

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3172109

Date: 01/06/2026

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.**

- Q.1**
- (a)** Classify Material characterization techniques. **03**
 - (b)** What is Magnification of Microscope? For a metallurgical microscope explain how you will get desired total magnification? **04**
 - (c)** Discuss the Principle, Working and application of DTA. **07**
- Q.2**
- (a)** Give the difference between Heat flux DSC and Power Compensated DSC. **03**
 - (b)** Interpret the method used to calculate enthalpies of transitions from DSC curve. **04**
 - (c)** Explain the principle and instrumentation of Rotary pump with their merits, limitations and applications. **07**
- OR**
- Q.2**
- (c)** What is Vacuum gauge? Explain the principle and instrumentation of Pirani gauge with their merits and limitations. **07**
- Q.3**
- (a)** Discuss advantages of AES. **03**
 - (b)** Interpret the effect of Refractive index of the medium on resolution of the microscope. **04**
 - (c)** Compare different x-ray diffraction methods including their method, advantages and limitations. **07**
- OR**
- Q.3**
- (a)** What are the advantages and disadvantages of Laue method? **03**
 - (b)** Explain briefly Laue method of diffraction. **04**
 - (c)** Describe the steps for microstructural study by image analysis. Discuss applications of Image analyzer. **07**
- Q.4**
- (a)** Describe the Back scattered electron detector in SEM. **03**
 - (b)** With a ray diagram Describe working of TEM. **04**
 - (c)** What do you mean by Field Ion Microscope? Describe the principle and instrumentation. Give applications. **07**
- OR**
- Q.4**
- (a)** Explore the Secondary electron detector in SEM. **03**
 - (b)** Discuss the sample preparation techniques for TEM. **04**
 - (c)** Discuss the principle and instrumentation of STM. Give merits, limitations and applications. **07**

- Q.5** (a) Give applications and limitations of Auger Electron Spectroscopy **03**
(b) Explain the principle and instrumentation of XPS. **04**
(c) Describe the instrumentation of AAS and explain working of it. List the applications & limitations. **07**

OR

- Q.5** (a) Give applications and limitations of XPS. **03**
(b) Describe the Auger Electron Spectroscopy. **04**
(c) Explain qualitative analysis setup for specimen, microscope column and X-ray spectrometer in EDS analysis. **07**
