Dr. Subhash Chand Physics (199)

B.Tech. Engineering Physics (III-Sem) End Semester Examination (December, 2022)

Electromagnetic Theory (PH-213) **Total Marks = 50** **Time: 3.00 hrs.**

Note: Attempt all the questions.

Q. No.	Question statement	Marks
1 (a)	The temperature at any point in space is given by $T = x^2 + y^2 + z$. Will the temperature be same everywhere. If not in which direction the temperature will change maximum.	(4)
(b)	A point in space is displaced from its coordinates (r, θ, ϕ) to a new position having coordinates ($r+dr$, $\theta+d\theta$, $\phi+d\phi$). How much volume will be swapped during this displacement.	(3)
2 (a)	In a region the electrical potential is given as $V = \frac{24}{\sqrt{x^2+y^2+z^2}}$. Find the electrical field at (2,2,2).	(4)
(b)	Obtain the boundary condition for the electric displacement vector D at the interface of two dielectric media.	(3)
3	For an e.m. wave having electric field E parallel to the plane of incidence entering from one medium to another the ratio of reflected and incidence amplitudes of the electric field is given as $\frac{E_r}{E_i} = \frac{\tan(\theta_i-\theta_t)}{\tan(\theta_i+\theta_t)}$. Using this discuss the nature of reflected wave. Graphically show this ratio for incident angles from 0 to 90° and explain the Brewster angle. Also estimate the Brewster angle for wave incidence from air (refractive index 1) to glass (refractive index 1.5).	(7)
4 (a)	The magnetic vector potential in the region is given as $\vec{A} = (y^2\hat{i} + x^2\hat{j})$. Estimate the magnetic induction B and current density J associated with this potential.	(4)
(b)	Discuss the nature of magnetic flux density which may be expressed in terms of magnetic scalar potential.	(3)
5	A circular loop of radius R carries a current I. Show that it will be equivalent to a magnetic dipole. Estimate the magnetic moment of this dipole.	(7)
6	Identify the electromagnetic potentials so that the four Maxwell's equations may be expressed in terms of these potentials. Discuss the condition that makes these potentials satisfy the d'Alembert's equation.	(7)
7 (a)	What is the significance of skin depth. Calculate skin depth of copper for an electromagnetic wave of frequency 1MHz. The conductivity of copper is $\sigma=5.8\times10^7$ mho/m and permeability is 1.	(5)
(b)	If ϕ_m is the magnetic scalar potential, then show that it satisfies the Laplaces's equation (i.e. $\nabla^2\phi_m=0$).	(3)

***Good Luck ***