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Reg. No. : .....

Name : .....

Fifth Semester B.Tech. Degree Examination, Dec. 2012
(2008 Scheme)
08.505 : APPLIED ELECTROMAGNETIC THEORY (T)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** carry **4** marks.

1. State Gauss-Divergence theorem and Stoke's theorem.
2. Give Poissons and Laplace equation in electrostatics. Give application.
3. Consider the vector $A = 3a_x - 4a_y - 5a_z$ at the point (3, 4, 5) in rectangular coordinate system. Represent the direction of this vector in spherical coordinate system.
4. Explain Poynting theorem and complex Poynting vector.
5. Derive the wave equation for electromagnetic waves in free space. From this find the velocity of light in free space.
6. Explain what is skin depth. Find the skin depth for Cu when an electromagnetic wave is incident normally. (Given f = 30 MHz, $\mu_r = 1$ and conductivity = 5.8 mho/m).
7. Explain on the basis of boundary conditions, why it is necessary that reflection coefficient is - 1 at the boundary between a dielectric and a perfect conductor.
8. A 100 m long transmission line has a total inductance and capacitance of 27.72 μH and 18 nF respectively. Determine (a) the velocity of propagation and phase constant for an operating frequency of 100 kHz and (b) characteristic impedance of the transmission line.
9. Explain the need of stub matching.
10. Explain the dominant modes in TE and TM modes of wave guide.

P.T.O.

PART – B

Answer **any two** questions from **each** Module.

Module – 1

11. a) Derive the expression for electric field intensity and potential for an infinitely long conductor having uniform charge density ρ_1 at a point h meters from it. 5

    b) Planes x = 2 and y = –3 respectively carry charges 10 nC/m^2 and 15 nC/m^2. If the line x = 0, z = 2 carries charge 10π nC/m, calculate E at (1, 1, –1) due to the three charge distributions. 5

12. Substantiate the following boundary conditions with proof

    $(E_1 - E_2) \times a_n = 0$

    $(B_1 - B_2) . a_n = 0$

    $\tan\theta_1\mu_2 = \tan\theta_2\mu_1$

    Where μ_1, μ_2 denote the permeability of the two media and θ_1, θ_2 are the angle between normals to the boundary in the two media a_n.

13. Explain the concept of magnetic scalar and vector potentials. Derive the expression for magnetic vector potential at a point due to a straight current carrying conductor.

Module – 2

14. Given $E = 20sin(10^8 t - \beta z) a_y$ in free space. Find D, B, H and β so that the electromagnetic wave exist.

15. Derive the expression for reflection and transmission coefficients when a uniform plane electromagnetic wave is incident obliquely on a dielectric surface with perpendicular polarization.

16. Explain the wave propagation in a lossy dielectric medium and give the expression for intrinsic impedance.

Module – 3

17. a) Analyse a uniform transmission line by taking an elemental length and derive voltage and current equations. Also derive the expression for input impedance, reflection coefficient and VSWR. 7

    b) Find the reflection coefficient and SWR of a transmission line of characteristic impedance 50 Ω and load impedance j50 Ω. 3

18. a) TEM wave cannot propagate in a single conductor hollow waveguide. Substantiate. 5

    b) Give the dominant modes for TE and TM modes in a rectangular waveguide, with reason derive the expressions for cut off frequency for dominant mode. 5

19. Explain how Smith chart can be used for the design in sub matching.
