

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 : 25E03304

Sub Code : 24PEPH26

PG Degree - End Semester Examinations, April 2025

Second Semester

M.Sc. PHYSICS

Elective - Characterization of Materials

(For those who joined in July 2024 onwards)

Time : 3Hours

Maximum : 75 Marks

PART - A ($10 \times 1 = 10$ Marks)

Answer ALL Questions

Choose the correct answer :

1. A substance which is commonly used as a reference material in DTA is _____
(a) Iron (b) Alumina
(c) Chromium oxide (d) None of these

2. In DSC, glass transition appears as
- (a) A sharp endothermic peak
 - (b) A sudden weight loss
 - (c) A baseline shift
 - (d) A sharp exothermic peak
3. An image analyzer in microscopy is used for
- (a) Viewing only
 - (b) Storing samples
 - (c) Automated quantitative measurements
 - (d) Polarized light imaging
4. Digital holographic microscopy provides
- (a) Fluorescence-based contrast
 - (b) High-resolution colour images
 - (c) Quantitative phase imaging
 - (d) Electron diffraction patterns
5. AFM can be used to image
- (a) Only conductive samples
 - (b) Only vacuum-stable samples
 - (c) Both conductive and non-conductive samples
 - (d) Only metals
6. STM operates on the principle of
- (a) Vander waals forces
 - (b) Electrostatic attractions

- (c) Quantum tunnelling of electrons
 - (d) Thermal conductivity
7. Electrochemical C-V profiling is particularly useful for
- (a) Measuring surface roughness
 - (b) Determining deep level traps
 - (c) Profiling doping concentration as a function of depth
 - (d) Measuring carrier mobility
8. The capacitance of a schottky barrier diode decreases with increasing reverse bias due to
- (a) Increase in carrier concentration
 - (b) Decrease in depletion width
 - (c) Increase in depletion width
 - (d) Decrease in built-in potential
9. ESR is used to detect species with
- (a) Zero spin
 - (b) Unpaired electrons
 - (c) Paired electrons
 - (d) Neutral charge
10. PIXE works by irradiating samples with
- (a) Neutrons
 - (b) Protons
 - (c) Electrons
 - (d) X-rays

PART – B (5 X 5 = 25 Marks)

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

Answer should not exceed 250 words.

11. (a) List the advantages of DSC over DTA and TGA in thermal analysis.

(OR)

- (b) Explain the basic instrumentation of a TGA.

12. (a) Explain the steps involved in the specimen preparation for optical microscopy.

(OR)

- (b) Write short notes on dispersion staining microscopy.

13. (a) What are the steps involved in TEM sample preparation? Explain.

(OR)

- (b) Compare STM with AFM.

14. (a) Describe the working of a Hall probe and also give its applications in semiconductor.

(OR)

- (b) Discuss the advantages of the four probe method over the two probe method in detail.

15. (a) Describe the instrumentation of a UV-Vis spectroscopy.

(OR)

- (b) Describe the basic instrumentation of XPS.

PART – C (5 X 8 = 40 Marks)

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

Answer should not exceed 600 words.

16. (a) Discuss the principle, working and application of DTA.

(OR)

- (b) Describe the instrumentation of DSC and explain how it is used to measure specific heat capacity.

17. (a) Explain the principle and working of Differential Interference contrast (DIC) microscopy.

(OR)

- (b) Compare and contrast bright field and dark field optical microscopy.

18. (a) Explain the working principle and instrumentation of Scanning Electron Microscopy along with its advantages.

(OR)

- (b) Explain the working principle of Electron Probe Micro Analyser (EPMA). How does it differ from EDAX?

19. (a) Describe the principle of photoluminescence spectroscopy. Explain how it is used to study the band gap in semiconductors.

(OR)

- (b) Explain the principle of electrochemical C-V profiling. How does it help in determining impurity concentration as a function of depth?
20. (a) Explain the working of FTIR spectrometer along with a neat diagram.

(OR)

- (b) Describe the working principle and instrumentation of Nuclear Magnetic Resonance Spectrometer (NMR).