Code No. 2252

# FACULTY OF ENGINEERING

**B.E. 2/4 (ECE) I-Semester (Main) Examination, November / December 2012**

**Subject : Electromagnetic Theory**

**Time : 3 Hours** **Max. Marks: 75**

***Note:*** *Answer **all** questions of Part - A and answer any **five** questions from Part-B.*

## PART – A (25 Marks)

1. State uniqueness theorem. (3)
2. Determine laplacian of scalar field $A=x^2y+xyz$. (2)
3. What is displacement current? (2)
4. Given $E(z,t)=100\cos(10^9t+30z)$ for a plane wave. Find phase velocity assuming $\mu=\mu_0$. (3)
5. Define surface impedance. (2)
6. Write Maxwell equation in sinusoidal variation. (3)
7. Find electric field E at (0, 3, 4) in Cartesian co-ordinate system due to point charge Q=0.5 $\mu$C at (0, 0, 0). (2)
8. Determine the work expended in carrying 2C from B(1,0,1) to A(0.8, 0.6,1) along the shorter arc of circle $x^2+y^2=1$ and $z=1$ for the field $E=ya_x+xa_y+2a_z$. (3)
9. Define Amper's force law. (2)
10. What is skin depth in copper 1GHz, if $\sigma=5.7\times10^7$ mho/m? (3)

## PART – B (5x10=50 Marks)

11.(a) State and prove divergence theorem. (7)

(b) Give vector field $A=5x^2\left(\frac{\sin\pi x}{2}\right)a_x$ find divergence A at x=1. (3)

12.(a) Derive an expression for energy stored in the electrostatic field in terms of E and D. (6)

(b) Find the potential and electric field between the two right concentric cylinders where V=0 at $r_a$=1mm and V=200 at $r_b$=20 mm. (4)

13.(a) Find H at center of square loop of side L. (5)

(b) Show that $\nabla^2A = -\mu J$ where A is vector magnetic potential. (5)

14.(a) Show that E and H in free space is $\sqrt{\frac{\mu}{\in}}$. (5)

(b) A uniform plane wave is incident from air onto glass at an angle from the normal of $45^o$. Determine the fraction of the incident power that is reflected and transmitted for Parallel polarization. Glass has a refractive index 1.45. (5)

15.(a) State and prove Poynting theorem. (7)

(b) What is Brewster angle and critical angle? (3)

16.(a) Derive an expression for magnetic field intensity H in an ideal solenoid. (5)

(b) A boundary exist at y=0 between two dielectric $\in_{r1}$=2.5 region y<0 and $\in_{r2}$ =4 region y > 0 field in the region of electric field is $E_1 = -30a_x+40a_y+50a_z$ V/m.
Find (i) Normal component of $E_{n1}$ (ii) Tangent Component of $E_t1$. (iii) Angle
(iv) Normal component of $D_{n1}$. (5)

17.(a) Derive an equation for Electric and magnetic wave in free space. (5)

(b) Explain linear, elliptical and circular polarization. (5)

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