KARPAGAM
COLLEGE OF ENGINEERING
Rediscover | Refine | Redefine

(Autonomous/ Affiliated to Anna University, Chennai)
COIMBATORE-641 032

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**Semester III**

**Academic Year: 2015-2016**

**Regulations 2014**

# COURSE PLAN

**Vision**

To provide students with sound knowledge of Electrical and Electronics Engineering, that they become capable of facing the current and impending challenges to extend their expertise in the global arena.

**Mission**

**Mission of our department is to**

- Impart high quality education and training to the students in the field of Electrical and Electronics Engineering
- Transforming our students into enterprising technologists by giving them excellent facilities by qualified, committed members of faculty
- Motivating them to contribute immensely for the benefit of the entire humanity

**Programme Educational Objectives (PEOs)**

- **PEO1:** Graduates will be able to synthesize mathematics, science, engineering fundamentals, laboratory and work-based experiences to formulate and solve problems in Electrical and Electronics engineering and the related domains and will develop proficiency in Computer-based engineering and the use of computational tools.
- **PEO2:** Graduates will be prepared to communicate and work team-based on the multidisciplinary engineering projects in the allied fields of Electrical Science and will practice the ethics of their profession.
- **PEO3:** Graduates will realize the importance of self learning and engage in lifelong learning to become experts either as an entrepreneur or an employee so as to broaden their knowledge in the domain.

**Programme Outcomes (POs)**

At the end of the programme the students will have

a. Ability to apply knowledge of mathematics, science and engineering Principles to solve the problems in electrical and electronics engineering.

b. Ability to understand the design and conduct experiments, as well as to analyze and interpret data in electrical engineering.

c. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

d. Ability to design a system, component or process to meet the desired goals of electrical considering social environmental ethical and social aspects.

e. Ability to function on multidisciplinary teams.

f. Ability to identify, formulate and solve engineering problems in the field of electrical sciences.

g. Understanding of professional and ethical responsibility.

h. Ability to communicate effectively.

i. Ability to understand the impact of electrical science and engineering solutions.

j. Ability to realize the importance and understand the need for lifelong learning to become experts in the relevant field.

k. Knowledge of contemporary issues.

l. Ability to manage the projects in the relevant areas of electrical sciences and enhance research through engineering and management principles.

**Mapping of POs to PEOs**

| **POs** | **PEOs** | | |
|---|---|---|---|
| | **1** | **2** | **3** |
| a) Ability to apply knowledge of mathematics, science and engineering Principles to solve the problems in electrical and electronics engineering. | ✔ | | |
| b) Ability to understand the design and conduct experiments, as well as to analyze and interpret data in electrical engineering. | | ✔ | |
| c) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. | | | ✔ |
| d) Ability to design a system, component or process to meet the desired goals of electrical considering social environmental ethical and social aspects. | ✔ | ✔ | |
| e) Ability to function on multidisciplinary teams. | | | ✔ |
| f) ability to identify, formulate and solve engineering problems in the field of electrical sciences | | ✔ | |
| g) Understanding of professional and ethical responsibility. | ✔ | | |
| h) Ability to communicate effectively. | | ✔ | |
| i) Ability to understand the impact of electrical science and engineering solutions. | | ✔ | |
| j) Ability to realize the importance and understand the need for lifelong learning to become experts in the relevant field | ✔ | ✔ | |
| k) Knowledge of contemporary issues. | | | ✔ |
| l) Ability to manage the projects in the relevant areas of electrical sciences and enhance research through engineering and management principles. | ✔ | ✔ | |

**Evaluation Components:**

| | Internal (40 Marks) | | External (60 Marks) |
|---|---|---|---|
| SI.NO | Components | Max. Marks | End Semester Examination will be conducted for a duration of 3 Hours for 100 Marks and this will be converted for 60 Marks |
| 1 | CIA I,II,III(Best of Two will be considered) | 30 | |
| 2 | Assignment / Tutorial / Innovative Work | 10 | |
| | | 40 | 60 |
| Total | | 100 Marks | |

**List of Subjects**

| SI.NO. | Course Code | Course Title |
|---|---|---|
| Theory | | |
| 1 | 14E301 | Transforms and Complex Analysis |
| 2 | 14E302 | Data Structures |
| 3 | 14E303 | Electronic Circuits |
| 4 | 14E304 | Electromagnetic Theory |
| 5 | 14E305 | DC Machines and transformer |
| 6 | 14E306 | Digital Electronics |
| Practical | | |
| 1 | 14E311 | Data Structures Laboratory |
| 2 | 14E312 | Electronic Devices and Circuits Laboratory |
| 3 | 14E313 | DC Machines and Transformers Laboratory |

**COURSE PLAN OF ELECTRO MAGNETIC THEORY**
**(Core)**

1. Class : III - Semester BE(EEE)
2. Course Code & Name : 14E304 – Electro Magnetic Theory
3. Course Type : (Theory)

4. Course Status & Credits: UG Credits: 3

5. Aim/Course Description: To study and understand the concepts of electro-Magneto statics, electrical potential, energy density and their applications.

6. Prerequisites : Fundamental of Electrical Engineering

7. Course Objectives:

a) To understand the vectors, co-ordinate systems and static charges.
b) To impart knowledge on the concepts of electrostatics, energy density and their applications.
c) To get an exposure on conductors, dielectrics and capacitors.
d) To understand the concepts of magneto statics and magnetic flux density.
e) To know the concepts of electromagnetic waves and poynting vector

8. Course Outcomes:

Learners should be able to,

a) recognize the vectors, co-ordinate systems and static charges
b) posses knowledge about the concepts of electrostatics energy density and their applications.
c) acquire knowledge about the conductors, dielectrics and capacitance.
d) get an exposure to the concepts of magneto statics and magnetic flux density.
e) have a good knowledge about electromagnetic waves and Poynting vector

**Relationship of course to program outcomes**

| | | |
|---|---|---|
| a) | Ability to apply knowledge of mathematics, science and engineering Principles to solve the problems in electrical and electronics engineering. | ✔ |
| b) | Ability to understand the design and conduct experiments, as well as to analyze and interpret data in electrical engineering. | |
| c) | Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. | |
| d) | Ability to design a system, component or process to meet the desired goals of electrical considering social environmental ethical and social aspects. | |
| e) | Ability to function on multidisciplinary teams. | |
| f) | ability to identify, formulate and solve engineering problems in the field of electrical sciences | ✔ |
| g) | Understanding of professional and ethical responsibility. | |
| h) | Ability to communicate effectively. | |
| i) | Ability to understand the impact of electrical science and engineering solutions. | ✔ |
| j) | Ability to realize the importance and understand the need for lifelong learning to become experts in the relevant field | ✔ |
| k) | Knowledge of contemporary issues. | |
| l) | Ability to manage the projects in the relevant areas of electrical sciences and enhance research through engineering and management principles. | ✔ |

**Lesson Plan:**

**UNIT-1: VECTOR ANALYSIS**

| Hours | Topics | References | Mode of Delivery | | | |
|---|---|---|---|---|---|---|
| | | Text/ Reference Books | Chalk & Talk | OHP | LCD | Video Lecture |
| 1 | ▪ **Scalars**<br>▪ **Vectors**<br>▪ **Vector algebra** | T1,R1 | ✔ | | | |
| 2 | ▪ **Vector components**<br>▪ **Unit vectors** | T1,R1 | ✔ | | | |
| 3 | ▪ **Vector field**<br>▪ **Scalar field** | T1,R1 | ✔ | | | |
| 4 | Tutorial 1 | T1, T2, R1 | ✔ | | | |
| 5 | ▪ **Dot product**<br>▪ **Cross product** | T1,R1 | ✔ | | | |
| 6 | **Coordinate systems**<br>▪ Cartesian<br>▪ Cylindrical<br>▪ Spherical | T1,R1 | ✔ | | | |
| 7 | Relationship between the Systems<br>▪ Transformation of Vector<br>▪ Cartesian to Cylindrical<br>▪ Cylindrical to Cartesian<br>▪ Cartesian to Spherical | T1,R1 | ✔ | | | |
| 8 | Tutorial 2 | T1, T2, R1 | ✔ | | | |
| 9 | ▪ **Coulomb's Law**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | ✔ |
| 10 | ▪ **Electric field Intensity (E)**<br>▪ **Field of point charge**<br>▪ **Field of Line charge** | T1,R1 | ✔ | | | ✔ |
| 11 | ▪ **Field of surface charge.**<br>▪ **Field due to continuous volume charge distribution** | T1,R1 | ✔ | | | |
| 12 | Tutorial 3 | T2, R3 | ✔ | | | |

**UNIT-2: ELECTROSTATICS**

| Hours | Topics | References | Mode of Delivery | | | |
|---|---|---|---|---|---|---|
| | | Text/ Reference Books | Chalk & Talk | OHP | LCD | Video Lecture |
| 1 | ▪ **Electric flux**<br>▪ **Electric flux density**<br>▪ **Vector operator** | T1,R1 | ✔ | | | ✔ |
| 2 | ▪ **Divergence**<br>▪ **Maxwell's first equation** | T1,R1 | ✔ | | | |
| 3 | ▪ **Divergence theorem**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | |
| 4 | Tutorial 1 | T1, T2, R1 | ✔ | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | ▪ **Gauss's Law**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | ✔ |
| 6 | ▪ **Application of Gauss's Law** | T1,R1 | ✔ | | | |
| 7 | ▪ **Energy expended by moving point charge**<br>▪ **Line integral** | T1,R1 | ✔ | | | |
| 8 | Tutorial 2 | T2, R3 | ✔ | | | |
| 9 | ▪ **Potential difference**<br>▪ **Potential**<br>▪ **Potential field of point charge**<br>▪ **Conservative Property** | T1,R1 | ✔ | | | |
| 10 | ▪ **Potential gradient**<br>▪ **Electric dipole & Dipole Moment** | T1,R1 | ✔ | | | |
| 11 | ▪ **Energy Density in electrostatic field** | T1,R1 | ✔ | | | |
| 12 | Tutorial 3 | T1, T2, R1 | ✔ | | | |

**UNIT-3: CONDUCTORS, DIELECTRICS AND CAPACITORS**

| **Hours** | **Topics** | **References** | **Mode of Delivery** | | | |
|---|---|---|---|---|---|---|
| | | Text/ Reference Books | Chalk & Talk | OHP | LCD | Video Lecture |
| 1 | ▪ **Current**<br>▪ **Current density**<br>▪ **Continuity of current** | T1,R1 | ✔ | | | |
| 2 | ▪ **Conductors**<br>▪ Point Form of Ohm's Law<br>▪ Resistance of a Conductor<br>▪ Properties | T1,R1 | ✔ | | | |
| 3 | ▪ **Dielectric Materials**<br>▪ Polarization<br>▪ Properties | T1,R1 | ✔ | | | |
| 4 | Tutorial 1 | T1, T2, R1 | ✔ | | | |
| 5,6 | ▪ **Boundary Conditions at the interface of**<br>▪ **conductor and dielectric**<br>▪ **two Dielectrics medium** | T1,R1 | ✔ | | | |
| 7 | ▪ **Capacitance**<br>▪ **Capacitance for different charge distribution**<br>▪ Parallel plate capacitor with two dielectric media<br>▪ Parallel plate capacitor with three dielectric media | T1,R1 | ✔ | | | ✔ |
| 8 | Tutorial 2 | T1, T2, R1 | ✔ | | | |
| 9 | **Capacitance for different charge distribution**<br>▪ Parallel infinite wires<br>▪ Circular conductors | T1,R1 | ✔ | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10 | ▪ **Energy stored in Capacitor** | T1,R1 | ✔ | | | |
| 11 | ▪ **Poisson's and Laplace Equations**<br>▪ Statement<br>▪ Proof<br>▪ **Uniqueness Theorem** | T1,R1 | ✔ | | | ✔ |
| 12 | Tutorial 3 | T2, R3 | ✔ | | | |

**UNIT-4: MAGNETO STATICS**

| Hours | Topics | References | Mode of Delivery | | | |
|---|---|---|---|---|---|---|
| | | Text/ Reference Books | Chalk & Talk | OHP | LCD | Video Lecture |
| 1 | ▪ **Biot-Savart's Law**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | |
| 2 | ▪ **Ampere's circuital Law**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | ✔ |
| 3 | ▪ **Curl**<br>▪ **Stokes's Theorem**<br>▪ Statement<br>▪ Proof | T1,R1 | ✔ | | | |
| 4 | Tutorial 1 | T2, R3 | ✔ | | | |
| 5 | ▪ **Magnetic flux**<br>▪ **Magnetic flux density**<br>▪ **Scalar and Vector magnetic potential** | T1,R1 | ✔ | | | ✔ |
| 6 | ▪ **Magnetic Field due to**<br>• Straight conductor<br>▪ Circular loop<br>▪ Infinite sheet of current | T1,R1 | ✔ | | | |
| 7 | ▪ **Forces and Torque on a closed circuit** | T1,R1 | ✔ | | | |
| 8 | Tutorial 2 | T2, R3 | ✔ | | | |
| 9 | ▪ **Boundary Conditions at the interface of two Dielectrics medium** | T1,R1 | ✔ | | | |
| 10 | ▪ **Magnetic circuit**<br>▪ **Self Inductance**<br>▪ **Mutual inductance**<br>▪ **Inductance**<br>▪ Inductance of a solenoid<br>▪ Inductance of a Toroid<br>▪ Inductance of a Co-axial cable | T1,R1 | ✔ | | | |
| 11 | ▪ **Energy stored in Magnetic field** | T1,R1 | ✔ | | | |
| 12 | Tutorial 3 | T2, R3 | ✔ | | | |

**UNIT-5: ELECTRO MAGNETIC WAVES**

| Hours | Topics | References | Mode of Delivery | | | |
|---|---|---|---|---|---|---|
| | | Text/ Reference Books | Chalk & Talk | OHP | LCD | Video Lecture |
| 1 | ▪ **Faraday's Law of Electromagnetic Induction**<br>▪ Statement<br>▪ Proof<br>▪ **Displacement current** | T2, R3 | ✔ | | | |
| 2 | ▪ **Maxwell's equation in point form and integral form** | T2, R3 | ✔ | | | |
| 3 | ▪ **Comparison of electric and magnetic circuits** | T2, R3 | ✔ | | | |
| 4 | Tutorial 1 | T1, R1 | | | | |
| 5,6 | ▪ **Introduction-Wave equations**<br>▪ Wave Parameters<br>▪ Wave Equations in free space<br>▪ Electromagnetic wave in Perfect Dielectric<br>▪ Electromagnetic wave in Lossy Dielectric<br>▪ Electromagnetic Wave in Good conductor | T2, R3 | ✔ | | | ✔ |
| 7 | ▪ **Poynting vector**<br>▪ Average Power Density<br>▪ Integral and Point form | T2, R3 | ✔ | | | ✔ |
| 8 | Tutorial 2 | T1, R1 | ✔ | | | |
| 9 | ▪ **Standing wave ratio**<br>▪ **Wave polarization**<br>▪ **Skin effect** | T2, R3 | ✔ | | | |
| 10 | ▪ **Reflection of uniform plane waves**<br>▪ **normal incidence**<br>▪ **oblique angle incidence** | T2, R3 | ✔ | | | |
| 11 | ▪ **Effects of EMI and EMC** | T2, R3 | ✔ | | | |
| 12 | Tutorial 3 | T1, R1 | ✔ | | | |

9. Topics Beyond Syllabus:
   - Case study on Wave/Signal Propagation.

10. Assignment Topics :
    1. a) Divergence Theorem & its Proof.
       b) Gauss's Law**,** its Proof and applications of Gauss's Law.
       c) Coordinate systems.

2. a). Boundary Conditions
   (i) At the interface of conductor and dielectric
   (ii) At the interface of two Dielectrics
   b) Curl, Stokes's Theorem and its Proof.
   c) Poisson's and Laplace Equations and Solution to Laplace eqn

11. **Text Book :**

| SI.NO | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | William H Hayt<br>John A Buck | Engineering Electromagnetics | Tata McGraw Hill | 2011 |
| 2. | Mathew N C Sadiku | Elements of Electromagnetics | Oxford University Press,Third edition | 2010 |

12. **Reference Books:**

| SI.NO | Author(s) | Title of the Book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1. | John D Kraus | Electromagnetics | McGraw Hill book Co, Fifth Edition | 2010 |
| 2. | Joseph A Edminister | Electromagnetics | Tata McGraw Hill | 2010 |
| 3. | Seth S P | Elements of Electromagnetic Field | Dhanpatrai and co. | 2007 |
| 4. | Ashutosh Pramanik | Electromagnetism – Theory and Applications | Prentice-Hall of India Private Limited, New Delhi | 2006 |

12. Additional Resources for course:

WEB URLs:

1. http://www.mso.anu.edu.au/~geoff/HEA/EM_Theory.pdf
2. http://www.geom.uiuc.edu/docs/reference/CRC–formulas/node42.html
3. http://www.farside.ph.utexas.edu/teaching/em/lectures/node59.html
4. http://freevideolectures.com/course/2340/electromagnetic-fields
5. https://www.nasa.gov/centers/johnson/pdf/639521main_emi-mc_user _test planning_ guide.pdf

13. Professional Components:

| | |
|---|---|
| Engineering Topic | : 65% |
| General Education | : 15% |
| Mathematics | : 20% |

**Faculty In-Charge** **HOD**