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Code No. : 13405 S

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**B.E. (ECE: CBCS) III-Semester Supplementary Examinations, May/June-2018**

**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. Determine Laplacian of scalar field  $A = x^2y + xyz$ .
2. State Gauss law and give its applications.
3. Prove that electrostatic field is conservative.
4. Write the statement of uniqueness theorem.
5. Write Poisson's equation for steady Electric field.
6. Prove that magneto static fields have no sources or sinks and field lines are always continuous.
7. Convert the Maxwell's equations for mmf and emf from integral form to differential form related to the time varying fields.
8. Define is skin depth.
9. Differentiate Critical angle and Brewster angle with an example.
10. State Poynting theorem.

**Part-B (5 × 10 = 50 Marks)**

11. a) A sphere is defined with volume charge density  $\rho_v$  C/m<sup>3</sup> and has radius 'r'. Obtain the expressions for the electric field strength and electric displacement density inside and outside the sphere using Gauss law. [6]  
b) Determine the charge densities corresponding to the given displacement densities [4]  
 $D = 4x^2ya_x + 3xy^2a_y$  C/m<sup>2</sup>  
 $D = 2\rho \cos \phi a_\rho + 3\rho \sin \phi a_\phi + 5za_z$  C/m<sup>2</sup>.
12. a) Determine the capacitance between two parallel plates each one them having Area 'A'. [6]  
(the distance of separation between the parallel plates is 'd').  
b) The potential distribution is given as  $V = 10y^3 + 2x^2$ . Find the volume charge density at the point (2, 0). [4]
13. a) State and explain Ampere's circuital law for steady currents. Mention its applications and limitations. [6]  
b) Find the magnetic field strength H on the z-axis at a point P(0,0,4) due to a current carrying conductor loop,  $x^2 + y^2 = 4$  in  $z = 0$  plane. [4]
14. a) For free space propagation, derive the wave equations from Maxwell's equations. [6]  
b) In a non-magnetic medium, the wave has an electric field vector given by [4]  
 $\vec{E} = 50 \cos(10^9t - 8x)a_y + 40 \sin(10^9t - 8x)a_z$ . Find the dielectric constant  $\epsilon_r$  and the corresponding magnetic field vector H.

- 15. a) Find the reflection coefficients of a plane wave when the reflection is from a plane surface of a perfect dielectric due to normal incidence of wave. [6]
- b) Determine the reflection coefficient for an EM wave incident normally on a sheet of iron. The corresponding parameters are: frequency (f) = 1 MHz,  $\sigma = 1 \times 10^6$  mho/m and  $\mu = 1000\mu_0$ . [4]
- 16. a) Discuss the uniform and non uniform charge distributions. [5]
- b) Derive continuity equation. [5]
- 17. Answer any *two* of the following: [5]

  - a) Mutual inductance [5]
  - b) Wave polarization [5]
  - c) Oblique incidence. [5]

