

B. E Metallurgical Engineering, 4th Yr. 2nd Sem. Examination, 2025

X- Ray Diffraction and Electron microscopy

Time: Three hours

Full Marks: 100

Answer questions from each COs. (Answer all parts of a question sequentially in a common place)

1. a) Define a pole and trace of a pole. Define great circle and small circle.
b) Define the Miller Indices of a pole with the help of Wolff net. Do it for a FCC Unit Cell
c) Explain the Braggs' Law. Make the differences between Reflection and Diffraction.

(CO1)

8+4+8=20

2. a). What is non ideal Diffraction? Derive Scherrer's Formula and calculate the particle size.

- b) Compare the Laue method, Rotating crystal method and powder method for diffraction.

(CO2)

3+4+4+3+6= 20

3. a) Compare the Laue method, Rotating crystal method and powder method for diffraction.
b) Draw the XRD pattern of a crystalline solid, an amorphous solid and an monoatomic gas.
c) Determine the values of 2θ and (hkl) for the first three lines (those of lowest θ values) of the powder patterns of substances with the following structures, the incident radiation is Cu $K\alpha$,
 - i) simple cubic ($a = 2\text{\AA}$)
 - ii) simple face centred cubic ($a=4\text{\AA}$)
 - iii) simple tetragonal ($a= 2\text{\AA}$, $c=3\text{\AA}$)

(CO3)

5+3+12= 20

or

[Turn over

3. a) Derive the structure factor of a close packed Hexagonal unit cell.

b) Explain briefly the Lorentz Polarization factor. [CO3] 10+10 = 20

4. Describe the following applications of X-Rays.

a) Solvus curve determination. b) Retained austenite estimation in a hardened and

quenched steel. [CO4] 10+10 = 20

5. Write short notes on the following.

a) Scanning Electron Microscopy b) Transmission Electron Microscopy [CO5] 10+10 = 20

or

5. a) What is reciprocal lattice? State its properties and prove them. Apply RL concept to

Powder diffraction pattern and explain the importance of sphere of reflection, limiting

Sphere. [CO5] 3+4+5+5= 20