KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages) **Reg. No:……**

Question Code: 26O03303 **Course Code : 24PEPH26**

PG Degree - End Semester Examinations, November 2026

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 :

CO:1 K:2 1. The glass transition temperature obtained for polymers in Differential Scanning Calorimetry is related to _____ nature of the material.

(a) Amorphous (b) Crystaline

(c) Dielectric (d) Conducting

CO:1 K:1 2. A flat horizontal line in a cooling curve graph represents _____ of materials.

(a) Heating (b) Phase change

(c) Constant energy (d) Decomposition

CO:2 K:2 3. On increasing the numerical aperture of a microscope lens, what happens to the resolution limit (d) in Abbe's equation?

(a) d-decreases and the image becomes blurred

(b) d-stays unchanged

(c) d-decreases and allows to see the image with finer details

(d) Reduces light gathering

CO:2 K:2 4. In fluorescence microscopy, the special chemical dyes used to stain specific parts of cells which glow under ultraviolet rays is _____ .

(a) Refractors (b) Fluorophores

(c) Immersion oils (d) Contrast lenses

CO:3 K:1 5. _____ is defined as any feature that appears in the image but is not present in the original probed object.

(a) False image (b) Artifact

(c) Unifact (d) Topography

CO:3 K:1 6. In electron microscopy optical lenses are replaced with the help of _____ lenses.

(a) Electromagnetic (b) Superconducting

(c) Liquid (d) Both (b) and (c)

CO:4 K:1 7. _____ technique helps to find sheet resistance on arbitrary or irregular 2D structures without complex correction factors.

(a) C-V profiling (b) AC impedance

(c) Van der Pauw (d) Hall effect measurement

CO:4 K:2 8. _____ spectroscopy helps to find the electronic structure, bandgap and carrier dynamics of the low dimensional materials.

(a) Photoluminescence (b) FTIR

(c) x-ray diffraction (d) AC impedance

CO:5 K:1 9. In X-ray diffraction the condition for constructive interference from adjacent atomic planes in a crystal lattice is given is _____.

(a) $n\lambda = d\ sin\theta$ (b) $n\lambda = 2d\ sin\theta$

(c) $n\lambda = d\ cos\theta$ (d) $n\lambda = 2d\ sin2\theta$

CO:5 K:2 10. In Raman scattering, the anti-stokes lines are _____ than the stokes line.

(a) Stronger (b) Weaker

(c) Brighter (d) Both (a) and (c)

PART – B (5 X 5 = 25 Marks)

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

Answer should not exceed 250 words.

CO:1 K:4 11. (a) Discuss the merits and demerits of Thermogravimetric analysis.

(OR)

(b) Discuss the limitations of Differential Scanning Calorimetry analysis.

CO:2 K:4 12. (a) Differentiate bright-field and dark-field optical microscopy.

(OR)

(b) Differentiate fluorescence and confocal microscopy.

CO:3 K:4 13. (a) List the advantages and disadvantages of scanning electron microscopy.

(OR)

(b) List the steps involved in sample preparation for Scanning Tunneling Electron Microscopy.

CO:4 K:3 14. (a) Justify four probe techniques are more accurate than two-probe techniques.

(OR)

(b) Justify the importance of electroluminescence over photoluminescence in characterizing light-generating materials.

CO:5 K:3 15. (a) Infer the instrumentation of UV-Visible spectroscopy.

(OR)

(b) Infer the instrumentation of Fourier Transform Infrared Spectroscopy (FTIR).

PART – C (5 X 8 = 40 Marks)

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

Answer should not exceed 600 words.

CO:1 K:5 16. (a) Interpret the instrumental setup and working of Differential Scanning Calorimetry.

(OR)

(b) Interpret any three thermal parameters obtained for materials from TGA and DTA characterization techniques.

CO:2 K:3 17. (a) Discuss digital holographic microscopic technique with a neat diagram.

(OR)

(b) Discuss the limitations and advantages of dispersion staining microscopy and phase contrast microscopy.

CO:3 K:5 18. (a) Explain different modes involved in Atomic Force Microscopy for analyzing surface topology of nanostructures.

(OR)

(b) Explain the construction and working principle of Scanning Electron Microscopy.

CO:4 K:3 19. (a) Analyze the electrical parameters obtained using the Van der Pauw method for thin films.

(OR)

(b) Analyze the importance of C-V profiling in energy storage materials.

CO:5 K:5 20. (a) Assess the principles and instrumentation of the Raman Spectroscopic technique.

(OR)

(b) Assess the principle and instrumentation of the powder X-ray diffraction technique.