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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (ECE) II Year I-Semester Backlog Examinations, December-2017

Electromagnetic Theory

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Draw the shapes of r = constant, θ = constant and ϕ = constant planes.
2. Classify electrostatic charge distributions.
3. Compare Absolute potential and relative potential.
4. What is the inconsistency in Ampere's circuital law?
5. List any two applications of Biot-Savart's law.
6. Highlight the use of Stoke's theorem.
7. Describe uniform plane wave.
8. Write the expressions for attenuation constant and phase constant in free space.
9. Define critical and Brewster angles.
10. State the Gauss's theorem for electromagnetic wave.

Part-B (5 × 10 = 50 Marks)

11. a) State and explain the Coulomb's law of force and the terms point charge, source point and field point. [5]
    b) In spherical coordinates, a volume charge density $\rho_v = 10e^{-2t}\text{c/m}^3$ is present. Determine the divergence of conduction current density. [5]

12. a) Prove that electrostatic field is a curl-free field. [5]
    b) Obtain an expression for the capacitance of parallel plate capacitor. [5]

13. a) Find the self inductance of a long coaxial cable of length 'l' with inner cylinder radius 'a' and outer cylinder radius 'b' carrying current 'I'. [5]
    b) Region 1, for which $\mu_{r1} = 3$, is defined by $x < 0$ and region 2, $x > 0$ has $\mu_{r2} = 5$. Given $\vec{H}_1 = 4\hat{a}_x + 3\hat{a}_y - 6\hat{a}_z$ A/m. Determine $\vec{H}_2$ for $x > 0$. [5]

14. a) Formulate EM wave equation for Electric field in free space. [5]
    b) If $\epsilon_r = 1$ and $\mu_r = 1$ for the medium in which a wave with frequency f = 0.3 GHz is propagating, determine the propagation constant and the intrinsic impedance of the medium when σ = 10 mho/m and σ = 0. [5]

15. a) Formulate expressions of reflection coefficient and transmission coefficients of a plane wave under normal incidence. [6]
    b) A plane wave travelling in free space has an average Poynting vector of 5W/m^2. Find the average energy density. [4]

16. a) State and prove Poynting's theorem. [5]
    b) Formulate Maxwell's equations for time varying fields [5]

17. Answer any ***two*** of the following:
    a) Ampere's law and its applications. [5]
    b) Wave polarization and different types. [5]
    c) Reflection of wave due to oblique incidence. [5]