

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -2 EXAMINATION-2025

PhD II Semester (CE)

COURSE CODE (CREDITS): 24P1WCE232 (3)

MAX. MARKS: 25

COURSE NAME: Characterization of Materials

COURSE INSTRUCTORS: Dr. Saurav

MAX. TIME: 1.5 Hour

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

Q.No	Question	CO	Marks
Q1	(a) Describe the fundamental principle behind X-ray diffraction. Explain how the diffraction angle is related to the inter planar spacing of crystal planes. (b) Define Bragg's Law and explain its significance in X-ray diffraction analysis. What factors affect the intensity of diffracted X-rays in a crystalline material?	2	7
Q2	For a cubic crystal, the inter planar spacing (d) for a plane is given by the equation: $\frac{1}{d^2} = \frac{h^2 + k^2 + l^2}{a^2}$ Where notations have their usual meanings. Given that the lattice constant is 3.615 \AA , for Copper (FCC structure) calculate the inter planer spacing for 211 plane and 220 plane.	2	4
Q3.	A diffraction pattern shows a peak at $2\theta = 38.52^\circ$. The X-ray wavelength used is 1.5406 \AA (Cu $K\alpha$). Using Bragg's law, calculate the inter planar spacing d for the plane corresponding to this peak.	2	3
Q4.	(a) Discuss the importance of sample preparation in XRD analysis. (b) What are the effects of poor sample grinding or sample mounting in X-ray diffraction studies?	2	7
Q5.	Calculate the theoretical density of a metal having a face-centered cubic (FCC) crystal structure. The atomic mass of the metal is 58.69 g/mol , and the lattice constant is $a=3.61 \text{ \AA}$. Assume that the metal has an FCC structure and Avogadro's number is $6.022 \times 10^{23} \text{ atoms/mol}$.	2	4