BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2023)

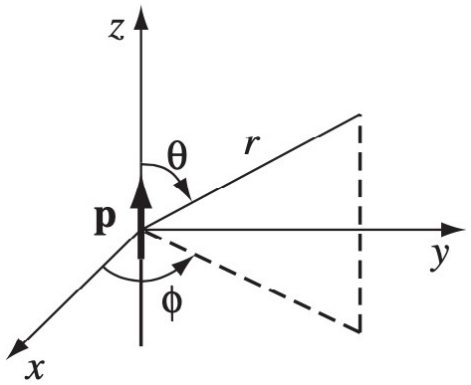
CLASS: IMSc **SEMESTER : II**
BRANCH: MATHS & COMPUTING **SESSION : SP2023**

SUBJECT: PH109 PHYSICS-I

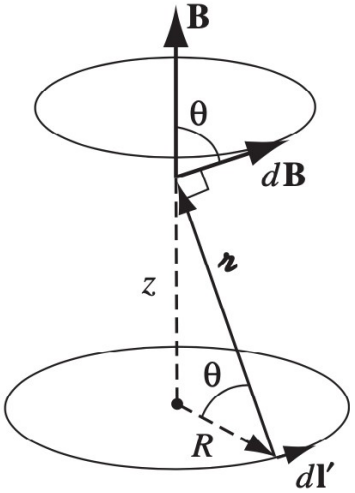
TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Define electrostatic potential. How is it related to the Electric Field ?	[2]	1	1
Q.1(b)	Determine the expression for the capacitance of a parallel plate capacitor. What are the various ways to increase its capacitance ?	[3]	1	5
Q.2(a)	Define electric dipole moment $\vec{p}$. What happens when an electric dipole is placed in a uniform, external electric field $\vec{E}$?	[2]	1	1
Q.2(b)	Evaluate the expression for the electric field due to an electric dipole at a distance r from it as shown in this figure.	[3]	1	5



Q.3(a)	Define inductance of a steady current carrying circuit. What is the difference between "self-inductance" and "mutual inductance" ?	[2]	1	1
Q.3(b)	Estimate the magnetic field a distance z above the center of a circular loop of radius R, which carries a steady current I (See Fig).	[3]	1	6



PTO

Q.4(a)	List all the Maxwell's equations in free space. What does each equation physically signify ?	[2]	1	1
Q.4(b)	Show that Maxwell's equations in vacuum predict that electric and magnetic fields satisfy the wave equation. What is the velocity of those electromagnetic waves ?	[3]	1	2
Q.5(a)	Define Poynting vector $\vec{S}$. What does it physically represent ?	[2]	1	
Q.5(b)	An Electromagnetic wave travels in free space with electric field component: $\vec{E} = 100\, e^{i(0.866y + 0.5z)}\, \hat{x}$ Volts/meter	[3]	1	

Determine the following:

(i) Angular frequency (ω) and wavelength (λ)

(ii) Magnetic Field ($\vec{H}$)

(iii) Energy flux density

(iv) Energy and momentum density

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