Hall Ticket No | | | | | | | | | | |  Question Paper Code: AEEB10

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

**Dundigal, Hyderabad - 500 043**

## MODEL QUESTION PAPER - I

Second Year B.Tech III Semester End Examinations, November – 2019

**Regulations: R18**

## ELECTRO-MAGNETIC FIELD

**(EEE)**

**Time: 3 hours** **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

### UNIT - I

1. a) Formulate the statement which says that force between charges is directly proportional to product of charges and inversely proportional to square of distance between them and explain. [7M]

   b) Four line charges of 30μC each are located four corners of a square, the diagonal of which measures 8m. Find the force on a 150 μC charge located at 3m above the centre of the square. [7M]

2. a) Derive the expression for electric field intensity due to a line charge and Surface Charge. [7M]

   b) Two small identical conducting spheres have charge of 2nc and -0.5nc respectively, when they are placed 4 cm apart, determine the force between them. If they are brought into contact and then separated by 4 cms, calculate force between them. [7M]

### UNIT – II

3. a) A sphere of radius x meters having a charge q coulombs , then by assuming a second conductor of infinite radius and zero potential, imagine the formation of capacitance between them. [7M]

   b) Calculate the capacitance of a parallel plate capacitor with following details. [7M]
   Plate area = 100 $cm^2$
   Dielectric $€_{r1} = 4$ , $d_1 = 2mm$
   Dielectric $€_{r2} = 3$ , d2 = 3mm

   If 200V is applied across plates , determine the voltage gradient and energy stored in each dielectric.

4. a) A spherical capacitor having two concentric spheres of radius a and b meters are separated by a dielectric whose relative permittivity is €r, formulate the capacitance between them. [7M]

b) A parallel plate capacitor consists of two square metal plates with 500mm side and separate by 10mm. A slab of sulphur ($\epsilon_r = 4$) 6mm thick is placed on the lower side of plate and air gap of 4mm. Give the capacitance of the capacitor. [7M]

**UNIT – III**

5. a) Write short notes on: [7M]

   i) Magnetostatic field
   ii) Magnetic flux density.
   iii) Magnetic field intensity
   iv) Magnetic permeability.
   v) Intensity of magnetization
   vi) Magnetic susceptibility.
   vii) Relation between B , H and I

b) A steady current I amperes flows in a conductor bent in the form of square loop of side a. Find the magnetic field at the center of the loop. [7M]

6. a) Using Ampere circuital law to derive the expression for magnetic field intensity Due to long current carrying filament and due to an infinite current sheet. [7M]

b) i) Calculate the magnetic flux density at the center of a current carrying loop when the radius of loop is 2cm, loop current in 1mA and loop is paced in air. [7M]

ii) The magnitude of H at a radius of 1m from a long linear conductor is 1A/m. Find current in the wire.

**UNIT – IV**

7. a) Derive the expression for force on a straight current carrying conductor in a magnetic field and between two straight long and parallel current carrying conductors. [7M]

b) A single phase circuit comprises two parallel conductors A and B 1 cm diameters and special 1m apart. The conductors carry current 100A and -100A respectively. Determine the field intensity at the surface of the each conductor and also in the space exactly midway between A and B. [7M]

8. a) Derive the expression for property of the single coil depending on which emf induces in it for solenoid and toroid. [7M]

b) Two mutually coupled coils are connected in parallel with L1 = 0.2H, L2 = 0.1H and M = 0.1H. , current flowing through circuit is increasing at rate of I A/sec. Derive the expression for effective inductance between coils i) when they in series aiding connection. ii) when they in series opposite connection. [7M]

**UNIT – V**

9. a) State faraday's laws of electro magnetic induction and explain the self , mutual induced emf . [7M]

b) Explain and Give the importance of finite difference method in studying electric and magnetic field. [7M]

10. a) Derive the expression from modified Ampere's law . [7M]
Write the short notes on Faraday's disc generator.

b) Give the importance of charge simulation method in studying electric and magnetic field. [7M]

# INSTITUTE OF AERONAUTICAL ENGINEERING
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## COURSE OBJECTIVES:

**The course should enable the students to:**

| | |
|---|---|
| I | Demonstrate the concept of electrostatic field intensity and electric potential. |
| II | Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in an electric field. |
| III | Understand the concept of field intensity and flux density in magnetic fields. |
| IV | Discuss forces in magnetic fields and laws of electromagnetic induction |
| V | Summarize the concept of time varying field and analyze propagation of electro-magnetic waves. |

## COURSE OUTCOMES (COs):

| | |
|---|---|
| CO 1 | Determine the force and electric field intensity due various types of charge distribution with the help of vector calculus. |
| CO 2 | Estimate the capacitance of various configurations and study behaviour of charges in conductors and dielectrics. |
| CO 3 | Understand Bio-Savart's law and determine magnetic field intensity due different configuration of conductors, their other deductions. |
| CO 4 | Calculate the magnetic force acting on body due to different configurations of conductors and deduce the magnetic potentials. |
| CO 5 | State Faraday's laws of electromagnetic induction in time varying fields and analyze wave propagation in electro-magnetic fields. |

## COURSE LEARNING OUTCOMES:

**Students, who complete the course, will have demonstrated the ability to do the following:**

| S. No | Description |
|---|---|
| AEEB10.01 | Analyze the force and electric field intensity in the electrostatic field. |
| AEEB10.02 | Identify the characteristics of electrostatic fields in terms of definitions. |
| AEEB10.03 | State different laws which defines characteristics of electrostatic fields. |
| AEEB10.04 | Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in electric field. |
| AEEB10.05 | Demonstrate the electric dipole and its effect on electric field. |
| AEEB10.06 | Estimate the capacitance of parallel plates, spherical and coaxial capacitors with composite dielectrics. |
| AEEB10.07 | Summarize the concept of magneto static and interrelate the terms of magnetic fields. |
| AEEB10.08 | Interpret the magnetic field intensity due to circular, square and solenoid current carrying wire. |
| AEEB10.09 | Use Ampere circuital law to determine magnetic field intensity due to an infinite sheet of current, a long current carrying filament and its applications. |

| | |
|---|---|
| AEEB10.10 | Predict the force due to moving charge in the magnetic field for different configuration of current carrying conductor. |
| AEEB10.11 | Demonstrate the magnetic dipole and its effect on magnetic field. |
| AEEB10.12 | Calculate the self inductance and mutual inductance for different configurations of wires and applications of permanent magnet. |
| AEEB10.13 | State the Faraday's laws of electromagnetic induction and nature of voltage induced in the coil. |
| AEEB10.14 | Derive and explain the differential and integral form of Maxwell's equation in time varying fields and fields varying harmonically with time. |
| AEEB10.15 | Discuss the electromagnetic wave propagation and its analysis. |
| AEEB10.16 | Apply the concept of electromagnetic and electrostatic fields to solve real time world applications. |
| AEEB10.17 | Explore the knowledge and skills of employability to succeed in national and international level competitive examinations. |

## MAPPING OF MODEL QUESTION PAPER QUESTIONS TO THE ACHIEVEMENT OF COURSE LEARNING OUTCOMES:

| SEE QUESTION No. | | COURSE LEARNING OUTCOMES | | BLOOM'S TAXONOMY LEVEL |
|---|---|---|---|---|
| 1 | a | AEEB10.01 | Analyze the force and electric field intensity in the electrostatic field. | Understand |
| | b | AEEB10.03 | Identify the characteristics of electrostatic fields in terms of definitions. | Understand |
| 2 | a | AEEB10.01 | State different laws which defines characteristics of electrostatic fields. | Understand |
| | b | AEEB10.02 | Illustrate polarization of dielectrics and the behavior of conductors and dielectrics in electric field. | Understand |
| 3 | a | AEEB10.06 | Demonstrate the electric dipole and its effect on electric field. | Understand |
| | b | AEEB10.05 | Estimate the capacitance of parallel plates, spherical and coaxial capacitors with composite dielectrics. | Understand |
| 4 | a | AEEB10.05 | Summarize the concept of magneto static and interrelate the terms of magnetic fields. | Understand |
| | b | AEEB10.06 | Interpret the magnetic field intensity due to circular, square and solenoid current carrying wire. | Understand |
| 5 | a | AEEB10.08 | Use Ampere circuital law to determine magnetic field intensity due to an infinite sheet of current, a long current carrying filament and its applications. | Understand |
| | b | AEEB10.09 | Predict the force due to moving charge in the magnetic field for different configuration of current carrying conductor. | Understand |
| 6 | a | AEEB10.08 | Demonstrate the magnetic dipole and its effect on magnetic field. | Understand |
| | b | AEEB10.08 | Calculate the self inductance and mutual inductance for different configurations of wires and applications of permanent magnet. | Understand |
| 7 | a | AEEB1012 | State the Faraday's laws of electromagnetic induction and nature of voltage induced in the coil. | Remember |
| | b | AEEB10.11 | Derive and explain the differential and integral form of Maxwell's equation in time varying fields and fields varying harmonically with time. | Understand |
| 8 | a | AEEB10.10 | Discuss the different numerical methods to calculate the electrostatic and magneto static fields. | Understand |
| | b | AEEB10.10 | Apply the concept of electromagnetic and electrostatic fields to solve real time world applications. | Understand |

| SEE QUESTION No. | | COURSE LEARNING OUTCOMES | | BLOOM'S TAXONOMY LEVEL |
|---|---|---|---|---|
| 9 | a | AEEB10.13 | Explore the knowledge and skills of employability to succeed in national and international level competitive examinations. | Understand |
| | b | AEEB10.13 | Analyze the force and electric field intensity in the electrostatic field. | Understand |
| 10 | a | AEEB10.13 | Identify the characteristics of electrostatic fields in terms of definitions. | Understand |
| | b | AEEB10.13 | State different laws which defines characteristics of electrostatic fields. | Understand |

**Signature of the Course Coordinator**
**Mr. T Anil Kumar, Assistant Professor,EEE**
**Mr. B. Muralidhar Nayak, Assistant Professor,EEE**

**HOD, EEE**