Reg. No. : | | | | | | | | | | | |

Question Paper Code : 21358

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Electronics and Communication Engineering

EC 2253/EC 43/10144 EC 404/EC 1253/080290021 — ELECTROMAGNETIC FIELDS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define electric field and electric potential.

2. State divergence theorem.

3. State Biot-Savarts law.

4. Define magnetic vector potential.

5. Determine the capacitance of the parallel plate capacitor composed of tin foil sheets, 25cm square for plates separated through a glass dielectric 0.5cm thick with relative permittivity of 6.

6. State point form of Ohm's law.

7. Distinguish between conduction current and displacement current.

8. Write down the expressions for instantaneous and complex Poynting vector.

9. Find the skin depth at a frequency of 3MHZ is aluminium where $\sigma = 38.2M\ s/m$ and $\mu_r = 1$.

10. What is Brewster angle?

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for the electric field due to a straight and infinite uniformly charged wire of length 'L' meters and with a charge density of $+\rho c/m$ at a point P which lies along the perpendicular bisector of wire. (16)

Or

(b) (i) A uniform line charge $\rho_L = 25Nc/m$ lies on the x = 3m and y = 4m in free space. Find the electric field intensity at a point (2, 3 and 15) m. (8)

(ii) Given that potential $V = 10\sin\theta\cos\Phi/r^2$ find the electric flux density D at $(2, \pi/2, 0)$. (8)

12. (a) (i) Derive an expression for force between two current carrying conductors. (8)

(ii) An iron ring with a cross sectional area of 3 cm square and mean circumference of 15cm is wound with 250 turns wire carrying a current of 0.3A. The relative permeability of ring is 1500. Calculate the flux established in the ring. (8)

Or

(b) Derive the expressions for magnetic field intensity and magnetic flux density due to finite and infinite line carrying a current 1. (16)

13. (a) Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics. (16)

Or

(b) The capacitance of the conductor formed by the two parallel metals sheets, each 100cm^2, in area separated by a dielectric 2 mm thick is 2×10^{-10} micro farad. A potential of 20kv is applied to it . Find

(i) Electric flux (4)

(ii) Potential gradient in kV/m (4)

(iii) The relative permittivity of materials (4)

(iv) Electric flux density. (4)

14. (a) With necessary explanation, derive the Maxwell's equation in differential and integral forms. (16)

Or

(b) (i) The conduction current flowing through a wire with conductivity $\sigma = 3\times10^7\ s/m$ and the relative permeability $\varepsilon_r = 1$ is given by $I_c = 3\sin\varpi t(mA)$. If $\varpi = 10^8$ rad/sec, find the displacement current. (8)

(ii) An electric field in a medium which is source free is given by $E = 1.5\cos(10^8 t - \beta z)\bar{a}_x V/m$. Find B,H and D. Assume $\varepsilon_r = 1, \mu_r = 1, \sigma = 0$. (8)

15. (a) A plane sinusoidal electromagnetic wave traveling in space has $E_{max} = 150\,\mu V/m$. (16)

(i) Find the accompanying H_{max}.

(ii) Propagation is in X direction and H is oriented in Y direction. What is the direction of E?

(iii) Compute the average power transmitted.

Or

(b) Explain in detail on what happens when the wave is incident

(i) Normally on perfect conductor (8)

(ii) Obliquely to the surface of perfect dielectrics. (8)