



B.E/B. Tech (Full Time) DEGREE END SEMESTER EXAMINATION NOV/DEC 2011

MATERIALS SCIENCE AND ENGINEERING

FIFTH SEMESTER – R 2008

ML 9303 – CHARACTERISATION OF MATERIALS

Time: 3 hr

Max. Marks: 100

PART – A (2 X 10 =20)

Define the following:

1. Multiplicity factor
2. Auger electrons

Answer the following by graphical/pictorial representation ONLY:

3. Distortion in optical microscopy
4. Moseley relationship
5. Effect on voltage on the gas amplification factor

State the reason for the following:

6. Non-contact AFM has slower scan speed than other types of AFM.
7. Only conductive or semi-conductive samples can be analyzed in STM.
8. The resolution of optical microscopy using interference principle is the highest.
9. Non-uniform strain results in peak broadening in XRD.
10. Allotropic phase changes cannot be analyzed by thermal gravimetric method.

PART – B (5 X 16 =80)

11. (a) (i) Derive simplified expression for F^2 for diamond which is cubic and contains 8 atoms per unit cell, located at following positions:

$$\begin{array}{cccc} 0 & 0 & 0 & \\ \frac{1}{2} & \frac{1}{2} & 0 & \\ \frac{1}{4} & \frac{1}{4} & \frac{1}{4} & \\ \frac{3}{4} & \frac{3}{4} & \frac{1}{4} & \end{array} \quad \begin{array}{cccc} \frac{1}{2} & 0 & \frac{1}{2} & \\ 0 & \frac{1}{2} & \frac{1}{2} & \\ \frac{3}{4} & \frac{1}{4} & \frac{3}{4} & \\ \frac{1}{4} & \frac{3}{4} & \frac{3}{4} & \end{array} \quad (8)$$

(ii) Brief on true absorption of X-ray and its consideration in choice of X-ray for diffraction studies of a material and in selection of filters. (8)

12. (a) (i) Describe Kohler Illumination system. (8)

(ii) Describe the working principle of phase contrast optical microscopy (8)

(OR)

- (b) (i) Describe working principle of interference based optical microscopy. (8)
(ii) Describe working principle of polarized microscopy. (8)

13. (a) (i) Show that diffraction at two different inclination helps in determination of residual stress of the materials. (8)
(ii) The powder pattern of alumina, made with Cu K_α , contain ten lines, whose $\sin^2\Theta$ values are 0.1118, 0.1487, 0.294, 0.403, 0.439, 0.583, 0.691, 0.727, 0.872 and 0.981. Index these lines and calculate the lattice parameter. (8)

(OR)

- (b) (i) Brief on semiconductor type of counter for X-ray intensity measurement. (6)
(ii) Compare and contrast External Standard and Direct Comparison Method of quantitative XRD analysis of phases. (10)

14. (a) (i) Draw ray diagram for bright field and dark field imaging in TEM. (4)
(ii) Derive an equation governing selected area electron diffraction and construct a pattern for a hypothetical BCC crystal system for zone axis of [110]. (8)
(iii) What do you mean by phase contrast and amplitude contrast in TEM? (4)

(OR)

- (b) (i) Brief on the various signals out of electron beam materials interaction in SEM and compare their use for imaging in terms of resolution, escape depth and its application. (14)
(ii) What do you mean by empty magnification? (2)

15. (a) (i) Differentiate between WDS and EDS technique of chemical analysis. (14)
(ii) What are the advantages of Auger Electron Spectroscopy? (2)

(OR)

- (b) (i) Compare DTA and DSC techniques. (12)
(ii) Give an example for endothermic and exothermic chemical reaction as well as for endothermic and exothermic physical process. (4)

- Best of Luck -