H.T.No. | | | | | | | | | | |

Code No: EC1517 **GEC-R14**

II B.Tech I Semester Regular Examinations, November 2016

ELECTROMAGNETIC FIELD THEORY

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. State Coulomb's Law for electrostatic fields.
2. Define Electric Dipole and Dipole moment.
3. Write equation for capacitance due to a co-axial cable of inner radius a and outer radius b (b>a).
4. A point charge of Q=-1.2C has velocity $\mathbf{u}$= $(5\mathbf{a_x}+2\mathbf{a_y}-3\mathbf{a_z})$ m/s. Find the force exerted by the charge it present in the magnetic field B=$-4\mathbf{a_x}+4\mathbf{a_y}+3\mathbf{a_z}$T.
5. Write equation for the relationship between displacement current density and conduction current density and magnetic field intensity.
6. A wave is incident at an angle of 30^0 from air to Teflon, ε_r=2.1. Calculate the angle of transmission.

PART-B

4 × 12 = 48M

1. a) Derive the expression for electric field strength due to infinite line of charge. (6M)

   b) If D = $(2y^2+z)\ \mathbf{a_x} + 4xy\ \mathbf{a_y} + x\ \mathbf{a_z}$ c/m^2, find i) The volume charge density at (-1,0,3) ii) The flux through the cube defined by $0\leq x \leq 1$, $0\leq y \leq 1$, $0\leq z \leq 1$. (6M)

2. a) Derive the expression for E due to an Electric dipole. (6M)

   b) A total charge of 40/3 nc is uniformly distributed over a circular ring of radius 2m placed in z=0 plane, with center as origin. Find the electric potential at A(0,0,5). (6M)

3. a) Derive the Laplace and Poisson's equation from fundamentals. (6M)

   b) A parallel plate capacitor has a plate area of 1.5m^2 and a plate separation of 5mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3mm with a relative permittivity of 6 and second has thickness of 2 mm with a relative permittivity of 4. Find the capacitance. (6M)

4. a) Derive an expression for H due to an infinite sheet of current. (6M)

   b) Two long parallel wires separated 7m apart carry currents of 55A and 105A respectively in the same direction. Determine the magnitude and direction of the force between them. (6M)

5. a) Derive the expression for torque produced on a rectangular current loop placed in a uniform magnetic field B. (6M)

   b) If the magnetic field H= [3x cosβ +6y sinα] $\mathbf{a_z}$, find the current density J if fields are invariant with time. (6M)

6. a) Show that the vector product P = E X H represents the ratio of energy flow per unit area at a point. (8M)

   b) In certain medium, $E = 16e^{-0.05x}\sin(2*108\ t - 2x)\boldsymbol{a_z}$ V/m. Find

      i) the propagation constant,
      ii) the wave length,
      iii) the speed of wave,
      iv) the skin depth. (4M)

*****