

Code: EE3T5

**II B.Tech - I Semester–Regular/Supplementary Examinations
November 2018**

**ELECTROMAGNETIC FIELDS
(ELECTRICAL & ELECTRONICS ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1.

- a) Express Coulomb's Law in vector form.
- b) What is the difference between conduction and convection current density?
- c) Write the expression for Lorentz force equation and write its significance.
- d) What is a dipole? Write the expression for electric potential due to a dipole.
- e) A solenoid with air core has 2000 turns and a length of 500 mm. Core radius is 40 mm. Find its inductance.
- f) Write the integral and point forms of Faraday's laws.
- g) What is mutual inductance? Explain.
- h) State properties of conductor and dielectric materials.
- i) What are differences between the statically and dynamically induced emfs and give the example for each one.

- j) Write the expression for Point form of Ampere's circuital law.
- k) Define Poynting vector.

PART – B

Answer any **THREE** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) State and prove Gauss's law in integral form, considering static charges in freespace. 8 M
- b) Find the electric field at point (2, 2, 2) due to two point charges Q1 ($4 \times 10^{-9} \text{C}$) and Q2 ($3 \times 10^{-9} \text{C}$) located with coordinates (0, 2, 2) and (2, 0, 2) respectively in freespace. 8 M
3. a) Prove that the derivative of the energy stored in an Electrostatic field with respect to volume is $\frac{1}{2} \text{D.E}$, where D and E are electric flux density and electric field intensity respectively. 8 M
- b) Point charges of $1 \mu\text{C}$ and $-1 \mu\text{C}$ are located at (0,0,1) m and (0,0,-1) m respectively in free space. (i) Find the potential at (0,3,4) m. (ii) Recalculate the same potential, treating the dipole as a pure dipole. 8 M

4. a) State and explain Biot-Savart's Law. 8 M
- b) A filamentary current of 15 A is directed in from infinity to the origin on the positive x axis, and then back out to infinity along the position y axis. Use the Biot-Savarts law to find H at P (0, 0, 1)? 8 M
5. a) Derive the expression for torque exerted on a current-carrying loop by a magnetic field. 8 M
- b) A solenoid of 10 cm in length consists of 1000 turns having the cross section radius of 1 cm. Find the inductance of solenoid. What is the value of current required to maintain a flux of 1 mWb in the toroid. Take $\mu_r = 1500$. 8 M
6. a) Show that power loss in a conductor is given as product of voltage and current using Poynting theorem. 8 M
- b) In a medium is characterized by $\mu = \mu_0$, $\epsilon = \epsilon_0$ and $\sigma = 0$.
If $\mathbf{E} = 20 \sin (10^8 t - \beta z) \mathbf{a}_y$ V/m. Calculate β and H. 8 M