

**B.E. (MET) Part-III 5th Semester Examination, 2012**  
**X-RAY AND CRYSTALLOGRAPHY (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 x-ray spectrum of target metal?
  - (b) What is Compton effect?
  - (c) Explain multiplicity factor.
  - (d) There is no diffraction from  $(2\bar{1}0)$  plane in a bcc crystal. Justify.
  - (e) Calculate the interplanar angles between  $(101)$  &  $(110)$  and  $(110)$  &  $(1\bar{1}0)$  sets of planes.
  - (f)  $(1\bar{1}1)$  plane does not belong to a zone whose zone axis is  $[100]$ , but belongs to a zone whose zone axis is  $[110]$ .
  - (g) Explain the principle of a collimator and its function in X-ray diffraction study.
  - (h) Briefly discuss Moseley's law.
  
2. (a) Explain why a series of K lines —  $K_{\alpha 1}$ ,  $K_{\alpha 2}$  and  $K_{\beta}$  appear in the characteristic spectrum of X-rays?  
(b) Briefly discuss the advantages and limitations of X-ray diffractometer over Debye-Scherrer Camera method. [5 + 5]
  
3. Compare the relative advantages and disadvantages of Proportional counter, Geiger counter and Scintillation counter as used in X-ray. [10]
  
4. How can X-ray diffraction method be applied to find out if a crystal structure is long-range ordered or not? Explain with a suitable example. [10]
  
5. Briefly discuss the Lattice Parameter method of determining the solvus curves using X-ray. [10]
  
6. Explain the Hanawalt method of qualitative chemical analysis using X-ray diffractometry. Identify the practical difficulties in this procedure. [7 + 3]
  
7. List the different methods of quantitative analysis using X-ray spectroscopy. Briefly discuss the causes of errors and the way to overcome them. [10]
  
8. Prove Bragg law using reciprocal lattice vector system. [10]