

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: IMSc
BRANCH: PHYSICS

SEMESTER : VI
SESSION : SP/2025

SUBJECT: PH315 ELECTROMAGNETIC THEORY

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)	What is Coulomb gauge?	[2] 1	1
Q.1(b)	Develop Maxwell's field equations of electromagnetic vector and scalar potentials.	[3] 1	6
Q.2(a)	What do you understand by momentum density of electromagnetic wave?	[2] 1	1
Q.2(b)	Explain how Maxwell's generalized Ampere's circuital law.	[3] 1	2
Q.3(a)	Starting from Maxwell's equations illustrate the wave equation in a conducting medium.	[2] 2	2
Q.3(b)	Show that the electromagnetic wave in unbounded media has transverse nature.	[3] 2	2
Q.4(a)	Find the wavelength and the propagation speed in copper for radio waves at 1 MHz. For copper assume $\epsilon=\epsilon_0$, $\mu=\mu_0$ and conductivity $\sigma=5.8\times 10^7 (\Omega\text{-m})^{-1}$.	[2] 2	1
Q.4(b)	Determine the expression for electrical conductivity of ionized gas.	[3] 2	5
Q.5(a)	An EM wave is incident normally from air on air-glass interface. Find the amplitude reflection coefficient. Taking refractive index of the glass= 1.5	[2] 3	1
Q.5(b)	Determine the relation between wave impedance and refractive index of the medium.	[3] 3	5

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