SHRI RAMSWAROOP MEMORIAL UNIVERSITY

End Semester Examination (2021-22)-Odd Semester

M.Sc. (Physics) – I Year (I Sem)

Course Name: Electromagnetic Theory	**Code: MPH1003**
Time: 02 Hours	**Max Marks: 60**

University Roll No.															

(To be filled by the Student)

Note: Please read instructions carefully:

a) *The question paper has 03 sections and it is compulsory to attempt all sections.*

b) *All questions of Section A are compulsory; questions in Section B and C contain choice.*

Section A: Very Short Answer type Questions Attempt all the questions.	BL	CLO	Marks (10)
1. How can a vector field be expressed as the gradient of scalar field?	BL2	CLO1	02
2. Define the terms phase velocity and group velocity.	BL1	CLO4	02
3. Write expression for differential length in cylindrical and spherical co- ordinates.	BL2	CLO1	02
4. Distinguish between displacement and conduction currents.	BL2	CLO3	02
5. Define magnetic flux density for a material.	BL1	CLO2	02
Section B: Short Answer Type Questions **Attempt any 03 out of 06 questions.**	**BL**	**CLO**	**Marks (30)**
1. If the magnetic field, $H = 100 \sin\theta \ a\theta$ A/m in spherical coordinates, determine J at $(10, \pi/2, 0)$.	BL3	CLO2	10
2. State Maxwell's equation and obtain them in integral and differential form.	BL4	CLO3	10
3. If a potential $V = x^2 yz + Ay^3 z$, (a) Find A so that Laplace's equation is satisfied with the value of A, determine electric field at $(2,1,-1)$.	BL3	CLO1	10
4. Derive the expressions for magnetic flux intensity due to solenoid of the coil using Bio-Savart law.	BL4	CLO2	10
5. Derive the boundary conditions of the normal and tangential components of electric field at the inter face of two media with different dielectrics	BL4	CLO3	10
6. Find the cut-off frequencies for TE12 mode in a hollow rectangular wave guide whose dimensions are (a) a = 2.286 cm, b=1.016 cm, (b) a = 1 cm, b=1 cm.	BL3	CLO4	10

Section C: Long Answer Type Questions Attempt any 01 out of 03 questions.	BL	CLO	Marks (20)
1. Discuss the propagation of TM waves in a rectangular waveguide with relevant expressions and diagrams for the field components. **or** Determine the reflection coefficient of oblique incidence in perfect dielectric for perpendicular polarization	BL4	CLO4	20
2. Obtained and discuss the solutions of Laplace equation in spherical coordinate system by orthogonal function. If electric flux density, **D** is given by **D** = [($2y^2+z$) **a$_x$** +4xy **a$_y$** + x **a$_z$**)] $\mu C/m^2$. Find the volume charge density at (0,0,0) and (-1, 0 ,4).	BL3	CLO1	20
3. Derive the electromagnetic wave equation for non conducting medium and also discuss the propagation of wave. In a three dimensional space, divided into region 1 (x<0) and region 2 (x>0), **σ$_1$** = **σ$_2$** = 0. **E$_1$** = 1**a$_x$** + 2**a$_y$** + 3**a$_z$**. Find **E$_2$** and **D$_2$**. $\varepsilon_{r1 = 1}$ and $\varepsilon_{r2 = 2}$.	BL4	CLO3	20