Code: EC4T4

II B.Tech - II Semester–Regular/Supplementary Examinations–April 2018

ELECTRO MAGNETIC FIELDS AND WAVES
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A

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

$$11 \times 2 = 22$$

1. a) Transform the vector $\mathbf{A}=y\ a_x - x\ a_y + z\ a_z$ into Cylindrical coordinates.

   b) State and express Gauss's Law for Electrostatics.

   c) A point charge $Q = 2 \times 10^{-6}$ c is located at the Centre of a cube. Determine the Electric flux passing through one face of the cube.

   d) Write the Poisson's and Laplace's equations.

   e) State and express Ampere's Circuit Law.

   f) The magnetic field intensity in free space is given by $\mathbf{H}=10\rho^2\ a_\varphi$ A/m. Find $\mathbf{J}$.

   g) Explain about inconsistency of Ampere's Law.

   h) Write the Maxwell's equations for time varying fields in point form.

   i) Find the self-inductance per unit length of an infinitely long Solenoid.

   j) State and explain Poynting's theorem.

   k) Define polarization of Uniform plane wave.

PART – B

Answer any ***THREE*** questions.   All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) State and prove Divergence theorem.   5 M

   b) A cube of side 2m is centered at the origin with edges parallel to the Coordinates axes of a Cartesian system. If $D = 10x^3/3 \ a_x \ C/m^2$, what is the Total charge contained in the cube.   5 M

   c) Derive the relationship between Electric potential and Electric field Intensity.   6 M

3. a) State and explain Coulomb's Law of force.   8 M

   b) Determine the Capacitance per unit length of a coaxial cable.   8 M

4. a) State and explain Gauss's Law for magnetic fields.   8 M

   b) Explain in detail about Magnetization in materials.   8 M

5. a) Explain physical interpretation and word statement of Maxwell's equations?   8 M

   b) The conduction current through a wire with a conductivity, 10^7 S/m and Relative permittivity, $\varepsilon_r = 1$ is given by $I_C = 2 \ Sin\omega t$ mA. If $f = 10^9/2\pi$ Hz, find Displacement current.   8 M

6. a) Derive wave equation for electromagnetic fields in homogeneous linear media.   8 M

   b) A uniform plane wave of frequency 1 MHz travels in a large block of copper, for which $\sigma = 5.8 \times 10^7$ S/m, $\varepsilon_r = 1$ and $\mu_r = 1$. Find the following: 8 M
    i) Attenuation constant and phase shift constant
    ii) Intrinsic impedance of copper at 1 MHz