FACULTY OF ENGINEERING B.E. 2/4 (ECE) I – Semester (Supplementary) Examination, July 2014

Subject : Electromagnetic Theory

Time : 3 hours

Max. Marks: 75

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Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B. **PART – A** (25 Marks)

- Obtain the expression for the volume of a sphere of radius 'a' from the differential volume. 2 1 3
- 2 Explain line, surface and volume charge distributions.
- 3 Define the equipotential surface.

For a line charge $\rho_L = \frac{10^{-9}}{2} c/m$ on the z-axis find V_{AB}, where A is (2m, $\pi/2$, 0) and B is 4 (4m, π, 5m)

- State Biot-Savart's law. 5
- In cylindrical co-ordinates, $B = \left(\frac{2.0}{r}\right) a_{\phi}$ Tesla. Determine the magnetic flux ϕ crossing 6

the plane surface defined by $0.5 \le r \le 2.5$ m and $0 \le z \le 20$ m.

- 7 List out the generalized forms of Maxwells equations in integral form for the static fields.
- Define plane of incidence and reflection co-efficient. 8
- Explain the term "skin effect resistance". 9
- 10 Define critical angle, Brewster angle and total internal reflection.

- Obtain the expressions for the electric field and the potential due to a small electric 11 a) dipole oriented along z-axis.
 - b) Two point charges are located as shown in fig 1 below $Q_1 = + 2\mu c$, $Q_2 = -5\mu c$.

Find the electric field intensity at point 'P'.



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- 12 a) Derive the expression of the electro static energy stored in a capacitor of value 'C' in terms of the total charge 'Q' as well as the voltage 'V'.
 - b) A line charge $\rho_L = 400$ Pc/m lies along the x-axis. The surface of zero potential passes through the point (0, 5, 12). Find the potential at point (2, 3, -4)m.
- 13 a) Explain the nature of line, surface and volume current distributions as applicable to static magnetic fields list out the expressions for the magnetic field intensity in these three cases.
 - b) Find the magnetic field about a long straight wire with current flow 'F' by means of the vector potential.
- 14 a) Find the magnetic field intensity at the centre of a circular loop of radius 'a' carrying a current I along ' ϕ ' in z = 0 plane.
 - b) For a N-turn toroid of circular cross section carrying a current 'I' determine the magnetic field inside and outside of the toroid.
- 15 a) What is the inconsistency in Amperes law? How it is rectified by Maxwell?
 - b) A parallel plate capacitor with plate area of 5cm^2 and plate separation of 3mm has a voltage 50 sin 10^3 t V applied to its plates. Calculate the displacement current assuming $\mathcal{E} = 2 \mathcal{E}_0$.
- 16 a) From the Maxwell's cure's equation derive the wave equations for an electromagnetic wave in conducting media.
 - b) An EM wave is propagated through a material having $\mu_r = 5$ and $\varepsilon_r = 10$. Determine the i) Velocity of propagation ii) Intrinsic impedance iii) Wave length if the frequency is 1 GHz.
- 17 a) State and prove poyinting theorem.
 - b) A wave in a perfect dielectric falls obliquely upon a plane boundary with a second dielectric. The magnetic vector is parallel to the reflecting surface (vertical polarization).
 - i) Determine the expression for the reflection factor relating the tangential components of E.
 - ii) Determine the critical incident angle for which reflection is zero in terms of the constants of the two materials.

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