

POKHARA UNIVERSITY

Level: Bachelor Semester – Spring Year : 2010
Programme: BE Full Marks: 100
Course: Electromagnetic Fields and Waves Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define electric field intensity. Derive the expression for the electric field intensity due to an infinite continuous line charge. 8
- b) Transform the vector 7
 - i. $\mathbf{F}=10\mathbf{a}_x-8\mathbf{a}_y+6\mathbf{a}_z$ into Cylindrical coordinates at point P(10,-5, 2)
 - ii. $\mathbf{H}=20\mathbf{a}_\rho-10\mathbf{a}_\phi+4\mathbf{a}_z$ into Cartesian coordinates at point A (5,2,-1).
2. a) Three infinite uniform sheets of charge are located in free space as follows: 3nc/m^2 at $Z=-4$, 6nc/m^2 at $Z=1$ and -8nc/m^2 at $Z=4$. Find \mathbf{D} at the point 5
 - i. $P_A(2,5,-5)$
 - ii. $P_B(4,2,-3)$
- b) "Coaxial cable carrying large currents would not produce any noticeable effect in any adjacent circuits." Do you agree with this statement? Give mathematical proof to support your answer. 5
- c) Determine whether the following fields satisfy Laplace's equation or not 5
 - i. $V=2x^2-4y^2+3z^2$
 - ii. $V=\rho\sin\theta+z\cos\theta$
3. a) With necessary derivations prove that "Electric Field Intensity is 5

- negative gradient of potential."
- b) Show that the stored energy density in a magnetic field of strength H is $\frac{1}{2} \times \mu H^2$. 7
- c) State divergence theorem. 3
4. a) Conducting spherical shells with radii $a = 10$ cm and $b = 30$ cm are maintained at a potential difference of 100V such that $V(r = b) = 0$ and $V(r = a) = 100$ V. Determine V and \mathbf{E} in the region between the shells. If $\epsilon_r = 2.5$ in the region, determine the total charge induced on the shells and the capacitance of the capacitor. 8
- b) Derive the boundary condition for perfect dielectric materials. 7
5. a) Derive the point form of continuity equation. Also discuss along with mathematical expression and relaxation time constant. 7
- b) State Biot- Savart's law in magnetostatics. Apply this to find magnetic field of direct current carrying infinitely long conductor. 8

OR

- A $(75 + j125) \Omega$ load is connected to 72Ω lossless line. Find 8
- i. Γ
- ii. s
- iii. The load admittance and Y_L
- Z_{in} at 0.3λ from the load (using Smith chart).
6. a) How does Stokes theorem relate line integral and surface integral? Given the magnetic vector potential $\mathbf{A} = -(\rho^2)/4 \mathbf{a}_z$ Wb/m, calculate the total magnetic flux crossing the surface $\phi = \pi/2$, $1 \leq \rho \leq 2$ m, $0 \leq z \leq 5$ m. 8
- b) Explain the propagation of EM waves in free space with necessary derivations. 7

OR

What is skin effect? Find the expression for skin depth. 7

7. Write short notes on **any two:** 2×5
- a) Magnetic boundary conditions
 - b) Faraday's law in electromagnetics
 - c) Relative permittivity
 - d) Waveguides