

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: IMSc
BRANCH: PHYSICS**

**SEMESTER: VI
SESSION: SP/2025**

SUBJECT: PH321 ADVANCED EXPERIMENTAL TECHNIQUES (AET)

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a)	Determine the lattice parameter of aluminum (Al) from the following Cu $K\alpha$ X-ray diffraction (XRD) data: 2theta (degree)- 38.43, 44.67, 65.02, 78.13, 82.33 Intensity (a.u.)- 100, 46.9, 26.4, 27.9, 7.8	[5] 1	3
Q.1(b)	What are the factors that influence the relative intensity of diffraction peaks in powder XRD pattern? Discuss the impact of temperature variation on the XRD pattern.	[5] 1	1,2,4
Q.2(a)	With schematic briefly discuss the mechanism to produce Auger electrons. How can an Auger peak be differentiated from a photoelectron peak in a typical XPS spectrum?	[5] 2	1,2,3
Q.2(b)	Draw a schematic of the experimental setup for X-ray Photoelectron Spectroscopy (XPS) and briefly describe how XPS works.	[5] 2	2
Q.3(a)	What is Thermogravimetric Analysis (TGA)? How does it work? Highlight its primary applications.	[5] 3	1,2
Q.3(b)	Draw a typical TGA curve and explain the key features observed in the graph. What is the primary difference between TGA and Differential Thermal Analysis (DTA)?	[5] 3	1,2
Q.4(a)	Briefly describe the concept of cyclic voltammetry (CV). Describe a basic instrumental setup (with schematic) use for CV measurements.	[5] 4	1,2
Q.4(b)	Draw a typical plot obtained from CV measurements (cyclic voltammogram). Explain the features of the curve to understand different processes involved. What are the primary applications of CV measurements?	[5] 4	1,2,3
Q.5(a)	Discuss any two physical vapor deposition (PVD) methods used for thin film growth. What is the main difference between PVD and chemical vapor deposition (CVD)?	[5] 5	1,2
Q.5(b)	Draw a schematic of a turbomolecular pump and explain how it functions.	[5] 5	2

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