Code No. : 5331/N

FACULTY OF ENGINEERING
B.E. 2/4 (ECE) I Sem. (New) (Main) Examination, Dec. 2011/Jan. 2012
ELECTROMAGNETIC THEORY

Time: 3 Hours] [Max. Marks: 75

Note: *Answer* ***all*** *questions from Part* ***A****, answer* ***any five*** *questions from Part* ***B****.*

PART – A **(25 Marks)**

1. State Coulomb's law. **2**
2. Describe the salient feature of electric flux density. **2**
3. Explain equation of continuity. **3**
4. Distinguish between internal inductance, self inductance and mutual inductance. **3**
5. State uniqueness theorem. **3**
6. Write short notes on solenoid. **3**
7. Write Maxwell equations in integral and differential form. **2**
8. At what frequencies may earth be considered a perfect dielectric of $\sigma = 5 \times 10^{-3} s/m$ $\mu_r = 1$ and $\epsilon_r = 8$? **3**
9. Find gradient of scalar field $A = 10r\sin^2\theta$. **2**
10. What is the propagation constant of EM wave in free space ? **2**

PART – B **(50 Marks)**

11. a) Verify divergence theorem for the vector field $D = r^2\cos^2\phi\, a_r + z\sin\phi\, a\phi$ over a closed surface bounded by $r = 4, 0 \le z \le 1$. **7**

    b) State Guass law. **3**

12. a) Derive the dielectric-dielectric boundary conditions in static electric field. **5**

    b) Find the charge in volume define by $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$, $\rho = 30x^2y\ \mu c/m^3$. **5**

13. a) Obtain the capacitance of two conductor system of infinite length. 5

b) Given the current density $J = \frac{10^3}{r^2} \cos\theta a\theta \ A/m^2$ in spherical co-ordinate system. Find current crossing conical strip $\theta = \pi/4$ and $0.001 \leq r \leq 0.8$. 5

14. a) Explain the physical interpretation of divergence, gradient and curl. 5

b) A point charge $Q_1 = 300\mu c$ located at P_1 (1, –1, –3) experience a force $F_1 = 8a_x - 8a_y + 4a_z N$ due to a point charge Q_2 at (3, –3, –2) m, determine Q_2. 5

15. a) Show that energy density in a magnetic field is $\frac{1}{2} BH$. 5

b) A radial field $H = \frac{2.39 \times 10^6}{r} \cos\phi \ a_r \ A/m$ exist in free space. Find the magnetic flux ϕ crossing the surface defined by $-\pi/4 \leq \phi \leq \pi/4$ and $0 \leq z \leq 1\,m$. 5

16. a) Distinguish between linear, circular and elliptical polarization. 5

b) Prove that for parallel polarization $\frac{E_r}{E_i} = \frac{\text{Tan}\,(\theta_1 - \theta_2)}{\text{Tan}\,(\theta_1 + \theta_2)}$. 5

17. Write short notes on :

a) Poisson's equation. 3

b) Magnetic boundary conditions. 4

c) Instantaneous, average and complex Poynting vector. 3