

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

CLASS: IMSc
BRANCH: PHYSICS

SEMESTER : VI
SESSION : SP/2025

SUBJECT: PH321 ADVANCED EXPERIMENTAL TECHNIQUES (AET)

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)	How are the characteristic X-rays produced? Explain your answer using schematic.	[2]	1 2
Q.1(b)	With schematic briefly describe the working principle of a sealed X-ray tube to produce X-ray.	[3]	1 2
Q.2(a)	Write down the Scherrer's formula to calculate the crystallite sizes from XRD pattern and explain all the terms.	[2]	1 1
Q.2(b)	Write down Bragg's equation in X-ray diffraction. A beam of X-rays of wavelength 0.154 nm undergoes Bragg reflection from planes of spacing 0.91 Å. Find the incident angle for the first-order Bragg diffraction.	[3]	1 3
Q.3(a)	How the X-ray reflectivity (XRR) plots would look for a 20 nm and a 5 nm of Au films on a silicon surface (assume all other parameters remain the same).	[2]	1 2
Q.3(b)	In the powder X-ray diffraction experiment, what information can we get from the position of a Bragg peak and the peak width of a crystalline material?	[3]	1 2
Q.4(a)	What are the advantages and disadvantages of an optical microscope over an electron microscope?	[2]	2 2
Q.4(b)	How the resolution in scanning electron microscopes be improved? Why is vacuum required in scanning electron microscope?	[3]	2 2
Q.5(a)	Schematically present different processes involved when an electron beam interacts with matter.	[2]	2 2
Q.5(b)	Briefly discuss any two of the processes.	[3]	2 2

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