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Roll No

EX-5001 (CBGS)**B.E. V Semester**

Examination, December 2017

Choice Based Grading System (CBGS)**Electro Magnetic Field Theory**

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) State and explain Gauss's law. Derive the equation for potential at a point inside a solid sphere having uniform volume charge density. 7
- b) Point charges 1mC and -2mC are located at (3, 2, -1) and (-1, -1, 4) respectively. Calculate the electric force on a 1 on C charge located at (0, 3, 1). 7
2. a) Discuss and prove Divergence theorem. 7
- b) Explain physical significance of gradient of a scalar, divergence of a vector and a curl of a vector. 7
3. a) Obtain the expression for the equation of continuity for steady currents. 7
- b) There exists a potential of $V = -2.5V$ on a conductor of 0.02m and $V = 15.0V$ at $r = 0.35m$. A dielectric material whose $\epsilon_r = 3.0$ exists between the conductors. Determine the surface charge densities of the conductors. 7
4. a) Determine the magnetic field intensity \vec{H} at the centre of a square current element. The length of each side is 2m and the current $I = 1.0Amp$. 7
- b) Calculate the magnetic flux density produced by a current loop of radius R on the loop axis when the loop is carrying a current I and situated in air. 7

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5. a) A parallel plate capacitor with plate area of $5cm^2$ and plate separation of 3mm has a voltage $50\sin^2 10^3 t$ volts applied to its plate. Calculate the displacement current assuming $\epsilon = 2\epsilon_0$. 7
- b) Assuming a source free region, derive the diffusion equation

$$\nabla^2 \vec{E} = \mu\sigma \frac{\partial \vec{E}}{\partial t}$$
 7
6. a) Write Maxwell's equation in
 i) Point form and
 ii) Integral form
 Explain the significance of each equations 7
- b) In free space, the magnetic field of an EM wave is given by:

$$\vec{H} = 0.4\omega\epsilon_0 \cos(\omega t - 50x) \vec{a}_z \text{ A/m}$$
 Find the electric field E. 7
7. In a medium: 14

$$\vec{E} = 4\sin(2\pi \times 10^{-7} t - 0.8x) \vec{a}_z \text{ V/m}$$
 Find:
 i) The time average power carried by the wave
 ii) The total power crossing $100cm^2$ of plane $2x + y = 5$
8. Write short notes (any two): $2 \times 7 = 14$
 a) Biot-Savart's Law
 b) Equation of continuity
 c) Circular Polarization
 d) Coulomb's Law

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