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Reg. No. : .....

Name : .....

Fifth Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)
08.505 : APPLIED ELECTROMAGNETIC THEORY (T)

Time: 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Transform the vector $r^{-1}a\hat{s}$ in spherical co-ordinates to Cartesian co-ordinates.
2. Define magnetic vector potential.
3. Derive the expression for capacitance of two wire transmission line.
4. Derive the expression for electrostatic energy.
5. What is Brewster angle ?
6. Derive the expression for surface impedance of good conductor.
7. What is Smith chart ?
8. What are the different types of polarization ?
9. What is cutoff wavelength of a waveguide ? Derive.
10. Explain the dominant modes in TE and TM modes of waveguide.

PART – B

Answer **any two** questions from **each** Module. **Each** question carries **10** marks.

Module – 1

11. a) Define Poissons and Laplace's equation. 4

    b) A five point charge of SPC is located at (0, 20) mm and another such charge at (20, 0) mm. Find the magnitude and direction of force F on a five charge of 20 nc at (20, 20) mm. 6

12. What are the boundary conditions for electric and magnetic field ? Derive.

13. a) What are the boundary conditions for magnetic field ?

    b) Derive the expression for capacitance of co-axial cable.

Module – 2

14. a) Derive the expressions for wave equation in conducting medium.

    b) The electric field intensity of a uniform plane wave in air is 7500 v/m in the y direction. The wave is propagating in the x-direction at a frequency of 2×10^9 rad/s. Find the wavelength, frequency and period.

15. State and derive Poynting vector theorem.

16. a) Derive voltage and current equations of a uniform transmission line. 5

    b) In free space ($z \leq 0$), a plane wave with $Hi = 10 \cos (10^8 t - \beta z)\, a\hat{z}$ mA/m is incident normally on a lossless medium ($\Sigma = 2\Sigma_0$, $\mu = 8\mu_0$ in region $z \geq 0$). Determine the reflected wave H_r, E_r and transmitted wave H_t and E_t. 5

Module – 3

17. A transmission line 2 m long operating at $w = 10^6$ rad/s has $\alpha = 8db/m$, $\beta = 1\,rad/m$ and $Z_0 = 60 + j40\Omega$. If the line is connected to a source of $10\angle 0°$ V, $Zg = 40\Omega$ and terminated by a load of $20 + j50\Omega$ determine input impedance, sending end current, propagation constant r and current at the middle of the line.

18. An RF transmission line with $Z_0 = 300\,\Omega$ is terminated in an impedance of $100\angle -45°$. This load is to be matched to the transmission line by short circuited stub. With the help of smithchart determine the length of the stub and distance from the load.

19. Derive expressions for electromagnetic fields for TM waves in a waveguide.