Mid-West University
Examinations Management Office
Surkhet, Nepal
Final Examinations -2079

Bachelor level/ B.Sc /4th Semester — Full Marks: 100
Time: 3 hrs — Pass Marks: 50
Subject : Electromagnetism (PHY341)

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks

Group – A

1. Answer in short any **NINE** questions. **[9x2 = 18]**
   a. Find the divergence of a radial vector.
   b. Discuss about different types of charge density used in electrostatics.
   c. Differentiate between conduction current and convection current.
   d. State Biot-savart's law and write its vector form.
   e. Define transformer with its principle.
   f. Define magnetic dipole moment and Magnetization of materials.
   g. Define motional E.M.F. and write name of one device in which such types of EMF found?
   h. If Potential V = $\frac{10}{r^2} sin\theta cos\phi$, find the electric flux density ($\vec{D}$) at $(2, \pi/2, 0)$.
   i. Explain about lossless line and distortion less line.
   j. Define reflection and transmission coefficient of electromagnetic waves.
   k. Write short note on Smith Chart.

Group – B

2. Answer in brief any **SEVEN** questions. **[7x4= 28]**
   a. Define line integral and volume integral. State and prove Stoke's theorem.
   b. State Gauss's law in electrostatics and use it to find the electric field outside an uniform sphere having charge density ρ.
   c. Concentric spherical shells r=0.1m and r=2m are maintained at V=0V and V=100V respectively. Assuming free space between shell. Find potential (V), Electric Fields(E) and Displacement Current(D).
   d. Show that; $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$, where symbol have usual meaning.
   e. Find the magnetic field due to a circular coil of radius 0.1m and having 200 turns at the center of the coil when circulating current is 500 mA.
   f. State and prove Amperes circuital law. For which condition this law is useful for determination of magnetic field?
   g. Define magnetic torque and magnetic moment? Derive the relation between them.
   h. Show that the general expression for input impendence at any point on transmission line is,
   $Z_{in} = Z_0[\frac{Z_L + Z_0 tanhrl}{Z_0 + Z_l tanhrl}]$, Where symbol have usual meaning.
   i. Define eddy current and explain about different energy losses in a transformer.

Group – C

3. What do you mean by solenoidal vector field? Give one example and write the meaning of $\nabla . \vec{E} \neq 0$. Also find the value of '**p**' so that the vector field, $\vec{A} = x^2 \hat{a}_x + (y - 2xy)\hat{a}_y + (x + pz)\hat{a}_z$ is solenoidal. **[6]**
4. What is the method of image? Determine the location and magnitude of image charge due to a point charge placed near a conducting sphere which is earthed. **[6]**
5. The finite sheet $0 \leq x \leq 1, 0 \leq y \leq 1$ on the $z = 0$ plane has a charge density, $\rho_s = xy(x^2 + y^2 + 25)^{3/2}\ nc/m^2$. Find,
   a. Total charge on sheet.
   b. The electric field at (0,0,5)
   c. The force experienced by $-1mc$ charge located at (0,0,5)

OR

A spherical charge distribution is given by,

$\rho = \rho_0(1 - \frac{r^2}{a^2})$ $r \leq a$ and $\rho = 0, r > a$.

a. Find the total amount of charge.
b. Calculate the electric field inside and outside the charge distribution. **[6]**

6. Given that , $\vec{J} = \frac{5e^{-1}\ ^{4t}}{\rho^2}\hat{a}_\rho\ A/m^2$, at t=0.1 ms, find;
   a. Current passing surface r=2m,
   b. The charge density ρ_v on the surface. **[6]**
7. State and prove Faradays law of electromagnetic induction and derive its Differential form. **[6]**

OR

Discuss different types of magnetic potential and derive expression for magnetic scalar potential.

8. A coil of 100 turns and 1 cm radius is kept coaxially within a long solenoid having 8 turns per cm and 5 cm radius. Calculate the mutual inductance.

OR

Two straight wires are kept in air 2m apart carrying currents 80 A and 30 A in the same direction. Calculate the force between them and specify its nature. **[6]**

9. Discuss about electromagnetic field and derive the plane electromagnetic waves in free space. **[6]**
10. Obtain the transmission line equations. **[6]**
11. Write the importance of boundary conditions satisfy by Electric and magnetic fields in between two dielectrics? Discuss the dielectric-dielectric boundary condition for Electric field ($\vec{E}$).

OR

Define relaxation time? Show that, $\rho_V = \rho_{V_0} e^{-t/\tau}$, where symbol have usual meaning. **[6]**

THE END