

# **KAMARAJ COLLEGE (Autonomous)**

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

**(6 Pages)**

**Reg. No: .....**

**Question Code No : 250003311**

**Course Code : 24PEPH26**

**PG Degree - End Semester Examinations, November 2025**

**Second Semester**

**M.Sc. PHYSICS**

**Characterization of Materials**

**(For those who joined in July 2024 onwards)**

**Time : 3Hours**

**Maximum : 75 Marks**

**PART – A (10 × 1 = 10 Marks)**

**Answer ALL Questions**

**Choose the correct answer :**

1. In a DTA curve, an exotherm results when the temperature of the sample is \_\_\_\_\_ than that of the reference.  
(a) Equal (b) Smaller  
(c) Greater (d) None of these
2. In a DTG curve, \_\_\_\_\_ is plotted against temperature.

- (a) W (b) Rate of change of weight  
(c) V (d) None of these

3. Dark field microscopy is most useful for observing
- (a) Stained samples
  - (b) Highly reflective surfaces
  - (c) Transparent, unstained specimens
  - (d) Fluorescent dyes
4. Phase contrast microscopy converts phase shifts in light into
- (a) Polarized light
  - (b) Colour differences
  - (c) Amplitude difference(contrast)
  - (d) Refractive index changes
5. In EPMA, the emitted X-rays are measured using
- (a) Energy dispersive detectors
  - (b) Wavelength dispersive spectrometers
  - (c) Photo multiplier tubes
  - (d) UV detectors
6. In SEM, the resolution mainly depends on
- (a) Wave length of the incident X-ray
  - (b) Spot size of the electron beam
  - (c) Thickness of the sample

- (d) Emission of secondary electrons
7. The Van der Pauw method is used to measure
- (a) Carrier mobility
  - (b) Hall coefficient
  - (c) Sheet resistance of arbitrarily shaped samples
  - (d) Band gap energy
8. In Hall effect measurements, the sign of the Hall Voltage indicates
- (a) Magnitude of carrier concentration
  - (b) Type of charge carriers
  - (c) Mobility of carriers
  - (d) Temperature dependence of resistivity
9. What is the typical wavelength range for UV-Vis spectroscopy?
- (a) 100-200 nm
  - (b) 200-800 nm
  - (c) 800-2500 nm
  - (d) 2500-5000 nm
10. Raman scattering involves which type of molecular interaction?
- (a) Absorption
  - (b) Emission
  - (c) Inelastic scattering
  - (d) Elastic scattering

**PART - B (5 X 5 = 25 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 250 words.**

11. (a) Compare DTA and TGA.

**(OR)**

(b) How are cooling curves obtained and interpreted in DTA? Explain.

12. (a) Discuss the steps for microstructural study by image analysis.

**(OR)**

(b) What is digital holographic microscopy? Explain.

13. (a) Differentiate between secondary and backscattered electron imaging in SEM.

**(OR)**

(b) Describe the instrumentation and detector used in EDAX.

14. (a) Describe the electrochemical C-V profiling technique and its significance.

**(OR)**

(b) What precautions are needed for accurate photoluminescence measurements? Explain.

15. (a) Describe the components of an ESR spectrometer.

**(OR)**

(b) How is PIXE useful in elemental analysis? Explain.

**PART - C (5 X 8 = 40 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 600 words.**

16. (a) Describe the instrumentation of TGA. Explain how TGA is used to determine weight loss and decomposition products of materials.

**(OR)**

(b) Discuss the working principle of DSC and explain how it can be used to study thermo mechanical parameters.

17. (a) Discuss the principle, working and applications of fluorescence microscopy.

**(OR)**

(b) Explain the construction and working of confocal microscopy.

18. (a) Explain with a neat diagram of TEM setup and its use in characterisation of nano materials.

**(OR)**

(b) What do you mean by AFM? Explain the principle and Instrumentation of AFM.

19. (a) Explain the working principle of the two-probe and four-probe methods for measuring resistivity.

**(OR)**

(b) Explain the instrumentation of electroluminescence with a neat diagram.

20. (a) What is Nuclear Quadrupole Resonance? Explain its principle and how it complements NMR?

**(OR)**

(b) How can particle size and texture of a crystalline material be studied using XRD? Explain with suitable examples.