

B.E. (MET) Part-III 5th Semester Examination, November 2013
X-RAY AND ELECTRON DIFFRACTION (MT-503)

Time: 3 hours

Full Marks :70

Answer question **no. 1** and any **Five** from the rest
Marks in the margin indicate full marks
All parts of a question must be written at one place
Give neat sketches wherever necessary
Graph paper may be required

1. Answer the following (any **Five**): [4 x 5]
 - (a) How does the applied voltage affect the continuous x-ray spectrum of target metal?
 - (b) Wavelength of k-absorption edge is less than that of k-characteristic spectrum – explain.
 - (c) Explain multiplicity factor.
 - (d) Mathematically show if there is any diffraction from $(2\bar{1}0)$ plane in a bcc crystal or not.
 - (e) Calculate the interplanar angles between (110) & (101) and (110) & $(1\bar{1}0)$ sets of planes.
 - (f) Show that $(1\bar{1}1)$ plane does not belong to a zone whose zone axis is $[100]$, but belongs to a zone whose zone axis is $[110]$.
 - (g) Calculate the magnitude of reciprocal lattice vector for 220 plane when the lattice parameter is 4\AA .
2. (a) What is the importance of scan speed of a sample while recording the diffraction pattern in a diffractometer?
(b) Explain the importance of broadening of diffraction pattern in Intensity vs. 2θ curve. In which condition does broadening occur? [4+6]
3. The powder pattern of a cubic metal with $\text{Cu}_{K\alpha}$ radiation ($\lambda = 1.5418 \text{\AA}$) contains seven lines whose 2θ values in degrees are 39.1, 45.4, 65.7, 78.8, 83, 99.6 and 112.5. Index these lines, identify the Bravais lattice and determine the lattice parameter. [10]
4. Briefly discuss the Lattice Parameter method of determining the solvus curves using X-ray. [10]
5. Explain the Hanawalt method of qualitative chemical analysis using X-ray diffractometry. Identify the practical difficulties in this procedure. [7+3]
6. (a) Identify the different types of lens aberrations, their causes and remedies in Transmission Electron Microscope.
(b) Briefly explain the dark and bright field images in Transmission Electron Microscope. [7+3]

[P.T.O.]

7. Neatly draw the two dimensional reciprocal lattice of a bcc crystal at least for two planes, in scale, showing all the reciprocal lattice vectors present there. (001) is the plane of reflection. Lattice parameter of the crystal is 4\AA . [10]
8. Write technical notes on: [5 x 2]
- (a) Proportional counter
 - (b) Thin film sample for TEM study.