

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII EXAMINATION – SUMMER 2025

**Subject Code:3172109**

**Date:19-05-2025**

**Subject Name:Materials Characterization**

**Time:02:30 PM TO 05:00 PM**

**Total Marks:70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

|            |                                                                                                                   | MARKS     |
|------------|-------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | (a) Discuss advantages of STEM over conventional TEM and SEM.                                                     | <b>03</b> |
|            | (b) Discuss- Diffraction pattern in TEM.                                                                          | <b>04</b> |
|            | (c) Draw schematic showing components of the SEM. Briefly explain each component and its working in SEM.          | <b>07</b> |
| <b>Q.2</b> | (a) What is optical microscopy? List the types of microscopes.                                                    | <b>03</b> |
|            | (b) Explain resolution of Microscope in using the formula.                                                        | <b>04</b> |
|            | (c) What do you mean by Vacuum gauge? Explain the Penning gauge with merits, limitations and applications.        | <b>07</b> |
|            | <b>OR</b>                                                                                                         |           |
|            | (c) Explain the principle and instrumentation of Diffusion pump with merits and applications.                     | <b>07</b> |
| <b>Q.3</b> | (a) Discuss the applications of Thermogravimetric analysis.                                                       | <b>03</b> |
|            | (b) Describe the difference in Heat flux DSC and Power Compensated DSC.                                           | <b>04</b> |
|            | (c) Describe the important steps for microstructural study by image analysis. List its applications.              | <b>07</b> |
|            | <b>OR</b>                                                                                                         |           |
| <b>Q.3</b> | (a) What do you meant by thermal analysis? Give its significance.                                                 | <b>03</b> |
|            | (b) Discuss the difference between DSC and DTA.                                                                   | <b>04</b> |
|            | (c) Describe the importance of Material characterization techniques. List important techniques with applications. | <b>07</b> |
| <b>Q.4</b> | (a) What is Spectroscopy? Write their classification.                                                             | <b>03</b> |
|            | (b) Explain the principle and working of WDS.                                                                     | <b>04</b> |
|            | (c) Explain the principle and instrumentation of AFM. Give merits and uses.                                       | <b>07</b> |
|            | <b>OR</b>                                                                                                         |           |
| <b>Q.4</b> | (a) Give applications and limitations of Field Ion Microscope.                                                    | <b>03</b> |
|            | (b) Explain the principle involved in Atomic Microscopy.                                                          | <b>04</b> |
|            | (c) With a block diagram explain the working of XRF system. Give merits.                                          | <b>07</b> |
| <b>Q.5</b> | (a) Derive Bragg's law.                                                                                           | <b>03</b> |
|            | (b) Explain how Bragg's law is useful to study crystal structure.                                                 | <b>04</b> |
|            | (c) Discuss Electron Probe Mico Analysis in terms of instrumentation and working principle using line diagram.    | <b>07</b> |
|            | <b>OR</b>                                                                                                         |           |
| <b>Q.5</b> | (a) Give applications and limitations of LEED.                                                                    | <b>03</b> |
|            | (b) Compare X-ray Photoelectron Specroscopy and Auger Electron Spectroscopy techniques.                           | <b>04</b> |
|            | (c) Explain Laue method of diffraction. Discuss advantages and limitations of Laue method.                        | <b>07</b> |

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