

Reg. No. :

Question Paper Code : 10863

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Elective

Manufacturing Engineering

MF 4013 – MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the major differences between electropolishing and electro-etching?
2. The intensity of Diffracted beam in XRD is independent on type of unit cell. Justify.
3. What do you mean by zone axis in SAED indexing?
4. In SEM the information is obtained with electron-solid interactions when electron beam strikes a sample- Comment.
5. "DSC is widely used in industrial settings as a quality control, instrument" – Comment.
6. Why allotropic phase changes cannot be analysed by the thermo-Gravimetric method?
7. Differentiate between Hardness and Hardenability.
8. What is the significance of true stress and true strain curve?
9. How does Low cycle fatigue differ from High cycle fatigue?
10. What is the significance of Larson Miller Parameter?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw a labeled diagram of optical microscope. (3)
(ii) Explain function of each part explaining critically its importance. (7)
(iii) Discuss Aberration and its remedies. (3)

Or

- (b) (i) Brief on the X-ray generation and state what do you mean by characteristic X-ray, White radiation and Filters. (8)
(ii) How does the shortest wavelength vary with atomic number and voltage? (5)
12. (a) Derive an equation governing selected area electron diffraction and construct a pattern for a hypothetical BCC crystal system with zone axis of $[1\ 0\ 0]$

Or

- (b) (i) Discuss on the electron beam — materials interaction, in SEM. (8)
(ii) Brief the applications of SEM in characterizing electronic circuit boards. (5)
13. (a) (i) A typical DSC curve of a Polymorphic system exhibits endothermic peaks and exothermic peaks. What information can be obtained from these events and explain them. (5)
(ii) Explain the basic working principle of X-ray Spectrometry with a schematic diagram. (8)

Or

- (b) Describe the working principle of Differential Thermogravimetry for analyzing powder samples at Constant rate.
14. (a) Discuss in detail the mechanical testing methods that is adopted to determine the impact strength of an engineering material.

Or

- (b) Explain in detail the testing procedure involved in the Rockwell hardness testing.

15. (a) Describe in detail the Rotating beam and Plate bending methods of High cycle fatigue testing.

Or

- (b) Discuss the different stages of creep when a component is subjected to elevated temperature and loading during its service.

PART C — (1 × 15 = 15 marks)

16. (a) Show with calculation and graphical representation, how the residual stress is determined by "Two exposure" diffraction method.

Or

- (b) Derive Bragg's law for X-ray diffraction. Explain its application with Debye Scherer method for crystal structure determination.

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