

B. Metallurgical Engineering, 4thYr. 2nd Sem. Examination, 2019

X- Ray and Electron microscopy

Time: Three hours

Full Marks: 100

Answer any five questions from the following. (Answer all parts of a question sequentially in a common place)

1. a) State the differences between fluorescent radiation and characteristic radiation.
b) Why isn't it possible to get a strictly monochromatic X-Ray by filtration?
c) Draw energy level diagram of an atom to show the excitation processes and develop an expression for λ (K_{α}) radiation. 20

2. What is Diffraction? Derive Bragg's Law. What is non ideal Diffraction? Derive Scherrer's Formula and calculate the particle size. 20

3. 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. 20

4. a) Define a pole and trace of a pole, great circle and small circle. 12
b) How can you estimate the Miller indices of a pole in a standard projection? Justify the method. 8

5. a) Derive an expression for Lorentz polarization factor.
b) Explain briefly the multiplicity factor. 20

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6.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 $\text{Cu K}\alpha$,

- i) simple cubic ($a = 3\text{A}^\circ$)
- ii) simple face centred cubic ($a=3\text{A}^\circ$)
- iii) simple tetragonal ($a= 2\text{A}^\circ, c=3\text{A}^\circ$) 20

b) Derive an extrapolation function for precise lattice parameter determination. 20

7. Describe the following applications of X-Rays.

a) Retained austenite estimation in a hardened and quenched steel.

b) Solvus curve determination. 20