(9)** |
| Need for computer control of power systems – Concept of energy control centre – Functions – System monitoring – Data acquisition and control – System hardware configuration – SCADA and EMS functions – Various operating states – State transition diagram showing various state transitions and control strategies | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. V.Ramanathan, P.S.Manoharan, 'Power System Operation and Control' Third Edition, 2015, Charulatha Publications, Chennai.
2. Gupta. J.B., "Electrical Machines (AC & DC Machines)", 4th ed., S K Kataria & Sons, New Delhi, 2012.
3. Rajput. R.K., "Electrical Machines", 5th Edition, Laxmi Publications, New Delhi, 2008.


**REFERENCES:**


1. Kothari D.P., Nagrath I.J, "Electric Machines", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
2. Fitzgerald, A.E., Kingsley, Charles and Umans, Stephen. D., "Electric Machinery", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
3. Alexander S. Langsdorf., "Theory of Alternating Current Machinery", 2nd ed., Tata McGraw Hill Publishing Company, New Delhi, 2004.


| 17EEP09-POWER SYSTEM SIMULATION LABORATORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 4 | 2 |
| **PREREQUISITE : 17EEC10 &17EEC15** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To develop programs for formation of bus admittance and impedance matrices | **1.1** | The students will be able to learn about power system components | **a,b,c,** | |
| **2.0** | To develop programs for Power flow solution using Gauss-Seidel method | **2.1** | The students will be able to solve the load flow problems using efficient numerical methods | **a,b,c,e** | |
| **3.0** | To know about Unit Commitment and Economic Dispatch | **3.1** | The students will be able to analyze the optimal dispatch problems and unit commitment in various power plants | **a,b,c,e** | |
| **4.0** | To design and develop for fault analysis using MATLAB | **4.1** | The students will be able to analyze the power system fault in symmetrical and unsymmetrical components | **a,b,c,e** | |
| **5.0** | To develop load frequency dynamics of single-area and two-area systems using MATLAB | **5.1** | The students will be able to understand control of real power by frequency control | **a,b,c,e** | |

**LIST OF EXPERIMENTS:**

1. Formation of bus admittance Matrices and solution of networks.
2. Computation of parameters and modeling of transmission lines.
3. Formation of Bus Impedance Matrices and Solution of Networks.
4. Solution of load flow and related problems using Gauss-Seidel method.
5. Solution of load flow and related problems using Newton-Raphson and fast-decoupled methods.
6. Fault analysis – symmetrical short circuit analysis.
7. Transient stability analysis of single-machine infinite bus system.
8. Transient stability analysis of multi-machine power systems.
9. Load – frequency dynamics of single- area and two-area power systems.
10. Electromagnetic transients in power systems.

**TOTAL = 60 PERIODS**

| 17EED01 – PROJECT WORK-I | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 0 | 0 | 8 | 4 |
| **PREREQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To practice the fundamental electrical and electronics engineering concepts and principles in addressing a real time situation autonomously or in a team. | **1.1** | The students will be able to study problems in the field of Electrical and Electronics Engineering through literature survey and its reviews. | **a,b,e,f** | |
| **2.0** | To develop an ability to solve problem by making a literature review and finding a solution for the same. | **2.1** | The students will be able Undertake problem identification, formulation and solution. | **a,b,e,f** | |
| **3.0** | To Study various types of methodology based on the problem. | **3.1** | The students will be able to Design engineering solutions to complex problems utilising a systems approach and develop projects | **a,c,d,f,i** | |
| **4.0** | To create platform to communicate and present the ideas in written and oral form | **4.1** | The students will be able to Communicate effectively and to present ideas clearly | **a,c,d,g,j** | |
| **5.0** | To create a team work to exhibit the knowledge and skills to contribute to the society. | **5.1** | The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal | **c,d,f,h** | |

**Work Description**

The students in a group of 4 works on a topic approved by a team of faculty project coordinators and the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL (P: 120) = 120 PERIODS**

| 17EED02 – PROJECT WORK II | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 0 | 0 | 16 | 8 |
| **PREREQUISITE : 17EED01** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To practice the fundamental electrical and electronics engineering concepts and principles in addressing a real time situation autonomously or in a team. | **1.1** | The students will be able to study problems in the field of Electrical and Electronics Engineering through literature survey and its reviews. | **a,b,e,f** | |
| **2.0** | To develop an ability to solve problem by making a literature review and finding a solution for the same. | **2.1** | The students will be able Undertake problem identification, formulation and solution. | **a,b,e,f** | |
| **3.0** | To Study various types of methodology based on the problem. | **3.1** | The students will be able to Design engineering solutions to complex problems utilizing a systems approach and develop projects | **a,c,d,f,i** | |
| **4.0** | To create platform to communicate and present the ideas in written and oral form | **4.1** | The students will be able to Communicate effectively and to present ideas clearly | **a,c,d,g,j** | |
| **5.0** | To create a team work to exhibit the knowledge and skills to contribute to the society. | **5.1** | The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal | **c,d,f,h** | |

**DESCRIPTION**

Project work may be allotted to a single student or to a group of students not exceeding 4 per group. The title of project work (same title as in project work-I if the same project is continued in project work-II or the title will be selected based on different project) is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

**TOTAL (P: 240) = 240 PERIODS**

| 17EEX01-FUNDAMENTALS OF FIBRE OPTICS AND LASER INSTRUMENTATION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To expose the basic concepts of optical fibers and their industrial applications. | **1.1** | The students will be able to analyze the theory and classification of fiber optics and fibre characteristics. | **a,b,e,** | |
| **2.0** | To provide adequate knowledge about Industrial application of optical fibres. | **2.1** | The students will be able to gain knowledge about the fibre optic sensor measurements. | **a,c,j** | |
| **3.0** | To provide basic concepts of lasers. | **3.1** | The students will be able to ensure ideas about the types of lasers and its applications. | **a,d,k** | |
| **4.0** | To provide knowledge about Industrial application of lasers. | **4.1** | The students will be able to learn about the industrial applications of laser. | **a,b,k** | |
| **5.0** | To provide knowledge about Industrial application of Holography and Medical applications of Lasers. | **5.1** | The students will be able to know the basic principle and methods of Holographic interferometry and application of laser instruments in medical surgeries | **a,b,i** | |

| **UNIT I - OPTICAL FIBRES AND THEIR PROPERTIES** | **(9)** |
|---|---|
| Theory and classification of fiber optics: Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Optical sources – Optical detectors. | |
| **UNIT II - INDUSTRIAL APPLICATION OF OPTICAL FIBRES** | **(9)** |
| Fibre optic sensors –– Different types of modulators - fibre optic communication set up- Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, voltage, liquid level and strain. | |
| **UNIT III - LASER FUNDAMENTALS** | **(9)** |
| Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping –-Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers. | |
| **UNIT IV - INDUSTRIAL APPLICATION OF LASERS** | **(9)** |
| Laser for measurement of velocity and Atmospheric effect – Material processing – Laser heating – Welding - Melting and trimming of material – Removal and vaporization. | |
| **UNIT V - HOLOGRAM AND MEDICAL APPLICATIONS** | **(9)** |
| Holography – Basic principle - Methods – Holographic Interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers - Laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. R.P.Khare, Fiber Optics and Optoelectronics, Oxford university press, 2008.
2. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.


**REFERENCES:**


1. Asu Ram Jha, Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems, PHI learning Private limited, 2009.
2. M. Arumugam, Optical Fibre Communication and Sensors, Anuradha Agencies, 2002.
3. John F. Read, Industrial Applications of Lasers, Academic Press, 1978.


| 17EEX02-ENERGY STUDIES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To know the various energy sources | **1.1** | The students will be able to learn the various energy sources | **d,f,g,l** | |
| **2.0** | To understand the different energy conversion methods | **2.1** | The students will be able to know about the energy conversion methods | **d,f,g,l** | |
| **3.0** | To impart knowledge on economic development and social transformation of global energy scenario | **3.1** | The students will be able to illustrate economic development and social transformation in global scenario | **d,f,g,l** | |
| **4.0** | To analyze the commercial, non-commercial forms and sector wise energy consumption of Indian scenario | **4.1** | The students will be able to epitomize the concept of commercial and non-commercial forms of Indian scenario | **d,f,g,l** | |
| **5.0** | To learn the state level, national level, global level issues of energy policy | **5.1** | The students will be able to explore the issues of energy policy across the state, national and global level | **d,f,g,l** | |

| | |
|---|---|
| **UNIT I – ENERGY SOURCES** | **(9)** |
| Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes. | |
| **UNIT II – ENERGY CONVERSION** | **(9)** |
| Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies. | |
| **UNIT III – GLOBAL ENERGY SCENARIO** | **(9)** |
| Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European union countries. | |
| **UNIT IV – INDIAN ENERGY SCENARIO** | **(9)** |
| Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption. | |
| **UNIT V – ENERGY POLICY** | **(9)** |
| Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**

1. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, Wiley Eastern, 2005
2. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002
3. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004

**REFERENCES:**

1. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
2. TEDDY Year Book, The Energy Research Institute (TERI), 2011
3. International Energy Outlook, EIA Annual Publication, 2011.

| 17EEX03-SEMICONDUCTING MATERIALS AND DEVICES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC03** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To enlighten about various properties of semiconductor materials. | **1.1** | The students will be able to understand the properties of semi conductor | **a,c,i** | |
| **2.0** | To make the students to understand the adequate knowledge in carrier transport properties | **2.1** | The students will be able to gain adequate knowledge in carrier transport properties | **a,b,c,i,l** | |
| **3.0** | To make the student to understand Circuit laws, Waveform and Network Theorems in AC circuits | **3.1** | The students will be able to acquire knowledge of P-N junction diode | **b,d,f,hj,l** | |
| **4.0** | To Understand the concept of construction and operation of bipolar junction transistor | **4.1** | The students will be able to familiar with operation of Bipolar Junction Transistor | **b,d,f,h** | |
| **5.0** | To stimulate the students for understanding of Optical Devices | **5.1** | The students will be able to get dynamic understanding of Optical Devices | **e,h,l** | |

| | |
|---|---|
| **UNIT I - PROPERTIES OF SEMICONDUCTOR** | **(9)** |
| Types and materials of semi conductor - Energy bands - Allowed and forbidden energy bands - Kronig Penny model - Electrical conductivity in solids based on energy bands - Electron effective mass - Recent trends and integrated usage of semiconductors. | |
| **UNIT II - CARRIER TRANSPORT PROPERTIES** | **(9)** |
| Carrier drift - Drift current density - Mobility effects on carrier density - Conductivity in semiconductor - Carrier transport by diffusion - Diffusion current density - Total current density -Breakdown phenomena. | |
| **UNIT III - P-N JUNCTION DIODE** | **(9)** |
| Qualitative description of charge flow in p-n junction - Boundary condition - Minority carrier distribution - Ideal p-n junction current - Temperature effects - The turn on transient and turn off transient - Applications. | |
| **UNIT IV - BIPOLAR JUNCTION TRANSISTOR** | **(9)** |
| Introduction to basic principle of operation - The modes of operation - Amplification - Minority carrier distribution in forward active mode - Non-ideal effects - Base with modulation - Current clouding - Breakdown voltage - Voltage in open emitter configuration and open base configuration. | |
| **UNIT V - OPTO ELECTRONIC DEVICES** | **(9)** |
| Optical absorption in a semiconductor, photon absorption coefficient - Electron hole pair generation - Solar cell - Homo junction and hetero junction - Photo transistor –Laser diode, the optical cavity, optical absorption, loss and gain -Threshold current. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Donald A Neamen, “Semiconductor physics and devices”, Tata McGraw Hill, 2007
2. Albert Malvino, David J Bafes, “Electronic Principles”, Tata McGraw Hill, 2007

**REFERENCES:**


1. M.S. Tyagi, Introduction to Semiconductor materials and devices, John Wiley and sons, 2008.
2. S.M. Sze & K.Ng. Kwok, Physics of semiconductor devices, John Wiley and sons, 2008.
3. M. K. Achuthanand and K.N. Bhat, Fundamentals of semiconductor devices, Tata McGraw Hill, 2007.


| 17ITC08 - FUNDAMENTALS OF JAVA PROGRAMMING | | | | | |
|---|---|---|---|---|---|
| (Common to BME, EEE,EIE & ECE) | | L | T | P | C |
| | | 2 | 0 | 2 | 3 |
| **PREREQUISITE : NIL** | **QUESTION PATTERN : TYPE - 1** | | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To learn the fundamental concepts of Java. | **1.1** | The students will be able to learn fundamental concepts of Java. | **a,c,j,k** |
| **2.0** | To apply inheritance concepts using class. | **2.1** | The students will be able to design concepts with inheritance. | **a,c,j,k** |
| **3.0** | To implement exception handling and Files. | **3.1** | The students will be able to implement exception handling and Files. | **a,b,c,j,k** |
| **4.0** | To create threads and interfaces in Java classes. | **4.1** | The students will be able to create threads and interfaces in Java classes. | **a,b,c,k** |
| **5.0** | To learn GUI and generics concepts | **5.1** | The students will be able to implement GUI and generics concepts. | **a,b,c,k** |

| **UNIT I – INTRODUCTION** | **(6+6)** |
|---|---|
| Introduction of Java - Features Of Java – Application of Java – Data Types –Statements – Operators – Control statements - Basics of Oops Concepts: Class – Objects – Methods –Constructor – finalizer –Access Control. | |
| **UNIT II - INHERITANCE AND KEYWORDS** | **(6+6)** |
| Inheritance: Types Of Inheritance – Polymorphism – Method Overloading – Method Overriding- super – final with inheritance – Abstract Class - Keywords : static –final - this - String – String Buffer - Arrays | |
| **UNIT III - PACKAGE, EXCEPTION HANDLING AND FILES** | **(6+6)** |
| Packages – Package Hierarchy –Basics of Exception Handling – Input / Output Basics – Streams – Byte streams and Character streams – Reading and WritingConsole – Reading and Writing Files | |
| **UNIT IV - INTERFACES AND THREADS** | **(6+6)** |
| Interfaces – Interface Design – Threads – Thread Synchronization - Multi-Thread Programming. | |
| **UNIT V - GENERICS AND GUI** | **(6+6)** |
| Generic Programming – Generic classes – generic methods - Introduction to Swing – layout management - Swing Components – TextFields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.Applet programming - Basics of event handling - event handlers - adapter classes - actions - mouse events. | |

**List of Experiments:**

1. Program to implement Operators, Flow Controls
2. Program to implement Classes, Constructors, Overloading
3. Program using Static and Final
4. Program using File Streams and IO Streams
5. Program to implement Strings, String Buffer
6. Program using Interfaces, Abstract Classes
7. Program to implement Exception Concepts and Threads
8. Program to implement Swing Application

**TEXT BOOK:**

1. Herbert Schildt, “The Complete Reference (Fully updated for jdk7)”, Oracle press Ninth Edition, 2014.

**REFERENCE:**

1. Deitel & Deitel, “Java How to Program”, Prentice Hall, 10th Edition, 2016.

**TOTAL (L:30+P:30) = 60 PERIODS**

| 17EEX04- NETWORK THEORY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC02** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the use of circuit analysis theorems and reduction methods | **1.1** | The students will be able to analyze and solve problems involving Electrical networks by using various network theorems | **a,b,c,d** | |
| **2.0** | To use complex numbers to develop impedance and admittance concepts. | **2.1** | The students will be able to develop and Solve the Electrical networks in the s-domain. | **a,b,c,d** | |
| **3.0** | To learn the concepts of Two-port Network theory | **3.1** | The students will be able to interpret the structure of 2-port networks. | **a,b,c** | |
| **4.0** | To gain knowledge in analyzing waveform using Fourier method | **4.1** | The students will be able to solve circuits involving inputs of different wave forms using Fourier Analysis | **a,c,d** | |
| **5.0** | To familiarize the concept of Passive filters | **5.1** | The students will be able to design networks using passive filters | **a,b,c,d** | |

| | |
|---|---|
| **UNIT I - SINUSOIDAL STEADY-STATE ANALYSIS** | **(9)** |
| Nodal and Mesh analysis for AC circuits - Network Theorems for AC circuits: Compensation, Milliman's. | |
| **UNIT II - CIRCUIT ANALYSIS IN THE S-DOMAIN** | **(9)** |
| Reviews of Laplace transform - Notations of Impedance and admittance - Poles, zeros driving point functions - Transfer functions and its necessary conditions – Complex, frequency plane - Circuits in the s-domain. | |
| **UNIT III – TWO- PORT NETWORKS** | **(9)** |
| One port Networks - Two port admittance parameters - Admittance parameter analysis of terminated two ports - Two port Impedance parameters - Impedance and gain calculations of terminated two ports modeled by z parameters - Hybrid parameters - Transmission parameters. | |
| **UNIT IV - FOURIER METHOD OF WAVEFORM ANALYSIS** | **(9)** |
| Trigonometric Fourier series - Effective values and power - Applications in circuit analysis - Fourier transform of Non periodic waveforms - Properties of the Fourier transform | |
| **UNIT V - PRINCIPLES OF BASIC PASSIVE FILTERING** | **(9)** |
| Classification of Filters: Constant K Filter-T & π section-Low pass Filter & High pass Filter. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. A. Sudhakar and Shyammohan S. Palli," Circuits and Networks: Analysis and Synthesis",5th ed., McGraw Hill Education (India) Private Limited, Jul 2017
2. J. Edminister and M. Nahvi, "Electric Circuit", 5th ed., Tata McGraw Hill, New Delhi, July 2017.
3. R. A. DeCarlo and Pen-Min Lin, "Linear Circuit Analysis", 2nd ed., Oxford University Press, New Delhi, 2001

**REFERENCES:**


1. W. H. Hayt, J.E. Kemmerly and S. M. Durbin, “Engineering Circuit Analysis”, 8th ed.,McGraw Hill, New Delhi, 2013.
2. Charles K Alexander and Mathew N O Sadiku, “Fundamentals of Electric Circuits”, Tata McGraw Hill, 2013.
3. James W.Nilsson and Susan A. Riedel, “Electric Circuits”, 11th ed., Pearson Prentice Hall, 2018.


| 17EEX05-COMPUTER ARCHITECTURE AND ORGANIZATION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC09** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To conceptualize the basics of organizational and architectural issues of a digital computer | **1.1** | The students will be able to compare the performance of different architectures and Develop applications for high performance computing systems | **a,b** | |
| **2.0** | To understand various data transfer techniques in digital computer. | **2.1** | The students will be able to identify the issues involved in the instruction execution and various stages of instruction life stage | **a,b** | |
| **3.0** | To provide essential understanding of control signal generation of modern computer system | **3.1** | The students will be able to design a pipeline for consistent execution of instructions with minimum hazards. | **a,b ,e** | |
| **4.0** | To study Various memories and their organization | **4.1** | The students will be able to analyze performance issues in processor and memory design of a digital computer. | **a,b** | |
| **5.0** | To study Input and output organizations and interfacing | **5.1** | The students will be able to predict various interrupts used for system organization | **a,b** | |

| | |
|---|---|
| **UNIT I - BASIC STRUCTURE OF COMPUTERS** | **(9)** |
| Functional units – Basic operational concepts – Bus structures – Performance and Metrics – Instruction and instruction sequencing – Addressing modes – Instruction set: RISC, CISC – ALU design. | |
| **UNIT II - DATA PATH DESIGN** | **(9)** |
| Fixed Point Arithmetic – Addition, Subtraction – Multiplication and Division – Combinational and Sequential ALUs – Robertson algorithm – Booth's algorithm – Non-restoring division algorithm – Floating Point Arithmetic. | |
| **UNIT III – CONTROL DESIGN** | **(9)** |
| Hardwired Control – Micro programmed Control – Multiplier Control Unit – CPU Control Unit – Pipeline Control – Instruction Pipelines – Pipeline Performance – Superscalar Processing – Nano Programming | |
| **UNIT IV - MEMORY ORGANIZATION** | **(9)** |
| Memory organization – Memory hierarchy – Main memory – Auxiliary memory – Associative memory – Cache memory – Virtual memory – Memory management hardware – RAID | |
| **UNIT V - SYSTEM ORGANIZATION** | **(9)** |
| Communication methods – System Bus Control – IO Interfacing – Arbitration – IO interface circuits –Handshaking – DMA and interrupts – Vectored interrupts – PCI interrupts – Pipeline interrupts | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**


1. William Stallings, "Computer Organization and architecture", 9th ed., Pearson Education, 2013.
2. Morris Mano, "Computer system architecture", 3rd ed., Pearson education, 2002.

**REFERENCES:**


1. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization",5th ed., McGraw-Hill Inc, 1996.
2. John P.Hayes, 'Computer architecture and Organisation', Tata McGraw-Hill, 3rd ed., 1998.
3. Behrooz Parhami, 'Computer Architecture', Oxford University Press, 2005.
4. John L. Hennessy, David A. Patterson, 'Computer Architecture: A Quantitative Approach', 4th ed., Elsevier Inc, 2007.


## 17ITC12- DATABASE SYSTEMS CONCEPTS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE REQUISITE : NIL** | **QUESTION PATTERN: TYPE - 1**

**COURSE OBJECTIVES AND OUTCOMES:**

| | Course Objectives | | Course Outcomes | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To understand the different issues involved in the design and implementation of a database system. | **1.1** | The students will be able to describe the role of Database Management System in an Organization. | **a,c,j,k** |
| **2.0** | To study the physical and logical database designs, database modeling. | **2.1** | The students will be able to study basic database concepts including the structure and operations of the relational data model. | **a,c,j,k** |
| **3.0** | To understand and use data manipulation language to query, update, and manage a database | **3.1** | The students will be able to construct simple and Moderately advanced database queries using SQL. | **a,b,c,j,k** |
| **4.0** | To develop an understanding of essential DBMS concepts. | **4.1** | The students will be able to apply logical database design principles includes E-R diagrams & Normalization. | **a,b,c,k** |
| **5.0** | To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. | **5.1** | The students will be able to explain various file organizing & Indexing structure. | **a,b,c,k** |

**UNIT I - INTRODUCTION TO DATABASE** **(9)**

Introduction to database systems - Definition of DBMS - Advantages of DBMS - Views of data - Levels of data abstraction - Data Models and types - Database architecture - Entity relationship model - ER diagram.

**UNIT II - RELATIONAL DATA MODEL** **(9)**

Relational database structure - Procedural and Non procedural languages - Relational algebra : operations - Relational Calculus : Tuple relational calculus - Domain Relational Calculus - Integrity Constraints - SQL Commands : DDL - DML - TCL.

**UNIT III - DATABASE DESIGN** **(9)**

Functional dependency: Full functional Dependency - Partial dependency - Transitive dependency - multi valued dependency - Decomposition - Normalization - Normal Forms: 1NF - 2NF - 3NF - BCNF - 4NF - 5NF.

**UNIT IV - TRANSACTIONAL PROCESSING** **(9)**

Transaction - Properties of transaction - Transaction state - Serialization : types - Need for Serialization - Two Phase Commit - Save Point - Concurrency - Advantages of concurrency - Concurrency control mechanism - Locking protocols.

**UNIT V - MEMORY STRUCTURES AND FILE ORGANIZATION** **(9)**

Memory hierarchy - Disk storage - Raid levels - Indexing: types - Hashing techniques - Query Processing tool - Query Evaluation.

**TOTAL (L: 45) = 45 PERIODS**

**TEXT BOOK:**

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2010.

**REFERENCES:**

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.

| 17EEX06-DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC09 & 17EEC12** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To expose the properties and representation of discrete and continuous time signals. | **1.1** | The students will be able to understand the basics of a signals and systems. | **a,b,d,f,i,j,k,l** | |
| **2.0** | To introduce various transformation techniques & their computation. | **2.1** | The students will be able to realize the frequency domain transformations and frequency domain analysis. | **a,b,c,d,f,i,j,k,l** | |
| **3.0** | To demonstrate IIR filters for digital implementation. | **3.1** | The students will be able to design IIR digital filters for the required order and cutoff specifications. | **a,b,c,d,f,i,j,k,l** | |
| **4.0** | To demonstrate FIR filters for digital implementation. | **4.1** | The students will be able to design FIR digital filters for the required order and cutoff specifications. | **a,b,d,i,k,l** | |
| **5.0** | To motivate the students for analyzing the purpose of signal processors and their applications | **5.1** | The students will be able to identify the suitable processor for the DSP applications along with required simulation tools. | **c,i,k,l** | |

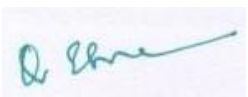
| | |
|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Signals: Classification – Continuous and Discrete, Periodic and Aperiodic, Even and Odd, Energy and Power; mathematical representation of signals. Systems: Classification – Continuous and discrete, Static and Dynamic, Linear, Time variant and invariant, Causal, Stable, revertible. Mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. | |
| **UNIT II - DISCRETE FOURIER TRANSFORM & COMPUTATION** | **(9)** |
| Discrete Fourier Transform – Properties - Computation of DFT using FFT algorithm – Decimation in Time (DIT) and Decimation in Frequency (DIF) using radix 2 FFT – Butterfly structure. | |
| **UNIT III – DIGITAL IIR FILTER** | **(9)** |
| Review of design techniques for analog low pass filter - Butterworth and Chebyshev approximations; Frequency transformation in Analogue domain, IIR filter design – Methods of IIR filter Design - Bilinear and Impulse Invariant Techniques. | |
| **UNIT IV - DIGITAL FIR FILTERS** | **(9)** |
| Design characteristics of FIR filters with linear phase – Frequency response of linear phase FIR filters – Design of FIR filters using windowing functions (Kaiser, Hamming, Hanning, Blackman) - Comparison of design methods of FIR filters. | |
| **UNIT V - DIGITAL SIGNAL PROCESSOR** | **(9)** |
| Introduction – Architecture– Features – Addressing Formats – Functional modes - Introduction to Commercial Processors: TMS 320. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOK:**

1. J.G.Proakis, D.G.Manolakis and D.Sharma, "Digital Signal Processing, Algorithms and Applications", Pearson Education, 2012.

**REFERENCES:**


1. P.RameshBabu, "Digital Signal Processing", 7th Edition, SciTech Publications (India) Pvt Limited, 2017.
2. Oppenheim V.A.V and Schaffer R.W, "Discrete – time Signal Processing", 2nd Edition, Prentice Hall, 2013.
3. S.K.Mitra, Digital Signal Processing, 4th Edition, TMH, 2010.
4. Lawrence R Rabiner and Bernard Gold, "Theory and Application of Digital Signal Processing", PHI 2010.
5. http://www.ti.com/lit/ds/symlink/tms320c6713.pdf "Floating Point Signal Processor data sheet" - Data Sheet, Texas Instruments.

| 17EEX07-DESIGN OF ELECTRICAL MACHINES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC02, 17EEC04 & 17EEC07** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the concepts of various engineering materials and ratings of electrical machines for design | **1.1** | The students will be able to remember the basic design concepts | **a,b,f,i,k** | |
| **2.0** | To determine the diameter and length of armature core, number of armature conductors and number of slots for armature design | **2.1** | The students will be able to understand the design of armature and field systems for D.C. machines. | **a,c,f,j** | |
| **3.0** | To derive the output equations and overall dimensions of single phase and three phase transformers and tank design. | **3.1** | The students will be able to understand the design of core, yoke, windings and cooling systems of transformers. | **a,d,i,k** | |
| **4.0** | To estimate and design the stator core dimensions, number of stator slots and number of stator conductors, rotor dimensions of an induction motor | **4.1** | The students will be able to understand the design of stator and rotor of induction machines and rotor | **a,b,f,k** | |
| **5.0** | To estimate and design the armature, length of air gap, rotor and explicate the step by step procedure for field winding of synchronous machine. | **5.1** | The students will be able to understand the design of stator and rotor of synchronous machines | **a,b,c,i,l** | |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow –Temperature rise - Rating of machines – Standard specifications. | |
| **UNIT II - DC MACHINES** | **(9)** |
| Output Equations – Main Dimensions - Magnetic circuit calculations – Carter's Coefficient – Net length of Iron –Real & Apparent flux densities – Design of field winding and inter pole winding – Selection of number of poles – Design of Armature –Design of commutator and brushes. | |
| **UNIT III – TRANSFORMERS** | **(9)** |
| Output Equations – Main Dimensions - KVA output for single and three phase transformers –Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers. | |
| **UNIT IV - INDUCTION MOTORS** | **(9)** |
| Output equation of Induction motor – Main dimensions – Design of Stator - Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor — Magnetic leakage calculations – Leakage reactance of poly phase machines. | |

| UNIT V - SYNCHRONOUS MACHINES | (9) |
|---|---|
| Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design. | |
| **TOTAL: 45 PEROIDS** | |

**TEXT BOOKS:**

1. Sawhney, A.K., "A Course in Electrical Machine Design", 6th ed., Dhanpat Rai & Sons, New Delhi, Reprint 2010.
2. K.G.Upadhaya, "Design of Electrical Machines", New Age International, 1st ed., 2008.

**REFERENCES:**

1. R.K.Agarwal, "Electrical Machine Design" - S.Kataria & Sons, N.Delhi. 4th ed., Reprint, 2003.
2. S.K.Sen, "Principles of Electrical machine Design" - Oxford & IBH pub. Co. Pvt. Ltd., 2nd ed., 2001.
3. V.N. Mittle,"Design of Electrical Machines", Standard Publishers Distributors, 2005.

| 17EEX08-ENERGY MANAGEMENT AND AUDITING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the various forms of energy & auditing techniques. | **1.1** | The students will be able to ensure ideas about the types of energy and auditing techniques. | **a,b,c,d,** | |
| **2.0** | To identify the various techniques of energy costing, monitoring & targeting | **2.1** | The students will be able to suggest methodologies for energy savings | **a,c,d** | |
| **3.0** | To realize the various methods of energy management & power quality analyses. | **3.1** | The students will be able to learn about the various methods for energy management & power quality analyses. | **a,d,i** | |
| **4.0** | To provide knowledge about lighting systems & cogeneration | **4.1** | The students will be able to learn about the lighting systems & cogeneration | **a,b,c** | |
| **5.0** | To give knowledge about energy economics. | **5.1** | The students will be able to know the basics of energy economics. | **a,b,c** | |

| | |
|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Types & Forms of Energy - Primary / Secondary Energy Sources –EC Act 2003 – Energy Auditing: Types, classifications, deliverables, barriers – Benchmarking - Roles & Responsibility of Energy Managers | |
| **UNIT II - ENERGY COSTING, MONITORING & TARGETING** | **(9)** |
| Data & Information Analysis – Cost / Energy Share Diagram – Data Graphing – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption – Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction - Demand Side Management. | |
| **UNIT III - METERING FOR ENERGY MANAGEMENT & POWER QUALITY ANALYSES** | **(9)** |
| Instruments Used in Energy systems: Load and power factor measuring equipment, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis. Relationships between parameters-Units of measure-Typical cost factors- Utility meters – Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements – Net metering - Metering techniques. | |
| **UNIT IV - LIGHTING SYSTEMS & COGENERATION** | **(9)** |
| Concept of lighting systems - The task and the working space - Light sources - Ballasts - Luminaries - Lighting controls - Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection. | |
| **UNIT V – ECONOMICS** | **(9)** |
| Energy Economics – Depreciation - Financial Analysis Techniques – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept - CUSUM Technique – ESCO Concept – ESCO Contracts. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Energy Manager Training Manual (4Volumes) available at www.energymanagertraining. com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004.
2. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006.

**REFERENCES:**


1. W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.
2. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982.
3. W.R. Murphy and G. McKay "Energy Management" Butterworths, London 1987.


## 17EEX09-COMPUTER NETWORKS AND PROTOCOLS

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PREREQUISITE : NIL** | **QUESTION PATTERN : TYPE - 3**

**COURSE OBJECTIVES AND OUTCOMES:**

| | Course Objectives | | Course Outcomes | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To educate on network fundamentals and their functions | **1.1** | The students will be able to understand the basics of data communication through transmission medium. | **a,b,c,e,f,i,k,l** |
| **2.0** | To motivate the students learn the concept of data link layer and its applications | **2.1** | The students will be able to choose the required functionality at each layer for given application. | **a,b,c,f,k,l** |
| **3.0** | To make the student to understand the purpose of network layer and its routing functions | **3.1** | The students will be able to apply solution for network related problems in real time. | **a,b,c,d,e,g,i,l** |
| **4.0** | To understand about the functions of connection oriented and connectionless protocols | **4.1** | The students will be able to recognize process to process delivery concepts and protocols used in it. | **d,e,g,l** |
| **5.0** | To motivate the students for analyzing the purpose of application layer in OSI model | **5.1** | The students will be able to analyze and recognize the application layer protocols and its applications. | **a,c,d,e,g,h,j,l** |

| | |
|---|---|
| **UNIT I - FUNDAMENTALS & LINK LAYER** | **(9)** |
| Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control | |
| **UNIT II - MEDIA ACCESS & INTERNETWORKING** | **(9)** |
| Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP) | |
| **UNIT III – ROUTING** | **(9)** |
| Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP,IPv4, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM) | |
| **UNIT IV - TRANSPORT LAYER** | **(9)** |
| Overview of Transport layer– UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance – QoS – Application requirements | |
| **UNIT V - APPLICATION LAYER** | **(9)** |
| Traditional applications – Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOK:**

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th ed., Morgan Kaufmann Publishers, 2011.

**REFERENCES:**


1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", 5th ed., Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
3. Behrouz A. Forouzan, "Data communication and Networking", 4th ed., Tata McGraw - Hill, 2011.


| 17EEX10-SPECIAL ELECTRICAL MACHINES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC04 & 17EEC07** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand basics of synchronous reluctance motor. | **1.1** | The students will be able to gain knowledge on basic synchronous reluctance motors | **a,b,e** | |
| **2.0** | To analyze movement of motors by step by step using microprocessor control. | **2.1** | The students will be able to learn about Stepping motors and its different types | **a,b,c,d,e,h** | |
| **3.0** | To understand the construction, principle of switched reluctance motor. | **3.1** | The students will be able to emphasize the ideas about operation and performance of switched reluctance motors | **a,b,c,d,e,f,h** | |
| **4.0** | To understand the relation between the electronic and mechanical commutator. | **4.1** | The students will be able to analyze the characteristics of permanent magnet brushless DC motors. | **a,b,c,d,e,f,h** | |
| **5.0** | To understand principles of power controllers and application of permanent magnet synchronous motor. | **5.1** | The students will be able to Know the basics of permanent magnet synchronous motors. | **a,b,c,e,f,h** | |

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|---|---|
| **UNIT I - SYNCHRONOUS RELUCTANCE MOTORS** | **(9)** |
| Constructional features – Types: Axial and Radial flux motors – Operating principles – Variable Reluctance and Hybrid motors – Voltage and Torque equations – Phasor diagram - Characteristics – Applications. | |
| **UNIT II - STEPPING MOTORS** | **(9)** |
| Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control. | |
| **UNIT III - SWITCHED RELUCTANCE MOTORS** | **(9)** |
| Constructional features – Principle of operation – Torque prediction –Power converters and their controllers – Methods of rotor position sensing – Closed loop control of SRM – Characteristics –Applications. | |
| **UNIT IV - PERMANENT MAGNET BRUSHLESS D.C. MOTORS** | **(9)** |
| Permanent Magnet materials and their characteristics – Principle of operation – Types – Applications –EMF and Torque equations – Electronic commutator – Power controllers – Motor characteristics and control. | |
| **UNIT V - PERMANENT MAGNET SYNCHRONOUS MOTORS** | **(9)** |
| Principle of operation – EMF and Torque equations – Sine wave motor with practical windings – Phasor diagram – Torque/Speed characteristics – Power controllers – Converter Volt-Ampere requirements – Applications. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. T.J.E. Miller, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
2. T. Kenjo, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 1984.

**REFERENCES:**


1. E.G. Janardanan, “Special Electrical Machines”, PHI learning Private Limited, Delhi, 2014.
2. K.Venkataratnam, “Special Electrical Machines”, Universities Press (India) Private Limited, 2008.
3. R.Krishnan, “Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design andApplication”, CRC Press, New York, 2001.
4. T. Kenjo and S. Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press,London, 1988.


| 17EEX11-BIO MEDICAL INSTRUMENTATION AND ITS APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To understand basics of human cell and its structure. | **1.1** | The students will be able to know about the cell and parts of the human body. | **a,b,g,k** |
| **2.0** | To analyze the fundamentals of non-electrical parameter measurements in human body. | **2.1** | The students will be able to know how to measure the heart sound and the blood pressure range. | **a,b,g,k** |
| **3.0** | To understand the modern methods of imaging techniques used for diagnostic purpose in the health care centre. | **3.1** | The students will be able to know how to measure the human body by using ECG, EMG and ERG. | **a,b,g,k** |
| **4.0** | To analyze the various methods of dialyzer and Defibrillators. | **4.1** | The students will be able to know the different therapeutic equipments used for diagnostic and surgery purposes. | **a,b,g,k** |
| **5.0** | To recognize the need of medical imaging equipments. | **5.1** | The students will be able to know the latest medical imaging equipments and patient monitoring systems | **a,b,g,k** |

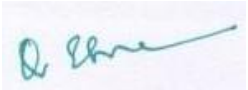
| | |
|---|---|
| **UNIT I - HUMAN PHYSIOLOGICAL SYSTEM** | **(9)** |
| Cell and its Structure – Action potential – Resting potential – Propagation of Action potential and Sodium pump action – Nerve cell: Neuron – Axon – Synapse – Central Nervous System-Peripheral Nervous System – Respiratory System-Electro Physiology of Cardiopulmonary Circulation system. | |
| **UNIT II - NON-ELECTRICAL PARAMETER MEASUREMENTS** | **(9)** |
| Measurement of Blood pressure – Cardiac Output measurement – Measurement of Heart Sounds – Phonocardiography – Measurement of Partial pressure of Carbon dioxide (PaCO2) and Partial pressures of Oxygen (PaO2) in the Arterial blood – Measurement of lung volumes: Spirometry. | |
| **UNIT III - ELECTRO–PHYSIOLOGICAL PARAMETERS MEASUREMENTS** | **(9)** |
| Basic components of a Biomedical system – Bio-Electrodes : Micro, Needle and Surface Electrodes – Different Lead configurations and recording methods of Electrocardiograph(ECG) – Electroencephalograph(EEG) – Brain Waves: Alpha, Beta, Theta and Delta waves and their frequency spectrum – Electromyography (EMG)- Electroretinography (ERG). | |
| **UNIT IV - PATIENT LIFE ASSISTING AND THERAPEUTIC EQUIPMENTS** | **(9)** |
| Pacemakers and its types –Defibrillators: D.C and AED – Ventilators: Pressure limited, Volume limited and Servo controlled ventilators –Surgical diathermy machines: Short wave, Microwave and Ultrasonic diathermy – Hemo and Peritoneal dialyzers. | |
| **UNIT V - MEDICAL IMAGING EQUIPMENTS & PATIENT MONITORING SYSTEMS** | **(9)** |
| Block diagram, operations and applications of X-Ray machines– Computer Tomography – Magnetic Resonance Imaging (MRI) System – Ultrasonography –Bio-telemetry systems. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. Khandpur R.S., “Handbook of Bio-Medical Instrumentation”, McGraw Hill Publishing Co Ltd., 2013.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, Pearson Education, 2011 / PHI, 2nd Edition.


**REFERENCES:**


1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, India, 3rd Edition, 2013.
2. Geddes L.A. and Baker L.E., “Principles of Applied Bio-Medical Instrumentation”, John Wiley & Sons, 3rd Edition, 2013.
3. Ed. Joseph D. Bronzino, “The Biomedical Engineering HandBook”, Boca Raton, CRC Press LLC, 2nd Edition, 2000.
4. Barbara L. Christe, “Introduction to biomedical Instrumentation” Cambridge University Press, 2009.

| 17EEX12-WIND AND SOLAR ELECTRICAL SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC13** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate about the fundamentals of solar cells | **1.1** | The students will be able to know about the fundamentals of solar PV cells | **a,c,d,f,g** | |
| **2.0** | To motivate the students to design solar based projects. | **2.1** | The students will be able to design solar based application projects | **a,b,c,d,e,f,g** | |
| **3.0** | To make the student to understand about the concepts of wind energy | **3.1** | The students will be able to understand the concepts of wind energy | **a,c,d,f,g** | |
| **4.0** | To encourage the students to implement the system running using wind energy | **4.1** | The students will be able to implement the system running using wind energy | **a,b,c,d,e,f,g** | |
| **5.0** | To motivate the students to know about other types of energy | **5.1** | The students will be able to understand about other sources of energy | **f,g** | |

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| **UNIT I - SOLAR PV FUNDAMENTALS** | **(9)** |
| Semiconductor –properties -energy levels -basic equations of semiconductor devices physics. Solar cells -p-n junction: homo and hetro junctions -metal-semiconductor interface -dark and illumination characteristics -figure of merits of solar cell -efficiency limits-variation of efficiency with band-gap and temperature -efficiency measurements -high efficiency cells –Solar thermo-photovoltaics | |
| **UNIT II - SPV SYSTEM DESIGN AND APPLICATIONS** | **(9)** |
| Solar cell array system analysis and performance prediction-Shadow analysis: reliability-solar cell array design concepts -PV system design -design process and optimization -detailed array design -storage autonomy -voltage regulation -maximum tracking-centralized and decentralized SPV systems -stand alone-hybrid and grid connected system -System installation -operation and maintenances -field experience -PV market analysis and economics of SPV systems. | |
| **UNIT III – WIND ENERGY FUNDAMENTALS & WIND MEASUREMENTS** | **(9)** |
| Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, A tmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis. | |
| **UNIT IV -MODERN WIND TURBINE CONTROL & MONITORING SYSTEM** | **(9)** |
| Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS control & LVRT & New trends for new Grid Codes. | |
| **UNIT V - OTHER SOURCES OF ENERGY** | **(9)** |
| Ocean energy resources -principle of ocean thermal energy conversion (OTEC) -ocean thermal power plant -ocean wave energy conversion -tidal energy conversion –small Hydro -geothermal energy -geothermal power plant –hydrogen production and storage -Fuel cell –principle of working -various types-construction and applications. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Mario Garcia –Sanz, Constantine H. Houpis, “Wind Energy Systems”,CRC Press 2012.
2. Chetan Singh Solanki, “Solar Photovoltatics –Fundamentals, Technologies and Applications”, PHI Learning Private limited, 2011.

**REFERENCES:**


1. John D Sorensen and Jens N Sorensen, “Wind Energy Systems”, Woodhead Publishing Ltd, 2011.
2. Roger Messenger and Jerry Vnetre, “Photovoltaic Systems Engineering”, CRC Press, 2010.
3. Kaldellis J.K., “Stand –alone and Hybrid Wind Energy Systems”, CRC Press, 2010.


| 17EEX13-POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC13** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand basics of electric energy conversion systems. | **1.1** | The students will be able to know about the environmental aspects of electric energy conversion. | **a,d,e,g,h,l** | |
| **2.0** | To analyze the fundamental and principle operation of electrical machines in renewable energy. | **2.1** | The students will be able to know about the operation of different electrical machines for renewable energy systems. | **c,e,h,l** | |
| **3.0** | To understand the construction and principle operation of power converters in solar and wind. | **3.1** | The students will be able to work in teams and independently for the design, development and testing of power electronics systems in various applications. | **a,d,g,h,j,l** | |
| **4.0** | To analyze the variable speed in wind energy conversion system. | **4.1** | The students will be able to recognize about the operation of different renewable energy conversion systems. | **a,c,d,e,g,h,l** | |
| **5.0** | To recognize the need for hybrid systems. | **5.1** | The students will be able to get the knowledge how to track the maximum power point for various renewable energy conversions. | **e,g,j,l** | |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems. | |
| **UNIT II - ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION** | **(9)** |
| Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG. | |
| **UNIT III - POWER CONVERTERS** | **(9)** |
| Basic Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing<br>Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters. | |
| **UNIT IV - ANALYSIS OF WIND AND PV SYSTEMS** | **(9)** |
| Standalone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system. | |
| **UNIT V - HYBRID RENEWABLE ENERGY SYSTEMS** | **(9)** |
| Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT). | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**

1. G D Rai, 'Non-conventional Energy sources', Khanna Publishers, 5th Edition, 2014.
2. S N Bhadra, D Kastha and S Banerjee, 'Wind Electric Systems', Oxford Publications, 2nd Edition, 2007.

**REFERENCES:**


1. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hal India, New Delhi, 4th ed, 2013.
2. D P Kothari, K C Singal and Rakesh Ranjan, 'Renewable Energy Sources and Emerging Technologies' 2nd Edition, 2012.
3. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi,2011.


| 17EEX14-COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC04, 17EEC07** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To motivate the students to know the importance of computer aided design method. | **1.1** | The students will be able to give importance of computer aided design method. | | **a,b,c,d** |
| **2.0** | To encourage the students for solving basic electromagnetic field equations | **2.1** | The students will be able to provide basic electromagnetic field equations and the problem formulation for CAD applications. | | **a,b,c,e** |
| **3.0** | To make the students to get familiarized with Finite Element Method | **3.1** | The students will be able to get familiarized with Finite Element Method as applicable for Electrical Engineering | | **a,b,f** |
| **4.0** | To motivate the students to learn about CAD packages | **4.1** | The students will be able to introduce the organization of a typical CAD package | | **a,b,c,d,e,f** |
| **5.0** | To encourage the students learn about the Finite Element Method for the design of different Electrical apparatus | **5.1** | The students will be able to introduce Finite Element Method for the design of different Electrical apparatus | | **a,b,c,d,e,f,g** |

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|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force. | |
| **UNIT II - MATHEMATICAL FORMULATION OF FIELD PROBLEMS** | **(9)** |
| Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance – Inductance- Laplace and Poisson's Equations – Energy functional. | |
| **UNIT III – : PHILOSOPHY OF FEM** | **( 9)** |
| Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques. | |
| **UNIT IV - CAD PACKAGES** | **(9)** |
| Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing. | |
| **UNIT V - DESIGN APPLICATIONS** | **(9)** |
| Voltage Stress in Insulators – Capacitance calculation – Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, YesDEE publishers, Indian reprint, 2012.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2011.

**REFERENCES:**

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2018.
2. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

| 17EEX16-HIGH VOLTAGE ENGINEERING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC02** | | **QUESTION PATTERN : TYPE - 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To motivate students to learn about overvoltage | **1.1** | The students will be able to impart knowledge of over voltage phenomenon and insulation coordination in electrical Power systems | **b,d,i,k** | |
| **2.0** | To educate about breakdown mechanisms | **2.1** | The students will be able to understand the breakdown mechanisms of dielectrics | **a,b,c,f,j** | |
| **3.0** | To make students to know about high voltage and high current | **3.1** | The students will be able to acquire knowledge to understand high voltage and high current generation techniques | **b,c,d,i,k** | |
| **4.0** | Understand about the measurement of high voltage and high current | **4.1** | The students will be able to gain adequate knowledge in the measurements of high voltages & currents | **a,b,f,i,k** | |
| **5.0** | To educate about various testing of electrical apparatus | **5.1** | The students will be able to conduct tests for various electrical equipments | **a,b,c,l** | |

| | |
|---|---|
| **UNIT I - OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS & INSULATION COORDINATION** | **(9)** |
| Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages– Protection against over voltages, protection gaps, surge arresters – Insulation coordination | |
| **UNIT II - DIELECTRIC BREAKDOWN** | **(9)** |
| Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown –Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics. | |
| **UNIT III – GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** | **(9)** |
| Generation of high AC voltages - Cascaded transformers - Generation of high DC voltages -Rectifier and Voltage doubler circuits - Cockroft Walton voltage multiplier circuit - Van de Graff Generator -Electrostatic Generator - Generation of impulse and switching surges – Marx circuit-generation of high impulse current - Tripping and control of impulse generators. | |
| **UNIT IV - MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** | **(9)** |
| High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers – PeakVoltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High voltage measurement using CRO. | |
| **UNIT V - HIGH VOLTAGE TESTING** | **(9)** |
| High voltage testing of electrical power apparatus as per Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. S.Naidu and V. Kamaraju, “High Voltage Engineering”, Tata McGraw Hill, 5 th ed., 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, “High voltage Engineering fundamentals”, Newnes 2 nd ed., Elsevier , New Delhi, 2005.
3. Subir Ray, An Introduction to High Voltage Engineering‟ PHI Learning Private Limited, 2 nd ed., 2013.


**REFERENCES:**


1. L.L. Alston, „High Voltage Technology, Oxford University Press, First Indian Edition, 2011.
2. C.L. Wadhwa, „High voltage engineering, New Age International Publishers, 3 rd ed., 2010.


| 17EEX17-POWER SEMICONDUCTOR DEVICES AND APPLICATIOS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC13** | | **QUESTION PATTERN : TYPE – 1** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand basics of power semiconductor switches. | **1.1** | The students will be able to know about the construction, physics of operation, safe operating areas and protection circuits for various semiconductor devices. | | **a,b,g** |
| **2.0** | To analyze the switching characteristics of power diode and power BJT. | **2.1** | The students will be able to distinguish about the construction and working principle of power diode and power BJT | | **a,b,d,e,f** |
| **3.0** | To understand the construction and principle of thyristor and GTOs. | **3.1** | The students will be able to identify regarding the static characteristics and switching characteristics of SCRS and GTOs | | **a,b,d,e,f** |
| **4.0** | To understand the relation between the various electronic switches. | **4.1** | The students will be able to recognize about the construction, static characteristics, and switching characteristics of IGBT and power FET | | **a,b,d,e,f** |
| **5.0** | To recognize the applications of various power devices. | **5.1** | The students will be able to get the knowledge how to use these devices for various converter. | | **a,b,d,e,f,g,h** |

| | |
|---|---|
| **UNIT I - OVERVIEW OF POWER SEMICONDUCTOR SWITCHES** | **(9)** |
| Introduction - Diodes, Thyristors, BJTs, JFETs, MOSFETs, GTOs IGBTs, Comparison of these as switching devices, Drive and Protection circuit for these devices – New Semiconductor materials for Power devices. | |
| **UNIT II - POWER DIODE AND POWER BJT** | **(9)** |
| Basic structure and I-V & Switching characteristics of Power diode, Schottky diode - Structure and Switching characteristics of Power BJT - Breakdown voltage considerations - Safe operating area - Drive circuits for BJT – Snubber design for Power diode. | |
| **UNIT III - THYRISTORS AND GTOs** | **(9)** |
| Basic structures - I-V characteristics - Physics of device operation - Switching characteristics of Thyristors and GTOs– Derive circuits - Snubber circuits for Thyristors and GTOs - Over current protection of GTOs. | |
| **UNIT IV - IGBT AND POWER JFET & MOSFETS** | **(9)** |
| Basic structures - I-V characteristics, physics of device operation - Switching characteristics – Safe operating area of IGBT and Power JFET & MOSFET - Derive circuits and Protection. | |
| **UNIT V – APPLICATIONS** | **(9)** |
| Single phase rectifiers and Three phase rectifiers using Diodes and Thyristors, Choppers, Inverters using GTOs-IGBTs and power JFETs & MOSFETs. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. B.W Williams,"Power Electronics Circuit Devices and Applications", Prentice Hall India, Third Edition, New Delhi, 2004.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hal India, New Delhi, 4th ed, 2013.

**REFERENCES:**

1. MD Singh and K.B Khanchandani, "Power Electronics", Tata McGraw Hill, 2010.
2. Mohan, Undcland and Robins, "Power Electronics – Concepts, applications and Design", John Wiley and Sons, Singapore, 2000.

| 17EEX18-POWER QUALITY | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC13** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To provide knowledge on analysis of power quality and harmonic phenomena in electric power systems. | **1.1** | The students will be able to introduce the power quality problem. | **a,b,c,e,i,k** | |
| **2.0** | To know the fundamental of characteristics and definitions, voltage sags, electrical transients. | **2.1** | The students will be able to educate on production of voltages sags and interruptions | **a,b,e,i** | |
| **3.0** | To study the production of over voltages | **3.1** | The students will be able to study the overvoltage problems. | **a,b,c,f,i** | |
| **4.0** | To learn about the basic idea of harmonics, | **4.1** | The students will be able to learn the sources and effect of harmonics in power system. | **a,c,e,f,i** | |
| **5.0** | To study various methods of power quality monitoring. | **5.1** | The students will be able to impart knowledge on various methods of power quality monitoring. | **b,c,e,l,k** | |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Need for power quality - Overloading - Under voltage - Sustained interruption - Sags and swells - Waveform distortion - Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve. . | |
| **UNIT II - VOLTAGE SAGS AND INTERRUPTIONS** | **(9)** |
| Sources of sags and interruptions - Estimating voltage sag performance - Motor starting sags - Estimating the sag severity - Mitigation of voltage sags - Active series compensators - Static transfer switches and fast transfer switches. | |
| **UNIT III – OVERVOLTAGES** | **(9)** |
| Capacitor switching - Lightning- Ferro resonance - Mitigation of voltage swells - Surge arresters - Low pass filters - Power conditioners – Lightning protection – Shielding - Line arresters - Protection of transformers and cables. | |
| **UNIT IV – HARMONICS** | **(9)** |
| Voltage and current distortion - Harmonic indices - Harmonic sources from commercial and industrial loads - Locating harmonic sources - Power system response characteristics - Resonance - Harmonic distortion evaluation - Devices for controlling harmonic distortion - Passive filters - Active filters - IEEE and IEC standards. | |
| **UNIT V - POWER QUALITY MONITORING** | **(9)** |
| Power line disturbance analyzer - Power quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters - Disturbance analyzer - Applications of expert system for power quality monitoring. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, “Electrical Power Systems Quality” McGraw Hill,2012.
2. C.Sankaran, “Power Quality”, CRC Press, New York, 2011.

**REFERENCES:**

1. Angelo Baggini, “Handbook of Power Quality”, John Wiley & Sons, New York 2011.
2. Kusko Alexander Thomson Marc. T, “Power Quality in Electrical Systems”, McGraw Hill, Professional, 2007.
3. M.H.J. Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, Wiley, 2011

| 17ECX16 – INTERNET OF THINGS AND ITS APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 1** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To make the students to know about basics of Electrical and Electronic devices | **1.1** | The students will be able to understand basics of Electrical circuits and Electron ic devices | **a,c,d,i** |
| **2.0** | To make the students to know about basics and block diagram of IoT | **2.1** | The students will be able to understand IOT characteristics and its essential components. | **a,b,d,e** |
| **3.0** | To make the students to know about Arduino processor and working of | **3.1** | The students will be able to describe Arduino processor and working of Analog | **a,b,c,g** |
| **4.0** | To make the students to know about Raspberry pi and its interface with other devices | **4.1** | The students will be able to understand Raspberry pi and its interface with other devices | **a,b,c,j** |
| **5.0** | To motivate the students to implement the IoT using Arduino/ Raspberry Pi. | **5.1** | The students will be able to implement a IoT system using Arduino/Raspberry Pi. | **a,f,k,l** |

| **UNIT I - BASIC ELECTRICAL CIRCUITS AND ELECTRONICS** | **(9)** |
|---|---|
| Introduction - Current, voltage and resistance - Analog and Digital Signal - conductors Vs Insulators – KCL- KVL - Basic Electronics components - calculating equivalent resistance for series and parallel circuits- Ohm's law- Color coding for a resistor – LED – LCD - LDR. | |
| **UNIT II - INTRODUCTION TO INTERNET OF THINGS** | **(9)** |
| Introduction - Definition and characteristics of Internet of Things - General Block Diagram and essential components of IOT - Role of microprocessor & Micro controller- communication of things - IOT connection with internet. | |
| **UNIT III- ARDUINO PROCESSOR** | **(9)** |
| Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART) , I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming. | |
| **UNIT IV - RASPBERRY PI** | **(9)** |
| Technical Description of Raspberry Pi - comparison of Raspberry Pi Vs Arduino - Operating Systems for RPi - Preparing SD Card for Pi - Connecting Raspberry Pi as PC - Exploring Raspberry Pi Environment- Logical design using Python. | |
| **UNIT V- APPLICATIONS OF IOT** | **(9)** |
| Various Real time applications of IoT- automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOK:**

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

**REFERENCES :**


1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd edition, 2013.
3. Marco Schwartz, — Internet of Things with the Arduino Yun, Packt Publishing, 2014.
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.


| 17EEX19 - PLC AND AUTOMATION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC03, 17EEC04 & 17EEC07** | | **QUESTION PATTERN : TYPE - 3** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To provide knowledge on the basics of PLC and its networking standards | **1.1** | The students will be able to get knowledge on the components for assembling PLC | **a,b,c,f,i,l** |
| **2.0** | To educate the students about the types of programming of PLC and HMI System and its Programming. | **2.1** | The students will be able to acquire knowledge on advance programming methods to apply in areas like operator panels, text and integrated display, Industrial automation. | **a,b,c,i,l** |
| **3.0** | To gain the knowledge on distributed control systems. | **3.1** | The students will be able to differentiate between SCADA &DCS Systems and their application areas. | **a,c,f,l** |
| **4.0** | To import the students about the application of PLC and DCS. | **4.1** | The students will be able to select the right hardware for given application | **a,b,e,l** |
| **5.0** | To motivate the students to learn the idea of industrial automation system. | **5.1** | The students will be able to get an idea of automation system as network communication and human machine interface. | **a,b,d,f,i** |

| **UNIT I - PROGRAMMABLE LOGIC CONTROLLERS** | **(9)** |
|---|---|
| Basics of PLC - Architecture of PLC - Advantages - Types of PLC - Introduction to PLC Networking- Networking standards - Protocols - Field bus - Process bus and Ethernet IEEE Standard | |
| **UNIT II - PROGRAMMING OF PLC & HMI SYSTEMS PROGRAMMING OF PLC** | **(9)** |
| Types of Programming - Simple process control programs using Relay Ladder Logic and Boolean logic methods - PLC arithmetic functions - Introduction to advanced programming methods.<br>HMI systems: Necessity and Role in Industrial Automation, Text display - Operator panels - Touch panels - Panel PCs – Integrated displays (PLC & HMI). | |
| **UNIT III - DISTRIBUTED CONTROL SYSTEMS (DCS)** | **(9)** |
| Difference between SCADA system and DCS - Architecture - Local control unit - Programming language – communication facilities - Operator interface - Engineering interfaces. | |
| **UNIT IV - APPLICATIONS OF PLC & DCS** | **(9)** |
| Case studies of Machine automation - Process automation - Introduction to SCADA –Comparison between SCADA and DCS | |

| UNIT V – AUTOMATION | (9) |
|---|---|
| Factory Automation: Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – Computer Integrated Manufacture – CNC - Intelligent automation - Industrial networking, - Bus standards - HMI Systems - DCS and SCADA - Wireless controls. | |
| **TOTAL = 45 PERIODS** | |

**TEXTBOOK:**


1. John.W.Webb & Ronald A. Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall of India, 2003.


**REFERENCES:**


1. Michael P. Lukas, "Distributed Control systems", Van Nostrand Reinfold Company, 1995.
2. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson Press, USA, 2005.
3. W. Bolton, "Programmable Logic Controllers", Elsevier India Private Limited, New Delhi, 2008.
4. Mikell P. Groover, "Automation Production systems and Computer Integrated Manufacturing", Prentice Hall of India, New Delhi, 2007.


| 17EEX20 -FLEXIBLE AC TRANSMISSION SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC10 & 17EEC15** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To edify basic things about reactive power control techniques. | **1.1** | The students will be able to acquire an introduction about reactive power control techniques. | **a,b,d,h** | |
| **2.0** | To trigger off the students for learning VAR compensator and its applications | **2.1** | The students will be able to learn about Static VAR Compensator and its applications | **a,b,c,d,f,h** | |
| **3.0** | To formulate the students to understand the concept of Thyristor Controlled Series Capacitor (TCSC) | **3.1** | The students will be able to gain knowledge on Thyristor Controlled Series Capacitor (TCSC). | **a,b,c,d,f,h** | |
| **4.0** | To identify with the application of STATCOM devices | **4.1** | The students will be able to understand the concept of STATCOM devices and applications. | **a,b,c,d,f,h** | |
| **5.0** | To stimulate the students for learn a coordination techniques of FACTS controller. | **5.1** | The students will be able to know about the coordination techniques of FACTS controller. | **a,b,d,h** | |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static VAR Compensator (SVC) – Thyristor Controlled Series Capacitor (TCSC) – Unified Power Flow Controller (UPFC). | |
| **UNIT II -STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS** | **(9)** |
| Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modeling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping. | |
| **UNIT III - THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS** | **(9)** |
| Operation of the TCSC – Different modes of operation – Modeling of TCSC – Variable reactance model – Modeling for power flow and stability studies –Applications: Improvement of the system stability limit – Enhancement of system damping. | |
| **UNIT IV - EMERGING FACTS CONTROLLERS** | **(9)** |
| Static Synchronous Compensator (STATCOM) - Principle of operation - V-I characteristics - Unified Power Flow Controller (UPFC) - Principle of operation - Modes of operation applications - Modeling of UPFC for power flow studies. | |
| **UNIT V - CO-ORDINATION OF FACTS CONTROLLERS** | **(9)** |
| Controller interactions – SVC-SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms. | |
| | **TOTAL = 45 PERIODS** |

**TEXT BOOKS:**


1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems",IEEE press and John Wiley & Sons, Inc, 2011.
2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, 2011.


**REFERENCES:**


1. V.K.Sood, "HVDC and FACTS controllers – Applications of Static Converters in Power System", Springer, 1st ed., 2013
2. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, "Flexible AC Transmission System: Modelling and Control" Springer-verlag Gmbh, 2nd ed., 2012.
3. K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, 2009.
4. Laszlo Gyugyi Narain G.Hingorain, "Understanding Facts : Concepts And Technology Of Flexible Ac Transmission Systems"wiley,2011.


| 17EEX21-POWER SYSTEM DYNAMICS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC10 AND 17EEC15** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To know the basic considerations of stability | **1.1** | The students will be able to inherit the knowledge on stability consideration | **a,b,c,d** | |
| **2.0** | To introduce the mathematical expressions for synchronous machine | **2.1** | The students will be able to develop the mathematical expressions for synchronous machine | **a,b,c,d** | |
| **3.0** | To understand the dynamic behaviour of synchronous machine | **3.1** | The students will be able to epitomize the concept of dynamic behavior in synchronous machine | **a,b,c,d,e** | |
| **4.0** | To analyze characteristics and effects of induction motor | **4.1** | The students will be able to illustrate the characteristics, circuit parameters and effect of induction motor. | **a,b,c,d** | |
| **5.0** | To employ mathematical tools for power system stability analysis | **5.1** | The students will be able to explore mathematical tools for stability analysis | **a,b,c,d,e** | |

| | |
|---|---|
| **UNIT I – STABILITY CONSIDERATIONS** | **(9)** |
| Dynamic modeling requirements- Angle stability - Equal area criterion- Critical fault clearing time and angle numerical integration techniques. | |
| **UNIT II – SYNCHRONOUS MACHINES** | **(9)** |
| Park's transformation – Flux linkage equations – Formulation of normalized equations – State space current model – Simplified models of the synchronous machine – Turbine, Generator – Steady state equations and phasor diagrams. | |
| **UNIT III – DYNAMICS OF SYNCHRONOUS MACHINES** | **(9)** |
| Mechanical relationships – Electrical transient relationships –Adjustment of machine models – Park's equation in the operational form | |
| **UNIT IV – INDUCTION MOTOR EQUIVALENT CIRCUITS AND PARAMETERS** | **(9)** |
| Free acceleration characteristics – Dynamic performance – Effect of three phase short circuit and unbalanced faults | |
| **UNIT V – TRANSIENT AND DYNAMIC STABILITY DISTINCTION** | **(9)** |
| Linear model of unregulated synchronous machine and its oscillation modes – Distribution of power impacts – Effects of excitation on stability – Supplementary stabilization signals. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. P. M. Anderson, A A Fouad, "Power System Control and Stability", John Wiley & Sons, 2nd ed., 2012.
2. Ramanujam R, "Power System Dynamics", PHI Learning Pvt. Ltd., New Delhi, 2009.


**REFERENCE:**


1. Krause P.C., "Analysis of Electric Machinery", McGraw-Hill, 3rd Revised Edition, 2013.


| 17EEX22-FUNDAMENTALS OF ELECTRIC POWER UTILIZATION | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC04, 17EEC07 AND 17EEC17** | | **QUESTION PATTERN : TYPE - 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To analyze the various concepts behind drives | **1.1** | The students will be able to inherit the knowledge about the electric drives for power utilization | **a,b,g,l** | |
| **2.0** | To introduce the energy saving concept by different ways of illumination | **2.1** | The students will be able to know about the lighting sources and there schemes | **a,b.cf,l** | |
| **3.0** | To understand the different methods of electric heating and electric welding | **3.1** | The students will be able to illustrate various heating and welding methods | **b,c,e,g** | |
| **4.0** | To introduce knowledge on Traction system and its trends | **4.1** | The students will be able to epitomize the concept of electric traction system for power utilization. | **g,h,l** | |
| **5.0** | To introduce concepts of Electrolytic processes | **5.1** | The students will be able to explore electrolytic process and its importance | **c,f,g** | |

| | |
|---|---|
| **UNIT I - INTRODUCTION TO DRIVES** | **(9)** |
| Group drive – Individual drive – Selection of motors – Starting and running characteristics – Mechanical features of electric motors – Choice of drives – Power requirement calculation – Power factor improvement. | |
| **UNIT II – ILLUMINATION** | **(9)** |
| Introduction – Definition and meaning of terms used in illumination engineering – Classification of light sources – Incandescent lamps, mercury vapour lamps, fluorescent lamps – Design of illumination systems – Indoor lighting schemes – Factory lighting halls – Outdoor lighting schemes – Flood lighting – Street lighting – Energy saving lamps, LED. | |
| **UNIT III - HEATING AND WELDING** | **(9)** |
| Introduction – Advantages of electric heating – Modes of heat transfer – Methods of electric heating – resistance heating – Arc furnaces – Induction heating – Dielectric heating – Electric welding – Types – Resistance welding – Arc welding – Power supply for arc welding – Radiation welding. | |
| **UNIT IV - ELECTRIC TRACTION** | **(9)** |
| Traction system – Speed– Time characteristics – Series and parallel control of D.C motors – Open circuited, shunt and bridge transitions – Traction effort calculation – Electric braking – Tramways and trolley bus – A.C traction and its recent trends. | |
| **UNIT V - ELECTROLYTIC PROCESSES** | **(9)** |
| Electrolysis – Polarization factor – Preparation work for electro plating – Tanks and other equipments – Calculation of energy requirements – Methods of charging and maintenance – Ni–ion and Ni– cd batteries – Components and materials – Capacity rating of batteries. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. N.V.Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 2nd ed., 2014.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 10th ed., 2014.

**REFERENCES:**

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited., 2nd ed., 2018
2. G.C.Garg, "Utilization of Electric Power and Electric Traction", Khanna Publishers, 10th ed, 2014
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt. Ltd., 4th ed., 2017.

| 17EEX23- ENGINEERING AUTOMOTIVE ELECTRONIC SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC03, 17EEC16 & 17EEC19** | | **QUESTION PATTERN : TYPE – 3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To provide knowledge on automotive component operation, charging and starting system. | **1.1** | The students will be able to develop charging and starting system and to design wiring for automotive component | **a,b,c,e,i,k** | |
| **2.0** | To know the fundamental of Ignition systems. | **2.1** | The students will be able to design ignition system by electronic instrument | **a,b,e,i** | |
| **3.0** | To give exposure to understand the basics concept of instrumentation system. | **3.1** | The students will be able to develop instrumentation system and sensors for different parameters | **a,b,c,f,i** | |
| **4.0** | To learn about the basic idea of braking, traction and electronic instrumentation. | **4.1** | The students will be able to design braking and traction system by electronic instruments. | **a,c,e,f,i** | |
| **5.0** | To acquire knowledge on energy management system and simulation tools. | **5.1** | The students will be able to design lighting and security systems | **b,c,e,l,k** | |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Automotive component operation - Electrical wiring terminals and switching - Multiplexed wiring systems - Circuit diagrams and symbols - Charging Systems and Starting Systems: Charging systems principles, alternations and charging circuits - Basic starting circuit. | |
| **UNIT II - IGNITION SYSTEMS** | **(9)** |
| Ignition fundamental, Electronic ignition systems - Programmed ignition distribution less ignition direct Ignition spark plugs - Electronic Fuel Control - Basics of combustion Engine fuelling and exhaust emissions - Electronic control of carburetion - Petrol fuel injection Diesel fuel injection. | |
| **UNIT III - INSTRUMENTATION SYSTEMS** | **(9)** |
| Introduction to instrumentation systems - Various sensors used for different parameters sensing - Driver instrumentation systems - Vehicle condition monitoring trip - Different types of visual display | |
| **UNIT IV - ELECTRONIC CONTROL OF BRAKING AND TRACTION** | **(9)** |
| Introduction and description control elements - control methodology - electronic control of automatic transmission - Introduction and description Control of gear shift and torque converter lockup - Electric power steering - Electronic clutch. | |
| **UNIT V - ENGINE MANAGEMENT SYSTEMS** | **(9)** |
| Combined ignition and fuel management systems - Exhaust emission control - Digital control techniques - Complete vehicle control systems - Artificial intelligence and engine management - Automotive microprocessor uses.<br>Lighting and Security Systems:<br>Vehicles lighting Circuits - Signaling Circuit Central locking and electric windows security systems - Airbags and seat belt tensioners - Miscellaneous safety and comfort systems. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOK:**

1.Tom Denton, "Automobile Electrical and Electronic Systems", Edward Arnold publications, 1995

**REFERENCES:**


1. Don Knowles, Don Knowles, Prentice Hall, Englewood Cliffs, "Automotive Electronic and Computer controlled Ignition Systems", New Jersey 1988.
2. William, T.M., "Automotive Electronic Systems", Heiemann Ltd., London, 1978.
3. Ronald K Jurgen, "Automotive Electronics Handbook", McGraw Hill, Inc, 1999.


| 17EEX24-THERMODYNAMICS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN :3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate about the concepts of thermodynamics | **1.1** | The students will be able to know the basics of thermodynamics | **a,b,f,i,k** | |
| **2.0** | To motivate students to learn about adiabatic process in first law of thermodynamics | **2.1** | The students will be able to calculate the different process of expansion of gases related to thermodynamics | **a,c,f,j** | |
| **3.0** | To make students to understand about heat engines | **3.1** | The students will be able to acquire knowledge to understand the principles of Carnot, Clausius inequality and Entropy | **a,d,f,i,k** | |
| **4.0** | To understand about gas power cycles | **4.1** | The students will be able to gain adequate knowledge in Otto cycle, diesel cycle, dual cycle and Bryton cycles | **a,b,f,k** | |
| **5.0** | To educate about various refrigeration cycles and systems | **5.1** | The students will be able to gain knowledge in vapor and gas refrigeration cycles | **a,b,f,k** | |

| | |
|---|---|
| **UNIT I – BASIC CONCEPTS AND DEFINITIONS** | **(9)** |
| Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics. | |
| **UNIT II - FIRST LAW OF THERMODYNAMICS** | **(9)** |
| The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases | |
| **UNIT III – SECOND LAW OF THERMODYNAMICS** | **(9)** |
| Equilibrium and the second law - Heat engines – Kelvin Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy | |
| **UNIT IV - GAS POWER CYCLES** | **(9)** |
| Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies | |
| **UNIT V - REFRIGERATION CYCLES AND SYSTEMS** | **(9)** |
| Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle – Absorption refrigeration system (only theory)- Liquifaction and solidification of gases | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**

1. Nag, P. K., “Engineering Thermodynamics”, 6th edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi,2017.
2. Wark, K., “Thermodynamics”, 6th edition, McGraw Hill, N.Y.,1999.

**REFERENCES:**


1. Arora, C.P., “Thermodynamics”, Tata McGraw Hill Publishing Co. Ltd., New Delhi,2017.
2. Burghardt, M.D., “Engineering Thermodynamics with Applications”, 4th edition, Harper and Row, N.Y., 1986.
3. Huang, F.F., “Engineering Thermodynamics” 2nd edition, Macmillan Publishing Co. Ltd., N.Y.,1989.
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 9th edition, McGraw Hill, 2017.


| 17GEA03 - TOTAL QUALITY MANAGEMENT | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PAPER TYPE : TYPE - 3** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To acquire various concepts of quality management. | **1.1** | The students will be able to acquire various concepts of quality management. | **b,c,f** |
| **2.0** | To implement various principles of quality management. | **2.1** | The students will be able to implement various principles of quality management. | **b,c,f** |
| **3.0** | To impart quality using statistical process. | **3.1** | The students will be able to impart quality using statistical process. | **b,c,e** |
| **4.0** | To use the various tools to maintain quality. | **4.1** | The students will be able to use the various tools to maintain quality. | **b,c,e** |
| **5.0** | To implement the quality system for ISO certification. | **5.1** | The students will be able to implement the quality system for ISO certification. | **b,c,f,h** |

**UNIT I – INTRODUCTION** **(9)**

Definitions-Basic approach –Gurus of TQM- TQM Framework -Defining Quality- Dimensions of quality- Benefits of TQM – Leadership: Leadership Concepts – The Deming philosophy - Quality council - Quality statements- Strategic planning- Customer satisfaction: Customer perception of quality- Using customer complaints- service quality- Customer retention.

**UNIT II - TQM PRINCIPLES** **(9)**

Employee involvement: Motivation- Empowerment- Teams- Recognition and Reward- Performance appraisal – Continuous process improvement: The Juran Trilogy – PDSA cycle- Kaizen – Six sigma - Supplier Partnership: Partnering, Supplier selection - Supplier Rating.

**UNIT III- TQM TOOLS AND TECHNIQUES- I** **(9)**

Bench marking - Reason to bench mark, process – Quality Function Development (QFD)- Failure mode and effect analysis – Stages of FMEA- Other types of FMEA-Management tools: Tree diagram- Matrix diagram- Process decision program chart-Activity network diagram.

**UNIT IV - TQM TOOLS AND TECHNIQUES- II** **(9)**

Statistical process control: Pareto diagram –Process flow diagram- Cause and effect diagram- Histogram-Charts – Variable control chart-Control chart for attributes-Scatter diagrams -Process Capability – Total productive maintenance: Learning the new philosophy-Training-Improvement needs.

**UNIT V- QUALITY MANAGEMENT SYSTEMS** **(9)**

Benefits of ISO registration-ISO 9000 series of standards–ISO 9001 Requirements- implementation, Documentation, Internal Audits – Environmental Management system- ISO 14000 series standards- Concepts of ISO 14001- Requirements of ISO 14001- Benefits of EMS.

**TOTAL (L: 45) = 45 PERIODS**

**TEXT BOOK:**

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2011.

**REFERENCES :**


1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th ed., First Indian Edition, Cengage Learning, 2012.
2. Subburaj Ramasamy , “Total Quality Management”, Tata McGrawHill, First reprint 2009.
3. Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.


| 17GEA04 - PROFESSIONAL ETHICS AND HUMAN VALUES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : NIL** | | **QUESTION PATTERN : TYPE - 3** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To understand the theory of engineering ethics. | **1.1** | The students will be able to know the concepts of ethics and values. | **f, h** |
| **2.0** | To enable the students to create an awareness on Engineering Ethics and Human Values. | **2.1** | The students will be able to acquire the knowledge of interpersonal and organizational issues in ethics | **f, h** |
| **3.0** | To instill Moral and Social Values and Loyalty. | **3.1** | The students will be able to will be able to Highlight the ethical issues related to engineering. | **f, h, i, l** |
| **4.0** | To appreciate the safety, responsibilities and rights of others. | **4.1** | The students will be able to learn the concepts of engineer's responsibilities and their rights. | **f, h, i, l** |
| **5.0** | To understand the role of professional bodies | **5.1** | The students will be able to understand the role of global issues and professional bodies. | **f, h, i, l** |

| **UNIT I - HUMAN VALUES** | **(9)** |
|---|---|
| Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality- Introduction to Yoga and meditation for professional excellence and stress management. | |
| **UNIT II - ENGINEERING ETHICS** | **(9)** |
| Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories. | |
| **UNIT III - ENGINEERING AS SOCIAL EXPERIMENTATION** | **(9)** |
| Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger case study – Bhopal Gas Tragedy and Chernobyl case studies. | |
| **UNIT IV - SAFETY, RESPONSIBILITIES AND RIGHTS** | **(9)** |
| Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. | |
| **UNIT V - GLOBAL ISSUES** | **(9)** |
| Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility. | |
| | **TOTAL (L: 45) = 45 PERIODS** |

**TEXT BOOKS:**


1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition , Tata Mc Graw Hill, New Delhi, 2014.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India Private Limited, New Delhi, 20012.

**REFERENCES:**


1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2008
4. Web sources: 1. www.onlineethics.org 2. www.nspe.org 3. www.globalethics.org 4. www.ethics.org


| 17ITX26- PROBLEM SOLVING AND ALGORITHMIC SKILLS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE: NIL** | | **QUESTION PATTERN : TYPE – 1** | | | |

**COURSE OBJECTIVES AND OUTCOMES**

| Course Objectives | | Course Outcomes | | Related Program Outcomes |
|---|---|---|---|---|
| **1.0** | To impart fundamental concepts of OOP using python | **1.1** | The students will be able to understand the basics of object oriented concepts in python. | **a,c,l** |
| **2.0** | To gain exposure about inheritance and polymorphism | **2.1** | The students will be able to develop applications using inheritance and polymorphism | **a,b,c,d,e,k,l** |
| **3.0** | To understand the abstract data types and tree data structures | **3.1** | The students will be able to implement the ADTs and trees | **a,b,c,d,e,k,l** |
| **4.0** | To see how graphs and heaps can be used to solve a wide variety of problems | **4.1** | The students will be able to design graph abstract data type and heap | **a,b,c,d,e,k,l** |
| **5.0** | To understand the sorting techniques and shortest path algorithms. | **5.1** | The students will be able to implement the sorting techniques and shortest path algorithms. | **a,b,c,d,e,k,l** |

| | |
|---|---|
| **UNIT I - MOTIVATION OF FUNDAMENTAL CONCEPT IN PROGRAMMING** | **(9)** |
| Implementation of Classes and Objects in Python - Class Attributes and Instance Attributes - 'self ' parameter - Static Methods and Instance Methods - init() method | |
| **UNIT II - ADVANCED FEATURES IN CONCEPT OF PROGRAMMING** | **(9)** |
| Performing Abstraction and Encapsulation in Python - Single Inheritance - Multiple Inheritance - Multilevel Inheritance - Public, Protected and Private - Naming Conventions. Polymorphism- Overriding and the super() method - Diamond Shape Problem in Multiple Inheritance - Overloading an Operator - Implementing an Abstract Base Class (ABC) | |
| **UNIT III - INTRODUCTION TO ALGORITHMIC THINKING AND PEAK FINDING** | **(9)** |
| Array data structure - Linked List Data Structure and Its Implementation - Stacks and Queues - Binary Search Trees - Balanced Trees: AVL Trees and Red-Black Trees | |
| **UNIT IV - MAPPING VALUES AND PRINCIPLE OF OPTIMALITY** | **(9)** |
| Heaps - Heapsort Algorithm - Associative Arrays and Dictionaries - Ternary Search Trees as Associative Arrays - Basic Graph Algorithms - Breadth - First And Depth - First Search - Spanning Trees | |
| **UNIT V - ANALYZING NUMBER OF EXCHANGES IN CRAZY-SORT** | **(9)** |
| Shortest Path Algorithms, Dijkstra's Algorithm - Bellman-Ford Algorithm - Kruskal Algorithm - Sorting Algorithms- Bubble Sort, Selection Sort and Insertion Sort - Quicksort and Merge Sort, Non-Comparison Based Sorting Algorithms, Counting Sort and Radix Sort | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Dusty Phillips, Python 3 Object-oriented Programming, Packt Publishing, Second Edition.
2. Bradley N. Miller, David L. Ranum,- Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, 2011.

**REFERENCES:**


1. Mark Summerfield - Programming in Python 3, Pearson Education, 2nd Edition
2. Michael T. Goodrich, Irvine Roberto Tamassia, Michael H. Goldwasser, - Data Structures and Algorithms in Pythonll, 2013 edition.


| 17CSX31- PROBLEM SOLVING AND PROGRAMMING | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17CSC01 / 17CSC02** | | **QUESTION PATTERN : TYPE 1** | | | |

**COURSE OBJECTIVES AND OUTCOMES:**

| Course Objectives | | Course Outcomes | | Related Program Outcomes |
|---|---|---|---|---|
| **1.0** | To gain knowledge about the basics of programming | **1.1** | The students will be able to understand the basics of Python Programming constructs. | **a,c,l** |
| **2.0** | To gain exposure about selection structure | **2.1** | The students will be able to design programs involving selection structure | **a,b,c,d,l** |
| **3.0** | To get knowledge about repetition structure, function and modules | **3.1** | The students will be able to design programs involving function, modules and loops. | **a,b,c,d,k,l** |
| **4.0** | To gain exposure about string | **4.1** | The students will be able to realize the need of strings. | **a,b,c,d,k,l** |
| **5.0** | To get knowledge about mutable and Immutable types | **5.1** | The students will be able to realize the need of list, tuples and dictionary. | **a,b,c,d,k,l** |

| | |
|---|---|
| **UNIT I - INTRODUCTION TO BASICS OF PROGRAMMING** | **(9)** |
| Basics - Variables and Assignment - Basic Data Types- Comments - Operators - print() – Floats | |
| **UNIT II - SELECTION STRUCTURE** | **(9)** |
| Introduction to Selection Structure - if statements, else statements, nested elif statements, truthy and falsey values, Control Structure | |
| **UNIT III - VALUE – REPETITION AND RETURNING STRUCTURE** | **(9)** |
| Loops - while loops, for loops - Nested Loops - Functions - modules - variable scope | |
| **UNIT IV - DATA AND STRING PROCESSING** | **(9)** |
| Strings - Accessing the Strings - Traversing the Strings - Working with Strings - Formatting Strings | |
| **UNIT V - MUTABLE AND IMMUTABLE TYPES AND METHODS** | **(9)** |
| Introduction to lists, indexing and slicing of list, del and list methods, Tuples, Dictionary and its methods. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Dr. R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2017 Edition.
2. Reema Thareja - Problem Solving and Programming – Python, Oxford University Press, 2nd Edition.


**REFERENCES:**


1. Wesley J. Chun, ―Core Python Programming, Pearson Education, 2nd edition, 2010.


| 17EEX25-ELECTRIC AND HYBRID VEHICLES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PREREQUISITE : 17EEC04, 17EEC07, 17EEC17** | | **QUESTION PATTERN :3** | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To educate about the concepts of electric vehicles | **1.1** | The students will be able to know the fundamentals of electric vehicles | **a,b,c,e,f,g,i,k,l** | |
| **2.0** | To motivate students to understand about the properties of batteries and its types | **2.1** | The students will be able to acquire knowledge in the capacity of battery charging. | **a,b,c,d,e,f,g,h,i,k,l** | |
| **3.0** | To make students to understand about electrical machines | **3.1** | The students will be able to know about the requirements of electrical machines for electric vehicles. | **a,b,c,d,e,f,g,h,i,k,l** | |
| **4.0** | To understand working of different configurations of electric vehicles | **4.1** | The students will be able to gain adequate knowledge in electric vehicle drive train. | **a,b,d,f,i,l** | |
| **5.0** | To educate about basic of hybrid electric vehicles | **5.1** | The students will be able to design the hybrid electric vehicles using different size of components. | **a,b,c,e,f,g,h,i,k,l** | |

| | |
|---|---|
| **UNIT I – INTRODUCTION TO ELECTRIC VEHICLES** | **(9)** |
| Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion system design. | |
| **UNIT II - BATTERY** | **(9)** |
| Basics – Types, Parameters: Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics - Battery pack Design - Properties of Batteries. | |
| **UNIT III – DC & AC ELECTRICAL MACHINES** | **(9)** |
| Motor and Engine rating – Requirements - DC machines - Three phase A/c machines - Induction machines - Permanent magnet machines - Switched reluctance machines. | |
| **UNIT IV - ELECTRIC VEHICLE DRIVE TRAIN** | **(9)** |
| Transmission configuration - Components: gears, differential, clutch, brakes regenerative braking, motor sizing. | |
| **UNIT V - HYBRID ELECTRIC VEHICLES** | **(9)** |
| Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS:**


1. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2016.
2. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.
3. Bose, B.K., ―Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2010


**REFERENCES:**


1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010
2. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2000 .
3. http://nptel.ac.in/courses/108103009/

| 17EEX26-EMBEDDED SYSTEMS DESIGN | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To know the overview of embedded system and its challenging principles. | **1.1** | The students will be able to understand and Integrate new knowledge within the field. | a,b,c,d,e,f,g,h,k,l | |
| **2.0** | To learn various concepts of processor and its designing Principles. | **2.1** | The students will be able to design, execute and evaluate experiments on embedded Platforms | a,b,c,d,e,f,g,h,i,k,l | |
| **3.0** | To gain the basic knowledge about memories and their applications | **3.1** | The students will be able to learn the basic of memories and their applications | a,b,c,d,e,f,g,h,i,l | |
| **4.0** | To know about various interfacing techniques and various interfacing peripherals | **4.1** | The students will be able to use various interfacing techniques with numerous peripherals | a,b,c,d,e,f,g,h,i,k,l | |
| **5.0** | To acquire practical skills on embedded systems in various fields | **5.1** | The students will be able to gain practical knowledge on embedded systems | a,b,c,d,e,f,g,h,i,k,l | |

| | |
|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Embedded systems overview - Design challenges - Optimizing metrics - Processor technology - IC technology - Design technology- Automation- Synthesis - Verification: hardware,software co-simulation-trade-offs. | |
| **UNIT II - PROCESSING ELEMENTS** | **(9)** |
| Custom single purpose processor design - RT level custom single purpose processor design-Optimizing custom single purpose processors-General purpose processor's software: architecture, operation, programmer's view and development environment – ASIPs - selecting a microprocessor - General purpose processor design. | |
| **UNIT III – MEMORIES** | **(9)** |
| Introduction-Memory writes ability and storage Permanence-Common memory types-Composing memory-Memory hierarchy and caches-Advanced RAM. | |
| **UNIT IV – INTERFACING** | **(9)** |
| Introduction-Communication basics-Microprocessor interfacing: I/O addressing, interrupts,DMA-Arbitration Multilevel bus architectures-Advanced communication principles-Serial protocols-Parallel protocols-Wireless protocols-Standard single purpose processor's peripherals: Timers, PWM, LCD controllers, stepper motor controllers, RTC. | |
| **UNIT V – APPLICATIONS** | **(9)** |
| Digital camera-Washing machine-Cell phones-Home security systems-Finger print identifiers-Cruise control -Automated teller machine. | |
| **TOTAL (L:45) = 45 PERIODS** | |

| **TEXT BOOK:** |
|---|
| 1. Jonathan.W.Valvano, "Embedded Microcomputer systems: Real Time Interfacing", Cengage learning,3 rd ed. 2012. |
| **REFERENCES:** |
| 1. Vahid and Tony Givargis, "Embedded system design: A unified hardware/Software Introduction" John Wiley & sons,3rd edition, 2010.<br>2. Daniel D. Gajski, Samar and Abdi, Andreas. Gerstlauer, "Embedded system design: Modeling, synthesis and verification", Springer, 2009. |
| |

| 17EEX27-EMBEDDED SYSTEM FOR AUTOMOTIVE APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To expose the students to the fundamentals and building of Electronic Engine Control systems | **1.1** | The students will be able to insight into the significance of the role of embedded system for automotive applications | | a,b,c,d,e,f,g,h,i,j,k,l |
| **2.0** | To teach on functional components and circuits for vehicles | **2.1** | The students will be able to illustrate the need, selection of sensors and actuators and interfacing with ECU | | a,b,c,d,e,f,g,h,i,j,k,l |
| **3.0** | To discuss on programmable controllers for vehicles management systems | **3.1** | The students will be able to develop the Embedded concepts for vehicle management and control systems | | a,b,c,d,e,f,g,h,i,l |
| **4.0** | To teach logics of automation & commercial techniques for vehicle communication. | **4.1** | The students will be able to demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs | | a,b,c,d,e,f,g,h,i,l |
| **5.0** | To introduce the embedded systems concepts for E-vehicle system development | **5.1** | The students will be able to improve Employability and Entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems. | | a,b,c,d,e,f,g,h,i,j,k,l |

| | |
|---|---|
| **UNIT I -BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS** | **(9)** |
| Overview of Automotive systems - Fuel economy-Air-fuel ratio-Emission limits and vehicle performance: Automotive microcontrollers- Electronic control Unit- Hardware & software selection and requirements for Automotive applications - Introduction to AUTOSAR - Introduction to Society SAE- Functional safety ISO 26262. | |
| **UNIT II- SENSORS AND ACTUATORS FOR AUTOMOTIVES** | **(9)** |
| Review of sensors- sensors interface to the ECU-Conventional sensors and actuators-Modern sensor and actuators - LIDAR sensor- Smart sensors- MEMS/NEMS sensors and actuators for automotive applications. | |
| **UNIT III -VEHICLE MANAGEMENT SYSTEMS** | **(9)** |
| Electronic Engine Control - Engine mapping-fuel control-Electronic ignition - Adaptive cruise control - Speed control-anti-locking braking system-Electronic suspension - Electronic steering, Automatic wiper control- Body control system - Vehicle system schematic for interfacing with EMS, ECU - Electrically assisted power steering system- Adaptive lighting system - Safety and Collision Avoidance. | |
| **UNIT IV -ONBOARD DIAGONSTICS** | **(9)** |
| On board diagnosis of vehicles - Vehicle communication protocols -Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 - Recent trends in vehicle communications-Navigation-Tracking Security for data communication- Dashboard display and Virtual Instrumentation - Role of IOT in Automotive systems. | |
| **UNIT V- ELECTRIC VEHICLES** | **(9)** |
| Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuel cells,Solar powered vehicles- Autonomous vehicles. | |
| | **TOTAL (L:45) = 45 PERIODS** |

| **TEXT BOOKS:** |
|---|
| 1. William B. Ribbens,"Understanding Automotive Electronics", Elseiver,2017.<br>2. Automotive Electricals / Electronics System and Components, Tom Denton, 5 rd Edition, 2017.<br>3. A. Galip Ulsoy , Huei Peng , Melih Cakmakci ,"Automotive Control Systems: For Engine, Driveline, and Vehicle", March 30, 2012. |
| **REFERENCES:** |
| 1. Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 5 th Edition, 2007.<br>2. Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection– Ford,2004<br>3. Jack Erjavec, JeffArias,"Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles",Cengage ,2012. |

| 17EEX28- SIGNAL PROCESSING | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To impart basic knowledge about signals and systems | **1.1** | The student will be able to explain the various basic signals and systems parameters | | a,b,c,d,f,g,j |
| **2.0** | To develop in students the ability to analyze various types of Fourier transform techniques | **2.1** | The student will be able to describe the properties and realize the filter structures | | a,b,c,d,f,g,j |
| **3.0** | To make the students to understand the design of Infinite Impulse Response filters | **3.1** | The student will be able to design the IIR filters like butterworth and chebyshev approximations | | a,b,c,d,f,g,j |
| **4.0** | To make the students to understand the design of Finite Impulse Response filters | **4.1** | The student will be able to design FIR filters and window functions. | | a,b,c,d,f,g,j |
| **5.0** | To gain the knowledge about the digital signal processors | **5.1** | The student will be able to examine the functional blocks of digital signal processor and its internal features. | | c,g,j |

| | |
|---|---|
| **UNIT I – INTRODUCTION TO SIGNALS AND SYSTEMS.** | **(9)** |
| Energy and power signals- Continuous and discrete time signal-Continuous and discrete amplitude signals-System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability- Effects of sampling and quantization in discrete domain. | |
| **UNIT II – DISCRETE FOURIER TRANSFORM** | **(9)** |
| DTFT - frequency domain sampling-DFT :properties, frequency analysis, Radix-2 FFT algorithms, applications, Realization of filter structures: Direct forms I and II, cascade, parallel and lattice structures. | |
| **UNIT III – DESIGN OF IIR FILTERS** | **(9)** |
| Design techniques for analog low pass filter-Butterworth and Chebyshev approximations-frequency transformation, approximation of derivatives, Bilinear transformation and impulse invariant technique | |
| **UNIT IV – DESIGN OF FIR FILTERS** | **(9)** |
| FIR Filter Design: Phase and group delay, design characteristics of FIR filters with linear phase, frequency response-FIR filters using window functions: Rectangular, Hamming, Hanning, Bartlett, Blackman and Kaiser. | |
| **UNIT V – DIGITAL SIGNAL PROCESSORS.** | **(9)** |
| Digital signal processor architectures: TMS320C series, General purpose processors: fixed point and floating point, MAC, pipelining, addressing modes- Typical implementation of DSP algorithms. | |
| **TOTAL(L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
|---|
| 1. John G. Proakis, D. G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, 4th edition, Pearson Education,2016<br>2. Oppenheim V.A.V and Schaffer R.W, Discrete – time Signal Processing,3 rd Edition, Pearson,2014 |
| **REFERENCES:** |
| 1. Lawrence R Rabiner and Bernard Gold, Theory and Application of Digital Signal. Processing Pearson Education,2016<br>2. Steven W Smith, Digital Signal Processing: A Practical Guide for Engineers and Scientists, Newnes,2014 |

| 17EEX29-EMBEDDED CONTROL SYSTEM | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To learn the basics of sensors and actuators in embedded platform. | **1.1** | The students will be able to apply the basics of Sensors and actuators in embedded platform. | | a,b,c,d,e,f,g,h,i,j,k,l |
| **2.0** | To know the interfacing techniques using communication Buses. | **2.1** | The students will be able to interface various Peripherals using communication buses. | | a,b,c,d,e,f,g,h,i,j,k, l |
| **3.0** | To acquire knowledge on embedded controller and their Applications. | **3.1** | The students will be able to develop applications based on embedded controller. | | a,b,c,d,e,f,g,h,i,l |
| **4.0** | To learn various software tools for controlling embedded based applications. | **4.1** | The students will be learn various software tools for controlling embedded based applications. | | a,b,c,d,e,f,g,h,i,l |
| **5.0** | To understand the basics of contemporary RTOS. | **5.1** | The students will be make a Survey on basics of contemporary RTOS. | | a,b,c,d,e,f,g,h,i,j,k,l |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Embedded systems - Interfacing a microprocessor to the analog world-Position and Velocity measurements - The world of sensors-Actuators-Motor control - Feedback systems - Haptic interfaces and Virtual environments Applications of embedded control systems | |
| **UNIT II - INTERFACE WITH COMMUNICATION PROTOCOL** | **(9)** |
| Design methodologies and tools – Design flow – Designing hardware and software interface – System integration – SPI - High speed data acquisition and interface - SPI read/write protocol - RTC interfacing and programming | |
| **UNIT III - EMBEDDED SYSTEM ORGANIZATION** | **(9)** |
| Embedded computing – Characteristics of embedded computing applications–Embedded system design challenges - Build process of real-time embedded system – Selection of processor – Memory - I/O devices -RS 485 - MODEM-Bus communication system using I2C- CAN- USB -ISA- EISA. | |
| **UNIT IV - DESIGN OF SOFTWARE FOR EMBEDDED CONTROL** | **(9)** |
| Software abstraction using Mealy - Moore FSM controller - Layered software development - Basic concepts of developing device driver – SCI – Interfacing & porting using standard C & C++ - Functional and performance debugging with benchmarking- Real-time system software – Survey on basics of contemporary RTOS – VXWorks - UC/OS-II. | |
| **UNIT V - CASE STUDIES WITH EMBEDDED CONTROLLER** | **(9)** |
| A low - cost web – Based infrared remote control system for energy management of aggregated air conditioners – PWM Motor speed controller – Serial communication interface. | |
| | **TOTAL (L:45) = 45 PERIODS** |

| **TEXT BOOKS:** |
| --- |
| 1. Steven F. Barrett, Daniel J. Pack, "Embedded Systems – Design and Applications with the 68HC12 and HCS12", Pearson Education, 2008<br>2. Muhammad Ali Mazidi, Rolin D. Mckinlay, and Danny Causey, "PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18", Pearson Education, 2008. |
| **REFERENCE:** |
| 1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Tata McGraw Hill, 2017. |

| 17EEX30-EMBEDDED PROCESSORS | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To impart basic knowledge about ARM architecture and cortex | **1.1** | The student will be able to explain the ARM and Cortex | a,b,c,d,e | |
| **2.0** | To impart the knowledge on timers, RTC, ADC & QEI | **2.1** | The student will be able to describe the operation of timers, RTC, ADC and QEI | a,b,c,d,e | |
| **3.0** | To make the students to understand the memory model and caches | **3.1** | The student will be able to explain the memory management and caches of ARM Cortex A architecture | a,b,c,d,e | |
| **4.0** | To make the students to understand the internal features of ARM Cortex A | **4.1** | The student will be able to explain the concepts of booting, power management and debugging | a,b,c,d,e,i | |
| **5.0** | To gain the knowledge about the functional blocks and tools of DSP processor | **5.1** | The student will be able to enumerate the various functions of DSP processor with its internal characteristics | a,b,c,d,e,i | |

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| **UNIT I – ARM ARCHITECTURE AND CORTEX** | **(9)** |
| Introduction to the ARM Cortex M4 -ARM Cortex M4 architecture: address space, on- chip peripherals (analog and digital) Register sets, addressing modes and instruction set . | |
| **UNIT II - TIMERS, PWM AND MIXED SIGNAL PROCESSING** | **(9)** |
| Timer- Basic Timer, Real Time Clock (RTC), Timing generation and measurements, ADC-PWM Module - Quadrature Encoder Interface (QEI) | |
| **UNIT III - ARM CORTEX A ARCHITECTURE** | **(9)** |
| Introduction to ARMv8A- Memory Management-Memory Model, Caches and Branch Prediction, Synchronization and Cache coherency. | |
| **UNIT IV - GUIDE LINES TO ARM CORTEX 64 BIT ARCHITECTURE** | **(9)** |
| Booting- Power Management,-Virtualization,-Security- Debugging. | |
| **UNIT V - DSP PROCESSORS** | **(9)** |
| Architecture of TMS320CXX Processor – Addressing modes – Assembly language Instructions – Assembler directives, Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals – Code Composer Studio – Support Files - Application Programs for processing real time signals. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Joseph Yiu, "The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors",3rd Edition, Newnes ,UK,2013
2. ARM Cortex-A Series Programmer's Guide for ARMv8-A Version: 1.0, ARM, United States,2015

**REFERENCES:**


1. Yifeng Zhu, Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C, E-Man Press LLC, United States, 2nd Edition 2015
2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.

| 17EEX31-EMBEDDED NETWORKING | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the various proctocols in embedded system | **1.1** | The student will be able to know the concept of communication protocols | a,d,g,h,k | |
| **2.0** | To acquire knowledge on CANBUS and USB | **2.1** | The student will be able to learn the importance of USB and CAN Bus | a,d,e,f,g,h,k | |
| **3.0** | To learn the basic of ethernet controllers and elements of the network | **3.1** | The student will be able to apply advanced technical knowledge in multiple contexts | b,c,d,e,g,l | |
| **4.0** | To acquire the knowledge on embedded ethernet | **4.1** | The student will be able to design, execute and evaluate experiments on embedded platforms | a,d,g,k | |
| **5.0** | To understand the concept of wireless sensor network and its protocols. | **5.1** | The student will be able to learn the basics of wireless embedded networking | a,d,e,f,g,h,k | |

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|---|---|
| **UNIT I - EMBEDDED COMMUNICATION PROTOCOLS** | **(9)** |
| Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 –Synchronous serial protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – Parallel communication protocols -ISA/PCI Bus protocols –Firewire. | |
| **UNIT II - USB AND CAN BUS** | **(9)** |
| USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames – Bit stuffing –Types of errors –Nominal bit timing – A simple application with CAN. | |
| **UNIT III - ETHERNET BASICS** | **(9)** |
| Elements of a network – Inside Ethernet – Building a network: Hardware options – Cables, connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet Protocol | |
| **UNIT IV - EMBEDDED ETHERNET** | **(9)** |
| Exchanging messages using UDP and TCP – Serving web pages with dynamic Data – Email for embedded Systems – Using FTP – Keeping devices and network secure. | |
| **UNIT V - WIRELESS EMBEDDED NETWORKING** | **(9)** |
| Wireless sensor networks – Introduction – Applications – Network topology – Localization –Time synchronization – Energy efficient MAC Protocols –SMAC – Energy efficient and robust routing – Data centric routing | |
| **TOTAL(L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
| --- |
| 1. Jan Axelson,Parallel Port Complete**,** Programming, Interfacing, and Using the PC's Parallel Printer Port ,Jan Axelson Series,2012<br>2. Dogan Ibrahim,Advanced PIC microcontroller projects in CII, Elsevier 2008. |
| **REFERENCE:** |
| 1. Jan Axelson, Embedded Ethernet and Internet Complete: Designing and Programming Small Devices for Networking Jan Axelson Series,2007. |

| 17EEX32-VLSI DESIGN TECHNIQUES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To impart basic knowledge about VLSI design methodology | **1.1** | The student will be able to explain the various VLSI design process | a,b,c,i,l | |
| **2.0** | To impart the knowledge on MOS device design and stick diagrams | **2.1** | The student will be able to describe the operation of nMOS and pMOS transistor and circuit model | a,b,c,i,l | |
| **3.0** | To make the students to understand the CMOS characteristics and its performance parameters | **3.1** | The student will be able to explain the various characteristics related to CMOS Inverter | a,b,c,e,j | |
| **4.0** | To make the students to understand the design of static and dynamic CMOS logic | **4.1** | The student will be able to design the static and dynamic CMOS logic | a,b,d,i,k | |
| **5.0** | To gain the knowledge about the design of arithmetic circuits and FIR filter design | **5.1** | The student will be able to design adders/subtractors, various multipliers and FIR filters | a,b,c,i,l | |

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| **UNIT I - VLSI DESIGN METHODOLOGY** | **(9)** |
| VLSI design process: Architectural design, logical design, physical design- Layout styles: Full- custom, Semi-custom approaches | |
| **UNIT II - MOS DEVICES** | **(9)** |
| MOS Transistor Theory: nMOS, pMOS Enhancement Transistor-MOSFET as a Switch, Threshold voltage,MOS Device Design Equations, Second order effects-MOS Transistor Circuit Model, Stick Diagram, Layout Design Rules | |
| **UNIT III - CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION** | **(9)** |
| DC Characteristics of CMOS Inverter- Switching Characteristics of CMOS Inverter-Transistor Sizing, Analytical Delay model: Rise Time, Fall Time, Gate Delays,RC Delay Models, Logical Effort- Power Dissipation: Static, Dynamic, Short Circuit Power Dissipation . | |
| **UNIT IV-COMBINATIONAL LOGIC CIRCUITS** | **(9)** |
| Static CMOS Design-Complex Logic Gates-Ratioed Logic-Pass-Transistor Logic-Transmission gate Logic-Dynamic CMOS Logic Design: Considerations, Speed and Power Dissipation-Signal integrity issues | |
| **UNIT V -DESIGN OF ARITHMETIC CIRCUITS** | **(9)** |
| Adders & subtractors-Array based multipliers,Tree based multipliers-Speed and Area trade-off,Pipelined Multiplier - Accumulator,FIR filter design . | |
| **TOTAL(L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
|---|
| 1. Neil H.E.Weste, David Money Harris, “CMOS VLSI DESIGN: a circuits and systems perspective”, 4th edition, Pearson 2015 .<br>2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated circuits: A design perspective”, Prentice Hall of India,2nd Edition 2016. |
| **REFERENCES:** |
| 1. Samir Palnitkar, “Verilog HDL”, Prentice Hall, 2010<br>2. Sung-Ma Kong, Yusuf Leblebici and Chulwoo Kim, "CMOS digital integrated circuits: analysis and design", 4th edition, McGraw-Hill Education, 2015 |

| 17EEX33-EMBEDDED IOT | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To impart basic knowledge of IOT and its applications. | **1.1** | The student will be able to explain the various applications of IOT | a,b,c,d,e,f,l | |
| **2.0** | To acquire knowledge in understanding the basic components in IOT | **2.1** | The student will be able to describe the operation of IOT Architecture | a,b,c,d,e,f,l | |
| **3.0** | To make the students to understand the Communication principles | **3.1** | The student will be able to explain the Communication Principles | a,b,c,d,e,f,l | |
| **4.0** | To make the students to understand communication interfaces in IOT | **4.1** | The student will be able to explain communication interface in IOT | a,b,c,d,e,f,l | |
| **5.0** | To gain the knowledge about the Cloud security concepts . | **5.1** | The student will be able to explain security concepts in cloud. | a,b,c,d,e,f,l | |

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|---|---|
| **UNIT I - FUNDAMENTALS AND APPLICATIONS OF IoT** | **(9)** |
| Introduction to Internet of Things (IoT)- Functional Characteristics- Recent Trends in the Adoption of IoT - Societal Benefits of IoT- Health Care -Smart Transportation- Smart Living -Smart Cities- Smart Grid. | |
| **UNIT II - IoT ARCHITECTURE** | **(9)** |
| Functional Requirements-Components of IoT-Sensors- Actuator- Embedded Computation Units - Communication Interfaces - Software Development | |
| **UNIT III - COMMUNICATION PRINCIPLES** | **(9)** |
| RFID – ZigBEE - Bluetooth - Internet Communication- IP Addresses - MAC Addresses - TCP and UDP - IEEE 802 Family of Protocols- Cellular-Introduction to Ether CAT | |
| **UNIT IV- COMMUNICATION INTERFACE IN IOT** | **(9)** |
| IEEE 802.11 Wireless Networks Attacks: Basic Types, WEP Key Recovery Attacks, Keystream Recovery Attacks against WEP – RFID Security – Security Issues in ZigBEE: Eavesdropping Attacks, Encryption Attacks - Bluetooth Security: Threats to Bluetooth Devices and Networks. | |
| **UNIT V - CLOUD SECURITY CONCEPTS** | **(9)** |
| Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege,PAAS, IAAS and SAAS,Cryptographic Systems, Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management,X.509 certificates, Open SSL. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Thingsǁ, John Wiley and Sons Ltd, UK, 2014.
2. Olivier Hersent, David Boswarthick and Omar Elloumi, The Internet of Things: Key Applications and Protocolsǁ, John Wiley and Sons Ltd., UK 2012.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, ―Architecting the Internet of Things ǁ, Springer, New York, 2011.


**REFERENCES:**


1. Johnny Cache, Joshua Wright and Vincent Liu, Hacking Exposed Wireless: Wireless Security Secrets and Solutionsǁ, Tata McGraw Hill, New Delhi, 2010
2. Himanshu Dwivedi, Chris Clark and David Thiel, ―Mobile Application Securityǁ, Tata McGraw Hill, New Delhi, 2010.
3. Vijay Madisetti, Arshdeep Bahga, ―Internet of Things (A Hands-on Approach), Universities Press, 2015.
4. Tim Mather, Subra Kumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009

| 17EEX34-FUNDAMENTALS OF ELECTRIC VEHICLES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To know the concepts, principles, operation and performance of the electric vehicle. | **1.1** | The students will be able to explain the overview of Electric Vehicle | | a,b,c,g |
| **2.0** | To gain knowledge about the basics of the Hybrid electric vehicle. | **2.1** | The students will be able to describe the overview of Hybrid Electric Vehicle | | a,b,c,d,g |
| **3.0** | To acquire knowledge on the fundamentals of the vehicles | **3.1** | The students will be able to illustrate the fundamental terminologies of Electric vehicle | | a,b,c,d,g |
| **4.0** | To develop the modeling of an electric vehicle. | **4.1** | The students will be able to design electric vehicle model | | a,b,c,d,g,h,j,l |
| **5.0** | To understand the Design Considerations for Electric Vehicle. | **5.1** | The students will be able to Design an electric vehicle based on the requirement | | a,b,c,d,g,h,j,l |

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|---|---|
| **UNIT I - ELECTRIC VEHICLES** | **(9)** |
| Introduction to EV- History- Components of Electric Vehicle- General Layout of EV-EV classification- Comparison with Internal combustion Engine: Technology, Advantages & Disadvantages of EV. | |
| **UNIT II – HYBRID ELECTRIC VEHICLES** | **(9)** |
| Introduction to HEV- History-Components of Hybrid Electric Vehicle -General Layout of Hybrid EV- Comparison with Electric Vehicles- Advantages & Disadvantages of Hybrid EV. | |
| **UNIT III – VEHICLE FUNDAMENTALS** | **(9)** |
| Vehicle resistance,-Types: Rolling Resistance, grading resistance, Aerodynamic drag vehicle performance- Calculating the Acceleration Force, maximum speed- Total Tractive Effort, Torque Required on the Drive Wheel, Transmission: Differential, clutch &gear box- Braking performance | |
| **UNIT IV – ELECTRIC VEHICLE MODELLING** | **(9)** |
| Tractive Effort-Modelling Vehicle Acceleration-Acceleration performance parameters-Modelling the acceleration of an electric scooter-Modelling the acceleration of a small car. | |
| **UNIT V – DESIGN CONSIDERATION FOR ELECTRIC VEHICLE** | **(9)** |
| Aerodynamic Considerations-Consideration of Rolling Resistance-Transmission Efficiency-Consideration of Vehicle Mass-Electric Vehicle Chassis and Body Design | |
| **TOTAL (L=45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Iqbal Hussain., "Electric and Hybrid Vehicles: Design Fundamentals", 3rd Edition, CRC press, Taylor & Francis Group, Florida,United States, 2021
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals,Theory and Design", 3rd Edition, CRC Press, 2018

**REFERENCES:**


1. James Larminie, John Lowry, "Electric Vehicle Technology Explained", 2nd Edition, Wiley, 2012
2. L.Ashok Kumar, and S.Albert Alexander, Power Converters for Electric Vehicles. CRC Press, 2020..
3. Francois Beguin and Elzbieta Frackowiak ,"Super capacitors", Wiley, 2013.
4. Tom Denton, "Advance Automotive Fault Diagnosis Automotive Vehicle Maintenance and Repair", 4th Edition, Routledge Taylor & Francis Group, New York, 2017.


| 17EEX35-BATTERY PACK MODELING AND CHARGING OF ELECTRIC VEHICLE | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand the different types of energy storage system. | **1.1** | The Students will be able to discuss about the different types of energy storage system. | | a,b,c,d,e,f,l |
| **2.0** | To study about the battery characteristic & parameters. | **2.1** | The Students will be able to describe about the battery characteristic & parameters | | a,b,c,d,e,f,l,l |
| **3.0** | To model the types of batteries | **3.1** | The Students will be able to model different types of batteries | | a,b,c,d,e,l |
| **4.0** | To know the concepts of battery management system and design the battery pack | **4.1** | The Students will be able to apply the concepts of battery management system and design the battery pack | | a,b,c,d,e,l |
| **5.0** | To enrich knowledge on various battery charging methods | **5.1** | The Students will be able to explain charging methods and its specifications | | a,b,c,d,e,f,l |

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| **UNIT I - ENERGY STORAGE SYSTEM** | **(9)** |
| Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery, Ultra capacitors,Flywheel Energy Storage System, Hydraulic Energy Storage System, Comparison of different Energy Storage System. | |
| **UNIT II- BATTERY CHARACTERISTICS & PARAMETERS** | **(9)** |
| Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics, Efficiency of batteries, Electrical parameters- Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries Meeting battery performance criteria- setting new targets for battery performance | |
| **UNIT III - BATTERY MODELLING** | **(9)** |
| General approach to modeling batteries- simulation model of a rechargeable Li-ion battery-simulation model of a rechargeable NiCd battery- Parameterization of the NiCd battery model- Simulation examples. | |
| **UNIT IV-BATTERY PACK AND BATTERY MANAGEMENT SYSTEM** | **(9)** |
| Selection of battery for EVs & HEVs- Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods-Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests. | |
| **UNIT V -EV CHARGERS** | **(9)** |
| Electric Vehicle Technology and Charging Equipment's- Basic charging -Block Diagram of Charger-Difference between Slow charger and fast charger-AC charging and DC charging- Inboard and off board charger specification | |
| **TOTAL (L=45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle Battery Systems", John Wiley& Sons Ltd., 2016.
2. Chris Mi, Abul Masrur& David Wenzhong Gao, "Hybrid electric Vehicle- Principles & Applications with Practical Properties", Wiley, 2011
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric Hybrid Electric and Fuel Cell Vehicles", Taylor& Francis Group, 2010.


**REFERENCES:**


1. G. Pistoia, J.P. Wiaux, S.P. Wolsky, "Used Battery Collection and Recycling", Elsevier, 2001. (ISBN: 0-444-50562-8)
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003

| 17EEX36-EV DESIGN AND DEVELOPMENT | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To learn about the basic concepts of electric vehicles. | **1.1** | The students should be able toDescribe about working principle of electric vehicles. | a,b,c,d,e,g,l | |
| **2.0** | To learn about the motors & drives for electric vehicles. | **2.1** | The students should be able to know the construction and working principle of various motors used in electric vehicles. | a,b,c,d,e,l | |
| **3.0** | To acquire knowledge on the battery characteristic & parameters | **3.1** | The students should be able to Describe about the battery characteristic & parameters. | a,b,c,d,e,l | |
| **4.0** | To impart in-depth analysis of electronics and sensors in electric vehicles. | **4.1** | The students should be able to Understand about working principle of electronics and sensor less control in electric vehicles | a,b,c,d,e,l | |
| **5.0** | To understand the concept of hybrid vehicles. | **5.1** | The students should be able to Describe the different types and working principle of hybrid vehicles | a,b,c,d,e,g,l | |

| **UNIT I - INTRODUCTION TO ELECTRIC VEHICLES** | **(9)** |
|---|---|
| Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life, Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar. | |
| **UNIT II -ELECTRIC VEHICLE MOTORS** | **(9)** |
| Motors (DC, BLDC,PMSM) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – SeriesHEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS),Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design. | |
| **UNIT III - BATTERY CHARACTERISTICS & PARAMETERS** | **(9)** |
| Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics, Efficiency of batteries, Electrical parameters- Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries Meeting battery performance criteria- setting new targets for battery performance. | |
| **UNIT IV - ELECTRONICS AND SENSOR-LESS CONTROL IN EV** | **(9)** |
| Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, self-drive Cars, Hacking; Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based. | |
| **UNIT V -HYBRID VEHICLES** | **(9)** |
| Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture- Series , Parallel and Series-Parallel Hybrid, Propulsion systems and components, Regenerative Braking, Economy, Vibration and Noise reduction, Hybrid Electric Vehicles System – Analysis and its types, Controls. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Amir Khajepour, Saber Fallah and AvestaGoodarzi, "Electric and Hybrid Vehicles Technologies, Modelling and Control: A Mechatronic Approach", John Wiley & Sons Ltd,2014.
2. Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.
3. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & SonsLtd, 2003.


**REFERENCES:**


1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
3. Krishnan R, "Permanent Magnet synchronous and Brushless DC Motor Drives", CRC Publishers,2010.
4. Antoni Szumanowski, "Hybrid Electric Power Train Engineering and Technology:Modelling, Control, and Simulation", IGI Global, 2013.

| 17EEX37- HYBRID ELECTRIC VEHICLES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To understand the concept of electric vehicles. | **1.1** | The student will be able to describe about working principle of electric vehicles. | | a,b,c,d,e,f,g,i,k,l |
| **2.0** | To study about the motors & drives for electric vehicles. | **2.1** | The student will be able to explain the construction and working principle of various motors used in electric vehicles. | | a,b,c,d,e,f,g,i,k,l |
| **3.0** | To understand the electronics and sensors in electric vehicles. | **3.1** | The student will be able to Understand about working principle of electronics and sensor less control in electric vehicles. | | a,b,c,d,e,f,g,i,k,l |
| **4.0** | To understand the concept of hybrid vehicles. | **4.1** | The student will be able to Describe the different types and working principle of hybrid vehicles. | | a,b,c,d,e,f,g,i,k,l |
| **5.0** | To study about fuel cell for electric vehicles. | **5.1** | The student will be able to Illustrate the various types and working principle of fuel cells. | | a,b,c,d,e,f,g,i,k,l |

| | |
|---|---|
| **UNIT I - INTRODUCTION TO ELECTRIC VEHICLES** | **(9)** |
| Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar. | |
| **UNIT II - ELECTRIC VEHICLE MOTORS** | **(9)** |
| Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design. | |
| **UNIT III - ELECTRONICS AND SENSORLESS CONTROL IN ELECTRICAL VEHICLE** | |
| Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self drive Cars, Hacking, Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based. | **(9)** |
| **UNIT IV - HYBRID VEHICLES** | |
| Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls. | **(9)** |
| **UNIT V -FUEL CELLS FOR ELECTRIC VEHICLES** | |
| Fuel cell- Introduction, Technologies & Types, Obstacles,Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics -Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle -System, Components, maintenance. | **(9)** |
| | **TOTAL(L:45) = 45 PERIODS** |

**TEXT BOOKS:**


1. Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012.
2. Jack Erjavec and Jeff Arias, “Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cengage Learning Pvt. Ltd., New Delhi, 2007
3. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2009.


**REFERENCES:**


1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.


| 17EEX38-TESTING AND ELECTRIC VEHICLE POLICY | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To impart basic knowledge about classification of vehicles and its schemes | **1.1** | The student will be able to gain knowledge in the field of E-vehicle certification | | a,b,c,g |
| **2.0** | To impart the knowledge on different types of static testing in E-vehicle | **2.1** | The student will be able to explain the concept of static testing of E-vehicle. | | a,b,c,d,g |
| **3.0** | To make the students to understand the different types of dynamic testing in E-vehicle | **3.1** | The student will be able to explain the concept of dynamic testing of E-vehicle. | | a,b,c,g |
| **4.0** | To make the students to understand the E-vehicle component testing | **4.1** | The student will be able to know about various E-vehicle component testing. | | a,b,c,g |
| **5.0** | To gain the knowledge about the policies imposed by government on E-vehicles | **5.1** | The student will be able to know various E-vehicle policies offered by Government of India | | a,b,c,d,g |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Specification & Classification of Vehicles (including M, N and O layout) -Homologation & its types-Regulations overview (EEC, ECE, FMVSS, AIS, CMVR)-Type approval Scheme-Homologation for export, Conformity of Production, various Parameters, Instruments and Types of test tracks-Hardware in The Loop (HIL) concepts for EV/HEVs | |
| **UNIT II - STATIC TESTING OF VEHICLE** | **(9)** |
| Photographs-CMVR physical verification-Tyre Tread Depth Test- Vehicle Weightment- Horn installation- Rear view mirror installation-Tell Tales-External Projection-Wheel Guard-Arrangement of Foot Controls for M1 Vehicle- Angle & Dimensions Measurement of Vehicle-The requirement of temporary cabin for drive- Chassis, electric vehicle -Safety norms, Energy consumption and power test. | |
| **UNIT III - DYNAMICS TESTING OF VEHICLE** | **(9)** |
| Hood Latch- Gradeability- Pass-by Noise- Interior Noise- Turning Circle Diameter & Turning Clearance Circle Diameter-Steering Effort-Constant Speed Fuel Consumption-Cooling Performance-Speedo-meter Calibration-Range Test- Maximum Speed- Acceleration Test-Coast-down test-Brakes Performance ABS Test, Broad band -Narrow band EMI Test-Electric vehicle - Range Test. | |
| **UNIT IV - VEHICLE COMPONENT TESTING** | **(9)** |
| Horn Testing- Safety Glasses Test: Windscreen laminated and toughened safety glass- Rear View Mirror Test- Hydraulic Brakes Hoses-Fuel Tank Test: Metallic & Plastic-Hinges and Latches Test-Tyre & Wheel Rim Test- Bumper Impact Test-Side Door Intrusion- Crash test with dummies- Demist test- Defrost Test-Interior Fittings-Steering Impact test (GVW<1500 kg)-Body block test- Head form test- Driver Field of vision- Safety belt assemblies-Safety belt anchorages-Seat anchorages & head restraints test- Airbag Test-Accelerator Control System-Motor power-Safety Requirements of Traction Batteries, EMI-EMC (CI, BCI, RE,RI and CTE). | |
| **UNIT V -E-VEHICLE POLICIES** | **(9)** |
| FAME II- PLI SCHEME- Battery Swapping Policy- Special Electric Mobility Zone- Tax Reduction on EVs. | |
| **TOTAL(L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
|---|
| 1. Michael Plint & Anthony Martyr, "Engine Testing & Practice", Butterworth Heinmenn, 3rd ed, 2007<br>2. Bosch Automotive Handbook, Robert Bosch, 7th Edition, 2007. |
| **REFERENCES:** |
| 1. Vehicle Inspection Handbook", American Association of Motor Vehicle Administrators.Proceedings- Automotive Testing & Certification held on 20th to 24th July 2010 |

| 17EEX39-EV INTELLIGENT SYSTEM | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To design and drive the mathematical model of a BLDC motor and its characteristics | **1.1** | Students will be able to design the mathematical model of a BLDC motor and to discuss about its characteristics | | a,b,c,d,h,j,l |
| **2.0** | To learn the different control schemes for BLDC motor | **2.1** | Students will be able to demonstrate the PID control, ant windup controller, Intelligent Controller and Vector Control. Control applied to BLDC motor. | | a,b,c,d,h,j,l |
| **3.0** | To study the basics of fuzzy logic controller | **3.1** | Students will be able to illustrate the basics of fuzzy logic system | | a,b,c,d,j,l |
| **4.0** | To study the FPGA & VHDL basics | **4.1** | Students will be able to describe the basics of VHDL & FPGA applied to control of EVs. | | a,b,c,d,j,l |
| **5.0** | To implement fuzzy logic control of BLDC motor in real time | **5.1** | Students will be able to design and implement of fuzzy logic control scheme for BLDC motor using FPGA in real time. | | a,b,c,d,e,h,j,l |

| | |
|---|---|
| **UNIT I - MATHEMATICAL MODEL AND CHARACTERISTICS ANALYSIS OF BLDC MOTOR** | **(9)** |
| Structure and Drive Modes - Basic Structure-General Design Method-Drive Modes. Mathematical Model-Differential Equations-Transfer Functions-State-Space Equations. Characteristics Analysis-Starting Characteristics-Steady-State Operation- Dynamic Characteristics- Load Matching Commutation Transients. | |
| **UNIT II - SPEED CONTROL FOR ELECTRIC DRIVES** | **(9)** |
| Introduction -PID Control Principle- Anti windup Controller-Intelligent Controller- Vector Control-Control applied to BLDC motor | |
| **UNIT III - FUZZY LOGIC CONTROLLER** | **(9)** |
| Membership functions: features, fuzzification, methods of membership value assignments, Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables- fuzzy propositions, formation of rules decomposition of rules- aggregation of fuzzy rules-fuzzy reasoning-fuzzy inference systems- overview of fuzzy expert system-fuzzy decision making. | |
| **UNIT IV - FPGA AND VHDL BASICS** | **(9)** |
| Introduction – FPGA Architecture-Advantages-Review of FPGA family processors- Spartan 3, Spartan 6 and Spartan 7. VHDL Basics- Fundamentals-Instruction set-data type-conditional statements- programs like arithmetic, sorting, PWM generation, Speed detection. | |
| **UNIT V -REAL TIME IMPLEMENTATION** | **(9)** |
| Inverter design- identifying rotor position via hall effect sensors-open loop and fuzzy logic control of 48 V BLDC motor using FPGA. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Electric Powertrain Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, John G. Hayes, G. Abas Goodarzi, Wiley 1st Edition 2018.
2. VHDL Primer, A (3rd Edition), Jayaram Bhasker, Prentice Hall, 1st Edition 2015.
3. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Third Edition" CRC Press, Taylor & Francis Group, 1st Edition,2021


**REFERENCES:**


1. Chang-liang, Permanent Magnet Brushless DC Motor Drives and Controls, Xia Wiley,1 st Edition,2012
2. M.N. Cirstea, A. Dinu, J.G. Khor,M. McCormick, Neural and Fuzzy Logic Control of Drives and Power Systems, Newnes publications, 1 st Edition, 2002.
3. Wei Liu, Hybrid Electric Vehicle System Modeling and Control, , 2nd Edition, Wiley 2017
4. Electric and Plug-in Hybrid Vehicle Networks Optimization and Control, Emanuele Crisostomi, Robert Shorten, Sonja Stüdli, Fabian Wirth, CRC Press, 1 st Edition. 2018.

| 17EEX40-ELECTRICAL VEHICLES IN SMART GRID | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To know the impact of charging strategies and smart charging technologies | **1.1** | The students will be able to describe vehicle electrification and impact of charging strategies. | | a,b,c,d,e,f,g,h,i,j,k,l |
| **2.0** | To acquire knowledge on the influence of EV's on power system | **2.1** | The students will be able to interpret influence of EVs on power system | | a,b,c,d,e,f,g,h,l |
| **3.0** | To gain knowledge on frequency control reserves & voltage support from EV's | **3.1** | The students will be able explain frequency control reserves & voltage support from EV's | | a,b,c,d,e,f,g,h,l |
| **4.0** | To learn about smart grid and ICT solutions to support EV deployment | **4.1** | The students will be able to illustrate smart grid architecture and ICT solutions to support EV deployment | | a,b,c,d,e,f,g,h,i,j,k,l |
| **5.0** | To understand the centralized charging, decentralized charging schemes and energy storage integration into microgrid | **5.1** | The students will be able to demonstrate centralized charging, decentralized charging schemes and energy storage integration into microgrid | | a,b,c,d,e,f,g,h,i,j,k |

| | |
|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Introduction- Impact of charging strategies-EV charging options and infrastructure-Energy- Economic and environmental considerations-Impact of EV charging on power grid- effect of EV charging on generation and load profile-Smart charging technologies- Impact on investment. | |
| **UNIT II - INFLUENCE OF ELECTRIC VEHICLES ON POWER SYSTEM** | **(9)** |
| Introduction- identification of EV demand- EV penetration level for different scenarios- Classification based on penetration level-EV impacts on system demand: dumb charging, multiple tariff charging, smart charging-case study | |
| **UNIT III - FREQUENCY CONTROL RESERVES** | **(9)** |
| Introduction-power system ancillary services-Electric vehicles to support wind power integration-Electric vehicle as frequency control reserves and tertiary reserves- Voltage support and electric vehicle integration-properties of frequency regulation reserves-Control strategies for EV's to support frequency regulation. | |
| **UNIT IV - ICT SOLUTIONS TO SUPPORT EV DEPLOYMENT** | **(9)** |
| Introduction-Architecture and model for smart grid & EV- ICT players in smart grid-Smart metering, information & communication models- functional and logical models- technology and solution for smart grid: interoperability, communication technologies. | |
| **UNIT V - EV CHARGING FACILITY PLANNING** | **(9)** |
| Energy generation scheduling-Different power sources- Fluctuant electricity-Centralized Charging schemes- Decentralized charging schemes-Energy storage integration into Micro-grid-Design of V2G Aggregator. | |
| **TOTAL(L:45) = 45 PERIODS** | |

| TEXT BOOKS: |
| --- |
| 1. Canbing Li, Yijia Cao, YonghongKuang and Bin Zhou, “Influences of Electric Vehicles on Power System and Key Technologies of Vehicle-to-Grid”, Springer-Verlag Berlin Heidelberg, 2016.<br>2. Qiuwei Wu, “Grid Integration of Electric Vehicles in Open Electricity Markets”, John Wiley & Sons, Ltd, 2013. |
| **REFERENCE:** |
| 1. Harald Naunheimer , Bernd Bertsche , Joachim Ryborz , Wolfgang Novak "Automotive Transmission: Fundamentals, Selection, Design and Application", 2nd Edition, Springer, 2011. |

| 17EEX41-DESIGN OF MOTOR AND POWER CONVERTERS FOR ELECTRIC VEHICLES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To review the drive cycles and requirements of EVs | **1.1** | The Students will be able to analysis the Dynamics of Electric Vehicles | a,c,h,j,l | |
| **2.0** | To know the working of motors used in Electric Vehicle | **2.1** | The Students will be able to use appropriate electric machine for electric vehicle application | a,b,c,d,e,h,j,l | |
| **3.0** | To analyze and model the buck/boost converter operation and to design the same | **3.1** | The Students will be able to compute transfer function with factors such as constant, integral, differential, first order factor and second order factor (both numerators & denominators) | a,b,c,d,e,h,j,l | |
| **4.0** | To learn the simulation basics of control systems | **4.1** | The Students will be able to design buck, boost and buck-boost converter. | a,b,c,d,e,h,j,l | |
| **5.0** | To derive transfer functions for DC-DC converters | **5.1** | The Students will be able to compute a power stage transfer functions for DC-DC converters | a,b,c,d,e,h,j,l | |

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|---|---|
| **UNIT I - ELECTRIC VEHICLE DYNAMICS** | **(9)** |
| Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed-Torque-Power-Energy requirements of EVs | |
| **UNIT II – ADVANCED MOTORS FOR ELECTRIC VEHICLES** | **(9)** |
| Introduction – Speed and Torque control of above and below rated speed - Speed control of EV in the constant power region of electric motors. Switched Reluctance Motors (SRMs). Synchronous Reluctance Machines-Choice of electric machines for EVs | |
| **UNIT III - CONTROL SYSTEMS SIMULATION** | **(9)** |
| Transfer Function- Poles & zeros- bode plot -Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions- state space modelling-Transfer function from state space Model | |
| **UNIT IV - MODELING OF DC-DC CONVERTERS** | **(9)** |
| Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling – Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter | |
| **UNIT V -POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS** | **(9)** |
| Power Stage Transfer Functions of buck-boost Converter in CCM Operation- Input-to-Output Transfer Function-Duty Ratio-to-Output Transfer Function- Load Current-to-Output Transfer Function. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Power Electronic Converters, Teuvo Suntio, Tuomas Messo, Joonas Puukko, First Edition 2017.
2. Fundamentals of Power Electronics with MATLAB, Randall Shaffer, 2nd Edition,Lakshmi publications,2013
3. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 1st Edition,2005
4. Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control, Md. Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, CRC Press 1st Edition,2021

**REFERENCES:**


1. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Third Edition 2021.
2. Feedback Control problems using MATLAB and the Control system tool box, Dean Frederick and Joe Cho, 1st Edition, Cengage learning,2000.
3. Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK, Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, Wiley,1st Edition,2021


| 17EEM01-ELECTRIC CIRCUITS | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 2 | 1 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To impart basic knowledge about electric circuits and networks to the students | **1.1** | The student will be able to name the various circuit elements, explain the behavior of circuit elements and circuits and analyze the circuits using KVL, KCL, Mesh analysis and Nodal analysis techniques. | a,b,c,d,e,f,g,h,k.l | |
| **2.0** | To develop in students the ability to analyze various types of DC circuits using network theorems. | **2.1** | The student will be able to state the various network theorems, explain it and use it for solving the problems of electric circuits and networks | a,b,c,e,f,g,h,k.l | |
| **3.0** | To make the student s to understand circuit laws, waveform and network theorems in AC circuits | **3.1** | The student will be able to describe fundamental concepts used in single phase AC circuits, explain these concepts and solve problems pertaining to these circuits. | a,b,c,d,e,g,h,k.l | |
| **4.0** | To get an insight into analysis of resonance and coupled circuits | **4.1** | The student will be able to design resonance and coupled circuits | a,b,c,d,f,g,h,k,l | |
| **5.0** | To gain the knowledge about the three phase circuits | **5.1** | The student will be able to examine the 3-phase circuits for impedance, voltage, current, power, phase shift and power factor. | a,b,c,d,e,f,g,h,k,l | |

| | |
|---|---|
| **UNIT I - DC CIRCUITS** | **(6+3)** |
| Circuit Elements –Current and Voltage sources- Ohm's and Kirchhoff's laws – Resistive circuits- Series and parallel reduction –Current division rule and Voltage division rule - Mesh analysis for D.C circuits | |
| **UNIT II -NETWORK REDUCTION AND NETWORK THEOREMS FOR DC CIRCUITS** | **(6+3)** |
| **Network reduction**: Source transformation, Star delta transformation.<br>**Network theorems**: Superposition theorem, Thevenin's theorem. | |
| **UNIT III - AC CIRCUITS** | **(6+3)** |
| Introduction to alternating quantities - Average and RMS values, Peak and Form Factors – Power and power factor of simple series RL circuits | |
| **UNIT IV - RESONANCE AND COUPLED CIRCUITS** | **(6+3)** |
| **Resonance circuits:** Resonant Frequency, Current and Voltage Variations, Bandwidth, Q factor for Series and Parallel Resonance Circuits. Coupled Circuits: Self and mutual inductance, Co-efficient of coupling. | |
| **UNIT V -THREE PHASE CIRCUITS** | **(6+3)** |
| Star and Delta systems – Line and Phase Quantities - Three Phase Power - Balanced and Unbalanced Circuit – Three wire and Four wire systems. | |
| **TOTAL (L:30+T:15) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Jr., William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M. “Engineering Circuits Analysis” ,9th edition., Tata McGraw Hill publishers, New Delhi, 2020.
2. Sudhakar A and Shyam Mohan S Pall, “Circuits and Network Analysis and Synthesis”, McGraw Hill Education India pvt.ltd New Delhi, 2015.


**REFERENCES:**


1. Van Valkenburg M.E., “Network Analysis”, Pearson Education India, Revised 3 rd Edition, 2019
2. S.R. Paranjothi, "Electric Circuits Analysis”, New Age International Ltd., New Delhi, 4th Edition, 2014
3. Charles K. Alexander and Mathew N.O. Sadiku, “Fundamentals of Electric Circuits", 2nd Edition Tata McGraw Hill publishers, 2013.


| 17EEM02-SOLID STATE DEVICES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To motivate the students to learn about the properties of semiconductor | **1.1** | The students will be able to understand the properties of semi conductor | a,b,c,e,f,g,k.l | |
| **2.0** | To educate about Carrier transport properties | **2.1** | The students will be able to gain adequate knowledge in carrier transport properties | a,b,c,e,f,g,k.l | |
| **3.0** | To learn about unidirectional diode | **3.1** | The students will be able to acquire knowledge of P-N junction diode | a,b,c,e,f,g,k.l | |
| **4.0** | To learn about Bipolar Junction Transistor | **4.1** | The students will be able to familiar with operation of Bipolar Junction Transistor | a,b,c,e,f,g,k.l | |
| **5.0** | To educate about Opto Electronic Devices | **5.1** | The students will be able to get dynamic understanding of Optical Devices | a,b,c,e,f,g,k.l | |

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|---|---|
| **UNIT I - PROPERTIES OF SEMICONDUCTOR** | **(9)** |
| Intrinsic and Extrinsic Semiconductors –Majority and minority carrier concentration-Energy band diagrams for P and N type semiconductors – Allowed and forbidden energy bands – Electron effective mass – Concept of holes in semiconductor. | |
| **UNIT II - CARRIER TRANSPORT PROPERTIES** | **(9)** |
| Carrier drift – Drift current density – Mobility effects on carrier density – Conductivity in semiconductor – Carrier transport by diffusion – Diffusion current density – Total current density – Breakdown phenomena – Avalanche breakdown. | |
| **UNIT III - PN JUNCTION DIODE** | **(9)** |
| Qualitative description of charge flow in p-n junction – Boundary condition – Minority carrier distribution – Ideal p-n junction current – Temperature effects – Applications – The turn on transient and turn off transient. | |
| **UNIT IV - BIPOLAR JUNCTION TRANSISTOR** | **(9)** |
| Introduction to basic principle of operation – The modes of operation – Amplification – Minority carrier distribution in forward active mode – Non-ideal effects – Base with modulation– Breakdown voltage – Voltage in open emitter configuration and open base configuration. | |
| **UNIT V - OPTO ELECTRONIC DEVICES** | **(9)** |
| Optical absorption in a semiconductor-Photon absorption coefficient – Electron hole pair generation – Solar cell – Homo junction and hetero junction - Photo transistor –Laser diode. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Donald A Neamen , Dhrubes Biswas "Semiconductor Physics and Devices" McGraw Hill Education; 4th edition 2017.
2. Albert Malvino , David J. Bates "Electronic Principles" McGraw Hill Education; 7th edition 2017


**REFERENCES:**


1. M.S. Tyagi, Introduction to Semiconductor materials and devices, John Wiley and sons,2008
2. S.M. Sze & K.Ng. Kwok, Physics of semiconductor devices, John Wiley and sons, Third edition 2008

| 17EEM03-POWER SEMICONDUCTOR DEVICES | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To acquire the knowledge on various power semiconductor switches | **1.1** | The students will be able to know about the construction, physics of operation, safe operating areas and protection circuits for various semiconductor devices | a,b,h | |
| **2.0** | To gain the knowledge on structure and switching characteristics of power diode and BJT | **2.1** | The students will be able to know about the Construction, static characteristics, and switching characteristics of power diode and power BJT | a,b,d,e,f | |
| **3.0** | To acquire the knowledge on basic operation and characteristics of thyristor and GTO | **3.1** | The students will be able to know about the Construction, static characteristics, and switching characteristics of SCRS and GTOs | a,b,d,e,f | |
| **4.0** | To understand the operation of IGBT and Power JFET and MOSFET | **4.1** | The students will be able to know about the Construction, static characteristics, and switching characteristics of IGBT and power FETS | a,b,d,e,f | |
| **5.0** | To acquire the knowledge on application of various converters. | **5.1** | The students will be able to get the idea of how to use these devices for various converters | a,b,d,e,f,h,i | |

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|---|---|
| **UNIT I-POWER SEMICONDUCTOR SWITCHES** | **(9)** |
| Introduction – Diodes-Thyristors- BJTs-JFETs-MOSFETs- GTOs IGBTs- Comparison of these as switching devices. | |
| **UNIT II - POWER DIODE AND POWER BJT** | **(9)** |
| Basic structure and I-V & Switching characteristics of Power diode- Structure and Switching characteristics of Power BJT - Safe operating area –Snubber design for Power diode. | |
| **UNIT III - THYRISTORS AND GTOs** | **(9)** |
| Basic structures - I-V characteristics -Switching characteristics of Thyristors and GTOs– Derive circuits - Snubber circuits for Thyristors and GTOs - Over current protection of GTO. | |
| **UNIT IV - IGBT AND POWER JFET & MOSFETS** | **(9)** |
| Basic structures - I-V characteristics- Switching characteristics – Safe operating area of IGBT and Power JFET & MOSFET - Derive circuits and Protection. | |
| **UNIT V - APPLICATIONS** | **(9)** |
| Single phase converters ,Three phase converters using Diodes and Thyristors-Inverters using GTOs. | |
| **TOTAL (L:45) = 45 PERIODS** | |

| **TEXT BOOK:** |
| --- |
| 1. Rashid M.H., “Power Electronics Circuits, Devices and Applications ", Pearson, fourth edition, 2021. |
| **REFERENCES:** |
| 1. MD Singh and K.B Khanchandani, “Power Electronics”, Tata McGraw Hill, 2010.<br>2. Mohan, Undcland and Robins, “Power Electronics – Concepts, applications and Design”, John Wiley and Sons, Singapore, 2000. |

| 17EEM04-ELECTRICAL MEASUREMENTS AND INSTRUMENTS | | | | |
|---|---|---|---|---|
| L | T | P | C |
| 3 | 0 | 0 | 3 |

**PRE REQUISITE : NIL**

| Course Objectives | | Course Outcomes | | Related Program outcomes |
|---|---|---|---|---|
| **1.0** | To educate the fundamental concepts and characteristics of measurement and errors | **1.1** | The students will be able to understand the fundamental art of measurement in engineering | a,b,c,d,e,f,l |
| **2.0** | To assimilate the operating principle of various measuring instruments | **2.1** | The students will be able to apply their knowledge to measure electrical quantities using analog instruments | a,b,c,d,e,l |
| **3.0** | To perceive knowledge on the fundamental working of potentiometer and instrument transformers | **3.1** | The students will be able to analyze and apply various transformers for measurement process | a,b,c,d,e,l |
| **4.0** | To impart the importance of various bridge circuits used with measuring instruments. | **4.1** | The students will be able to measure resistance, inductance and capacitance using various bridge circuits. | a,b,c,l,d,e, |
| **5.0** | To emphasize the need of digital instrumentation principles and display devices | **5.1** | The students will be able to understand the concept of digital instrumentation | a,b,c,d,e,l,l |

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| **UNIT I - MEASUREMENT OF VOLTAGE AND CURRENT** | **(9)** |
| Galvanometers: Ballistic -D'Arsonval galvanometer -Calibration-Application -Principle of operation , Construction and working of moving coil, moving iron meters – Errors and compensation. | |
| **UNIT II - MEASUREMENT OF POWER AND ENERGY** | **(9)** |
| Electrodynamometer type wattmeter-LPF wattmeter-Phantom loading – Induction type KWH meter – Calibration of wattmeter, and energy meter. | |
| **UNIT III – POTENTIOMETERS & INSTRUMENT TRANSFORMERS** | **(9)** |
| DC potentiometer :Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer : Drysdale (polar type) Gall-Tinsley (coordinate) type – Limitations & applications- C.T and V.T construction and operation, characteristics, testing, and error elimination – Applications | |
| **UNIT IV-BRIDGES** | **(9)** |
| Wheatstone bridge-Maxwell Bridge – Wein's bridge – Hey's bridge – Schering bridge – Anderson bridge | |
| **UNIT V -DIGITAL INSTRUMENTS & DISPLAY DEVICES** | **(9)** |
| Digital voltmeters (DVM) - Ramp type DVM- Integrating type- DVM and Successive approximation DVM.- Cathode ray tubes-Light emitting diodes-Liquid crystal displays. | |
| **TOTAL (L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
|---|
| 1. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 29th Edition 2021.<br>2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010 |
| **REFERENCES:** |
| 1. David A. Bell, Electronic Instrumentation and Measurements, Oxford University Press,2013<br>2. Jennings, Richard, and Fabiola De La Cueva. LabVIEW graphical programming, McGraw-Hill Education,2020<br>E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 6th Edition 2017. |

| 17EEM05-BASICS OF ELECTRICAL MACHINES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | | **Related Program outcomes** |
| **1.0** | To know the construction, operation and characteristics of various types of DC Generators | **1.1** | The students will be able to illustrate the construction and principle of operation and characteristics of DC machines | | a,b,c,d,e,l |
| **2.0** | To know the construction, operation and characteristics of various types of DC Motors | **2.1** | The students will be able to illustrate the construction and principle of operation and characteristics of DC motors | | a,b,c,d,e,l |
| **3.0** | To impart knowledge on Construction, principle of operation and performance of single phase induction motors. | **3.1** | The students will be able to gain knowledge about the basic principles and working of Single phase induction motors. | | a,b,c,d,e,l |
| **4.0** | To impart knowledge on construction, principle of operation and performance of induction machines | **4.1** | The students will be able to understand the construction and working principle of Three Phase Induction Motor | | a,b,c,d,e,l |
| **5.0** | To impart knowledge on Special electrical machines | **5.1** | The students will be able to gain knowledge about the basic principles and working of Special electrical Machines. | | a,b,c,d,e,l |

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| **UNIT I - DC GENERATORS** | **(9)** |
| Principle of operation-Constructional details- Emf equation- Methods of excitation- Self and separately excited generators- Characteristics of series, shunt and compound generators- Applications. | |
| **UNIT II - DC MOTORS** | **(9)** |
| Principle of operation- Back emf and torque equation- Characteristics of series, shunt and compound motor-Starter- Starting methods- Applications. | |
| **UNIT III -SINGLE PHASE INDUCTION MOTOR** | **(9)** |
| Single Phase Induction Motor: Constructional details– Double field revolving theory and operation – Equivalent circuit – Starting methods - Capacitor start ,capacitor start and run induction motor,Shaded pole induction motor. | |
| **UNIT III-THREE PHASE INDUCTION MOTOR** | **(9)** |
| Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests. | |
| **UNIT V- SPECIAL MACHINES** | **(9)** |
| Special Machines-:Repulsion motor - Servo motor – Switched Reluctance motor – Universal Motor – BLDC motor. | |
| | **TOTAL (L:45) = 45 PERIODS** |

| TEXT BOOKS: |
|---|
| 1. P. S. Bimbhra, “Electric Machinery”, Khanna Publishers, 2nd Edition, 2021.<br>2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 5th Edition, 2017.<br>3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 6th Edition 2017 |
| **REFERENCES:** |
| 1 . B.R.Gupta, ’Fundamental of Electric Machines’ New age International Publishers, 3rd Edition, Reprint 2015.<br>2. Murugesh Kumar, ‘Electric Machines’, Vikas Publishing House Pvt. Ltd, First edition 2010. |

| 17EEM06-ELECTRIC DRIVES | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To provide knowledge on the process of learning fundamental concept of electrical drive systems and drive motor characteristics. | **1.1** | The students will be able to know the fundamental concept electrical drive, the selection process involved in drives and drive motor characteristics | a,b,c,e,i,k | |
| **2.0** | To know the fundamental of DC motor drives | **2.1** | The students will be able to understand the operation of the converter, chopper fed dc drive and solve simple problems | a,b,c,f,i | |
| **3.0** | To give exposure to understand and analyze the various speed control of induction motor drives. | **3.1** | The students will be able to study and analyze the speed control of induction motor drive | a,b,c,f,i | |
| **4.0** | To acquire knowledge on digital control techniques used for speed control of dives | **4.1** | The students will be able to use recent microcontroller for motor control and PLC based control of drives. | b,c,e,f,i,k,l | |
| **5.0** | To learn about the design of different controllers for drives | **5.1** | The students will be able analyze and design various controllers for drives | a,b,c,e,i | |

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| **UNIT I – INTRODUCTION** | **(9)** |
| Basic elements and types of drives – Factors influencing the choice of electrical drives –Multi quadrant operation-heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors –Drive motor characteristics - Braking of electrical motors | |
| **UNIT II - DC DRIVES** | **(9)** |
| Speed control of DC series and shunt motors - Armature and field control- Ward-Leonard control system – Steady state analysis of the single and three phase converter fed separately excited DC motor drive –4 quadrant operations of converter ,chopper fed drive. | |
| **UNIT III - AC DRIVES** | **(9)** |
| Speed control of three phase induction motor: Stator control: Voltage / frequency control – Constant airgap flux – Field weakening mode –AC voltage Regulator- Voltage / current fed inverter – Rotor control – Rotor resistance control and slip power recovery schemes- Principle of vector control. | |
| **UNIT IV – STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR** | **(9)** |
| Digital techniques in speed control - Advantages and limitations– Microprocessor based control of drives- Microcontroller based control of drives . | |
| **UNIT V - DESIGN OF CONTROLLERS FOR DRIVES** | **(9)** |
| Introduction-Transfer function for DC motor / load and converter – Closed loop control with Current and speed feedback– Armature voltage control and field weakening mode – Design of controllers: Current controller - Speed controller | |
| **TOTAL (L:45) = 45 PERIODS** | |

| TEXT BOOKS: |
| --- |
| 1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2015.<br>2. Bose, B.K., Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2010 . |
| **REFERENCES:** |
| 1. Vedam Subramanyam, Electric Drives: Concepts and Applications II, Tata McGraw hill Pvt. Ltd, New Delhi, 2011.<br>2. Krishnan R, Electric Motor Drives: Modeling, Analysis and Control II, Prentice Hall of India, Pvt. Ltd, New Delhi,2010<br>3. S.K.Pillai, "A First Course on Electrical Drives", II Edition, New Age International Publishers, 2010. |

| 17EEM07-POWER SYSTEMS | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
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| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To know the structure of electric power system and classifications of power generation. | **1.1** | The students will be able to understand the concepts of various power generation systems. | a,b,c,d,e,f,g,h,i,j,k,l | |
| **2.0** | To give exposure to transmission line insulators and grounding concepts. | **2.1** | The students will be able to design modern substation layout with grounding techniques | a,b,c,d,e,f,g,h,i,j,k,l | |
| **3.0** | To learn about overvoltages in power system | **3.1** | The students will be able to impart knowledge of over voltage phenomenon in electrical power systems | a,b,c,d,e,f,g,h,i,j,k,l | |
| **4.0** | To edify basic things about reactive power control techniques. | **4.1** | The students will be able to acquire knowledge about reactive power control techniques. | a,b,c,d,e,f,g,h,i,j,k,l | |
| **5.0** | To study various methods of power quality monitoring. | **5.1** | The students will be able to impart knowledge on various methods of power quality monitoring. | a,b,c,d,e,f,g,h,i,j,k,l | |

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| **UNIT I – INTRODUCTION TO POWER SYSTEMS** | **(9)** |
| Structure of power system-Classification of power generation systems:Thermal, hydel, nuclear, wind and solar Power plant. | |
| **UNIT II – DISTRIBUTION SYSTEM** | **(9)** |
| Insulators – Cables: types of underground cables and its construction - Key diagram of 11 kV/415 V substation- Methods of Grounding | |
| **UNIT III – OVERVOLTAGES IN POWER SYSTEM** | **(9)** |
| Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages– Protection against over voltages | |
| **UNIT IV – REACTIVE POWER CONTROL** | **(9)** |
| Reactive power control in electrical power transmission lines -Uncompensated transmission line - Series compensation – Basic concepts of Static VAR Compensator (SVC) – Thyristor Controlled Series Capacitor (TCSC) – Unified Power Flow Controller (UPFC). | |
| **UNIT V – POWER QUALITY MONITORING** | **(9)** |
| Power line disturbance analyzer - Power quality measurement equipment - Harmonic / spectrum analyzer - Disturbance analyzer | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. D. P. Kothari, I. J. Nagrath, Power System Engineering, 3rd edition, McGraw Hill Education,2019
2. CL Wadhwa, Electrical Power Systems,7th Edition, New Age publication,2017
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.
4. S.Naidu and V. Kamaraju, ―High Voltage Engineering‖, Tata McGraw Hill, 5 th ed.,2013.
5. Narain G. Hingorani, ―Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems‖, Standard Publishers Distributors, 2011.


**REFERENCES:**


1. Arun Ingole, "power transmission and distribution" Pearson Education, 2017.
2. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.
3. V.K.Mehta, Rohit Mehta, 'Principles of power system', S.Chand & Company Ltd, New Delhi, 2013.
4. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, ―Electrical Power Systems Quality‖ McGraw Hill,2012

| 17EEM08-RENEWABLE ENERGY SYSTEM | | | | | |
|---|---|---|---|---|---|
| | | | L | T | P | C |
| | | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcomes** | |
| **1.0** | To understand the importance of solar energy and its applications | **1.1** | Students will be able to understand the working and applications of solar energy systems | a,b,c,e,g | |
| **2.0** | To acquire the knowledge principle of operation of wind energy and its applications | **2.1** | Students will be able to explain the working and applications of wind energy systems | a,b,c,e,g | |
| **3.0** | To gain the knowledge on principle of operation of Bioenergy,ocean energy and chemical energy sources | **3.1** | Students will be able to express the principle of the bio-energy production techniques and operation of geothermal energy and ocean energy sources | a,b,c,g | |
| **4.0** | To acquire the knowledge on chemical energy sources and additional energy sources. | **4.1** | Students will be able to explain the operation of additional alternate energy sources | a,b,c,e,g | |
| **5.0** | To gain knowledge on energy conservation technologies. | **5.1** | Students will be able to describe the principle of energy conservation and its technologies | a,b,c,g | |

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| **UNIT I - SOLAR ENERGY** | **(9)** |
| Solar radiation at the earth‟s surface – Solar radiation measurements – Solar energy collectors: flat plate and concentrating collectors. Solar electric power generation: Solar Photo Voltaics – Applications of solar energy: solar pumping and solar cooking. | |
| **UNIT II -WIND ENERGY** | **(9)** |
| Basic components of a wind energy conversion system – Classification. Wing Energy Collectors: horizontal axis and vertical axis machines – Performance of wind machines – Generating system – Energy storage – Applications of wind Energy – Interconnected systems – Safety systems – Environmental aspects | |
| **UNIT III- BIO ENERGY,OCEAN ENERGY AND GEOTHERMAL ENERGY** | **(9)** |
| **Bioenergy:** Biomass conversion technologies – Biogas generation – Classification of biogas plants – Ethanol production. **Geothermal Energy:** Geothermal sources – Prime movers for geothermal energy conversion. **Ocean Energy:** Basic principle of tidal power – Components – Operation methods, Ocean waves **–** Energy and power from waves – wind energy conversion devices. | |
| **UNIT IV- ADDITIONAL ALTERNATE ENERGY SOURCES AND CHEMICAL ENERGY SOURCES** | **(9)** |
| MHD power generation – Thermoelectric power generation. Chemical energy sources: Hydrogen production – Storage – Transportation and utilization – Hydrogen as an alternative fuel for motor vehicles – Fuel cell – Principle – Types. | |
| **UNIT V- ENERGY CONSERVATION** | **(9)** |
| Principles of energy conservation – Energy conservation approach/ technologies – Co-generation – Waste heat utilization – Combined cycle power generation – Heat regenerators – Heat pipes – Heat pumps. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOK:**

1. Rai G.D., "Non-Conventional Energy Sources", 6th Edition, Khanna Publishers, New Delhi, 2017.

**REFERENCES:**


1 Kothari D.P, Singal K.C & Rakesh Ranjan. "Renewable Energy Sources and Emerging Technologies", 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.

2 John Twidell & Tony Weir. "Renewable Energy Resources", 3rd Edition, Routledge, New York, 2015.

| 17ITX37 PROBLEM SOLVING USING JAVA | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **PRE REQUISITE : NIL** | | | | | |
| **COURSE OBJECTIVES AND OUTCOMES:** | | | | | |
| **Course Objectives** | | **Course Outcomes** | | **Related Program outcome** | |
| **1.0** | To understand the basics of Java Programming Language | **1.1** | The Students will be able to solve simple problems using Java. | **a,b,c,d,e, h,j,k,l** | |
| **2.0** | To understand fundamentals of programming such as conditional and iterative execution | **2.1** | The students will be able to write programs using branching and looping statements | **a,b,c,d,e, h,i,j,k,l** | |
| **3.0** | To understand the concepts of Java arrays and Strings. | **3.1** | The students will be able to Be able to develop confidently with Strings and implement arrays. | **a,b,c,d,e, h,i,j,k,l** | |
| **4.0** | To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods. | **4.1** | The students will be able to understand basic oops concepts and develop applications using inheritance and interfaces. | **a,b,c,d,e, h,i,j,k,l** | |
| **5.0** | To understand threads and collection concepts | **5.1** | The students will be able to build applications using threads and collection framework. | **a,b,c,d,e, h,i,j,k,l** | |

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| **UNIT I - INTRODUCTION TO JAVA** | (9) |
| History of java-Features-Glimpse of java-Data types and Variables-Local variable-Instance variable-static variable-Keywords: this, super, final- Type conversion & casting- Importance of Scanner class-Getting started with Eclipse IDE and VSCode. | |
| **UNIT II-OPERATORS AND DECISION MAKING STATEMENTS** | (9) |
| Operators- Arithmetic Operator, Bitwise Operator, Conditional Operator, Unary Operator-Relational and Logical operators-Conditional statements: If else, If else if, Nested if -Looping Statements: For Loop, while Loop, do while loop-switch-break-continue- auto boxing and unboxing**.** | |
| **UNIT III-ARRAYS AND STRINGS** | (9) |
| Arrays: One Dimensional Array-Two Dimensional Array-Inbuilt functions in arrays. Strings-String array-Inbuilt functions in Strings-String Buffer class-String Builder class-String Tokenizer class | |
| **UNIT IV-OBJECT-ORIENTED PROGRAMMING PARADIGM** | (9) |
| Class-objects-Encapsulation-Inheritance and its types-Polymorphism: Static binding and dynamic binding-Methods –Constructors and its types-Abstract class-Interface. | |
| **UNIT V- MULTITHREADING AND COLLECTIONS** | (9) |
| Throwable classes-Exception types-Exception keywords-Collection classes: List, Set-Thread-Ways of thread creation-methods-thread priorities-Synchronization-multithreading-Lambda Expression. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOK:**

1. Herbert Schildt, “Java:The Complete Reference”,McGraw Hill Education, Twelfth edition,2021.

**REFERENCE:**

1. Cay.S.Horstmann,GaryCornell, “Core Java-JAVA Fundamentals”, Prentice Hall,Eleventh edition, 2020.