Ex/Met/PC/B/T/421/2024

B. E Metallurgical Engineering, 4thYr. 2nd Sem. Examination, 2024

X- Ray 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) Draw energy level diagram of an atom to show the excitation processes and develop an expression for λ (K_α) radiation.

   b) Explain the importance of Filters in Monochromatic X-ray radiation.

   c) State the differences between White Radiation and Characteristic Radiation.

   [CO1] 10+5+5= 20

Or

1. a) Define a pole, trace of a pole, great circle and small circle.

   b) Draw and explain the Stereographic projection of Cubic Crystals on (010).

   [CO1] 8+6+6= 20

2. What is Diffraction? Derive Bragg's Law. What is non ideal Diffraction? Derive Scherrer's Formula and calculate the particle size. [CO2] 3+4+3+10=20

or

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

   b) Explain briefly the multiplicity and temperature factor. [CO2] 10+10 = 20

[Turn over

3. a) Calculate 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 Kα,

i) simple cubic (a = 3.5A°)

ii) simple face centred cubic (a=3 A°)

iii) simple tetragonal (a= 2A°, c=3A°) [CO3] 20

4. Describe the following applications of X-Rays.

a) Solvus curve determination. b) Retained austenite estimation in a hardened and quenched steel. [CO4] 20

5. Write short notes on the following (Any two).

a)Scanning Electron Microscopy b) TEM c) EDAX analysis. [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 and calculate the total number of reflections. [CO5] 20