

EX - 302**B.E. III Semester Examination, December 2014****Electro-Magnetic Theory***Time : Three Hours**Maximum Marks : 70*

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
 ii) All parts of each question are to be attempted at one place.
 iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
 iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Write the statement of Divergence theorem.
 b) Define electric potential.
 c) Given the two vectors,

$$\vec{A} = 2\vec{a}_x - 5\vec{a}_y - 4\vec{a}_z \text{ and } \vec{B} = 3\vec{a}_x + 5\vec{a}_y + 2\vec{a}_z$$

Find the dot product and the angle between the two vectors.

- d) Given the vector field, $G = 2x^2 y \vec{a}_x - 2(z-x) \vec{a}_y + 3xyz \vec{a}_z$, find (i) G at $P(2, -3, 4)$; (ii) A unit vector in the direction of G at P ; (iii) The (scalar) equation of the surface on which $|G| = 100$; (iv) The y coordinate of $Q(-3, y, 5)$ if $|GQ| = 100$ and $y > 0$; (v) The distance between P and Q .

OR

Explain the method of images.

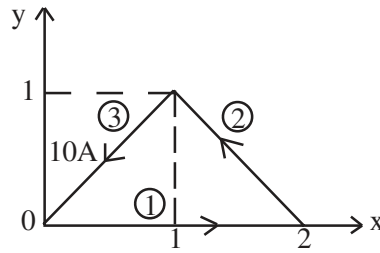
2. a) Define electric dipole.
 b) What is polarization?
 c) Define the capacitance of various types of capacitors.
 d) Derive the expression of energy stored in electric field.

OR

Explain Boundary value conditions.

3. a) What is the static magnetic field?
 b) Write down the statement of Ampere's circuital law.
 c) Derive the expression for magnetic field due to straight current carrying filament (conductor).
 d) The conducting triangular loop carries a current of 10 A. Find vector H at $(0, 0, 5)$ due to side 1 of the loop.

[2]



OR

Calculate \vec{B} and \vec{H} due to a long solenoid.

4. a) Define self and mutual inductances.
- b) Write the statement of Faraday's law.
- c) Write the Maxwell's equations for harmonically varying field.
- d) For a lossy dielectric, $\sigma = 5 \text{ s/m}$ and $\epsilon_r = 1$. The electric field intensity is $E = 100\sin 10^{10} t$. Find J_C , J_D and frequency at which both have equal magnitudes.

OR

Write Maxwell's equation in (i) point form and (ii) integral form. Explain the significance of each equation.

5. a) What do you mean by practical dielectric?
- b) What is loss tangent? Explain in brief.
- c) State Poynting theorem and explain its significance.
- d) Derive wave equations for free space and produce its solution.

OR

A lossy dielectric is characterized by $\epsilon_r = 2.5$, $\mu_r = 4$ and $\sigma = 10^{-3} \text{ } \Omega^{-1}\text{m}$ at a frequency 10 MHz. Find : (i) Attenuation constant; (ii) Phase constant; (iii) Velocity of propagation; (iv) Wavelength and (v) Intrinsic impedance.
