## FACULTY OF ENGINEERING

## B.E. 2/4 (ECE) I-Semester (Supplementary) Examination, July 2014

## Subject : Electromagnetic Theory

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

1 Obtain the expression for the volume of a sphere of radius ' $a$ ' from the differential volume. 2
2 Explain line, surface and volume charge distributions. 3
3 Define the equipotential surface. 2
4 For a line charge $\rho_{L}=\frac{10^{-9}}{2} c / m$ on the $z$-axis find $V_{A B}$, where $A$ is $(2 m, \pi / 2,0)$ and $B$ is ( $4 \mathrm{~m}, \pi, 5 \mathrm{~m}$ )
5 State Biot-Savart's law.
6 In cylindrical co-ordinates, $B=\left(\frac{2.0}{r}\right) a_{\phi}$ Tesla. Determine the magnetic flux $\phi$ crossing the plane surface defined by $0.5 \leq r \leq 2.5 \mathrm{~m}$ and $0 \leq z \leq 20 \mathrm{~m}$.2

7 List out the generalized forms of Maxwells equations in integral form for the static fields.

8 Define plane of incidence and reflection co-efficient. 2
9 Explain the term "skin effect resistance". 2
10 Define critical angle, Brewster angle and total internal reflection. 3
PART - B (50 Marks)

11 a) Obtain the expressions for the electric field and the potential due to a small electric 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 ' $P$ '.


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 $\rho_{L}=400 \mathrm{Pc} / \mathrm{m}$ 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 ' $\phi$ ' 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 $5 \mathrm{~cm}^{2}$ and plate separation of 3 mm has a voltage $50 \sin 10^{3} \mathrm{t} \mathrm{V}$ applied to its plates. Calculate the displacement current assuming $€=2 \Theta_{0}$.

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 $\mu_{\mathrm{r}}=5$ and $\varepsilon_{\mathrm{r}}=10$. 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.

