

KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages)

Reg. No:.....

Question Code: 26E03306

Course Code: 24PEPH26

PG Degree - End Semester Examinations, April 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:1
1. Which one of the following is a Differential thermal analysis measures?
- (a) Weight change of sample (b) Temperature difference between sample and reference
- (c) Pressure difference (d) Volume change
- CO:1
K:1
2. Which process can be studied using Differential Thermal Analysis (DTA)?
- (a) Phase transition (b) Decomposition
- (c) Oxidation (d) All of the above
- CO:2
K:1
3. What is the special component used in Dark field microscopy?
- (a) Polarizer (b) Analyzer
- (c) Dark field Condenser (d) Prism
- CO:2
K:1
4. Which phenomena is the working principle of the Phase contrast microscopy?
- (a) Light reflection (b) Phase reflection of light waves
- (c) Absorption of light (d) Polarization
- CO:3
K:1
5. What is the principle of STM
- (a) Optical reflection (b) Magnetic induction
- (c) Quantum tunneling of electrons (d) Absorption of light

- CO:3 6. What is the main component used to scan the surface of AFM?
K:1 (a) Glass needle (b) Magnetic coil
(c) Cantilever with a sharp tip (d) Prism
- CO:4 7. Which one of the following is commonly used in Four Probe
K:1 method to find resistivity?
(a) Liquids (b) Gases
(c) Semiconductors (d) Plastics
- CO:4 8. Which property is mainly studied using Photoluminescence?
K:1 (a) Mechanical properties (b) Magnetic properties
(c) Optical and Electronic properties of materials (d) Density of materials
- CO:5 9. Which one of the following is determined by X-Ray Diffraction
K:1 method?
(a) Color of material (b) Density
(c) Crystal structure of materials (d) Optical properties of material
- CO:5 10. What is the principle of Raman Spectroscopy?
K:1 (a) Light absorption (b) Scattering of Light
(c) Heat transfer (d) Magnetic field.

PART - B (5 X 5 = 25 Marks)

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

Answer should not exceed 250 words.

- CO:1 11. (a) Examine how weight loss of a material can be determined
K:4 from TGA curve.

(OR)

- (b) Analyze how heating rate affects DSC thermogram and how it can be applied to determine of thermo-mechanical parameters.

- CO:2 12. (a) Analyze the principle and working of Dark field spectroscopy
K:4 and how it differs from bright field spectroscopy.

(OR)

- (b) Examine how interference and diffraction contribute to image formation in Digital holographic microscopy.

CO:3 13. (a) Examine how elemental analysis is done using EDAX.

K:4

(OR)

(b) Compare TEM and SEM in terms of

- i. Image formation
- ii. Resolution
- iii. Sample preparation and
- iv. Information obtained

CO:4 14. (a) Examine the behavior of resistivity versus temperature of a semiconductor and metal using four probe method.

K:4

(OR)

(b) Analyze the principle of Electroluminescence and how light is produced in a material under an electric field.

CO:5 15. (a) Compare NMR and ESR in terms of Types of Particles, Energy Transitions, Resonance and Application.

K:4

(OR)

(b) Analyze the working principles of XPS and explain the components in XPS spectroscopy.

PART – C (5 X 8 = 40 Marks)

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

Answer should not exceed 600 words.

CO:1 16. (a) Explain the determination of weight loss and decomposition products in TGA.

K:2

(OR)

(b) Outline the working of DSC with neat sketches.

CO:2 17. (a) Compare Phase contrast microscopy with Bright Field microscopy in terms of

K:5

- Image Contrast mechanism
- Sample Requirements and
- Biological Applications

(OR)

(b) Explain the working principle of confocal microscope and examine the role of each component.

CO:3 18. (a) Explain the principle and working of TEM with neat diagram.

K:5

(OR)

(b) Determine how the interaction forces the AFM tip and sample surface contribute to image formation through different modes of operation.

CO:4 19. (a) Assess the accuracy of the Hall effect experiment in
K:5 determining charge carrier concentration in semiconductors.

(OR)

(b) Explain the electrochemical capacitance voltage profiling. What information can be obtained from C-V profiling?

CO:5 20. (a) Explain the instrumentation of Raman spectroscopy with
K:5 neat Diagram.

(OR)

(b) Determine the following using XRD pattern

- Indexing
- Phase identification and
- Particle Size.