(b) Derive speed of electromagnetic wave in medium and write equation of refractive index of medium in term of absolute permittivity and permeability. 8

9. (a) If monochromatic electromagnetic wave is incident normally from a dielectric medium of refractive index (μ_1) on the surface of dielectric medium of refractive index (μ_2) then show that

reflection coefficient $(R)=\left(\frac{\mu_1-\mu_2}{(\mu_1+\mu_2)}\right)^2$ and

transmission coefficient $(T)=\frac{4\mu_1\mu_2}{(\mu_1+\mu_2)^2}$. 7

(b) Derive the equation of pressure exerted by electromagnetic wave of intensity 'I' incident normally on perfect absorber. The intensity of sunlight hitting the earth is about 1300W/m². If sunlight strikes a perfect absorber, what pressure does it exert? 8

B.Tech. (ECE) 2nd Semester (G-Scheme)
Examination, July–2022
INTRODUCTION TO ELECTROMAGNETIC THEORY
Paper– BSC-PHY-101-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all selecting **one** question from each unit **and question no. 1 is compulsory**. Each question carries equal marks.*

1. Attempt any *six* questions

(a) Write Laplace and Poisson equations.

(b) Define permanent magnet and electromagnet.

(c) If an electric dipole is placed in a sphere then find out electric flux linked with the sphere.

(d) Explain Lenz's law and self-induction.

(e) State Gauss divergence theorem and explain its physical significance.

(f) Find out the value of gradient of a scalar $(S) = x^2yz$ at a point P (1, 2, –1) *i. e.* $\vec{\nabla} S$.

(g) What do you mean by electromagnetic breaking?

(h) Define electric dipole and electric dipole moment.

$6\times2.5=15$

Unit - I

2. (a) What do you mean by polar and nonpolar dielectrics? Define electric field intensity $(\vec{E})$, electric polarization vector $(\vec{P})$ and electric displacement vector $(\vec{D})$ and derive the relation between them. 7

   (b) Derive electric field intensity and electric potential at equatorial line of short electric dipole. 8

3. (a) Derive boundary conditions of electric field intensity and electric potential. 7

   (b) State Gauss law in electrostatics and find out electric field intensity at distance 'r' from center of uniformly charged solid sphere of radius 'R' and volume charge density 'λ'. Plot the graph of variation of electric field with distance from center. 8

Unit - II

4. (a) State Biot-Savart law and derive magnetic field intensity at center current carrying circular wire. 7

   (b) Show that relative permeability $(\mu) = 1 + \chi_m$, where χ_m is magnetic susceptibility and discuss important properties of diamagnetic, paramagnetic and ferromagnetic materials. 8

5. (a) Define electric current density $(\vec{J})$ and magnetic vector potential $(\vec{A})$ and show that $\nabla^2 \vec{A} = -\mu_o \vec{J}$ 7

   (b) Define Ampere's law and derive its differential equation. Also discuss incompleteness of Ampere's law. 8

Unit - III

6. (a) Write Maxwell's equations in integral and differential form in vacuum and discuss their physical significance. 7

   (b) Derive equation of continuity and show that modified Ampere's law satisfies the equation of continuity. 8

7. (a) Show that magnetic energy stored in a magnetic field i.e., $U_m = \frac{1}{2\mu o} \int B^2 \, dV$. 7

   (b) State and prove Poynting theorem and show that Poynting vector $(\vec{S}) = \frac{1}{\mu o}(\vec{E} \times \vec{B})$ 8

Unit - IV

8. (a) Write important properties of electromagnetic wave and write equation of electromagnetic wave in term of electric field and magnetic field. 7