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Register No: …… Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION(R,S), MAY 2024

M. Tech. Machine Design

(2021 SCHEME)

Course Code : **21MD204-E**

Course Name : **Experimental and CharacterisationTechniques for Nanotechnology**

Max. Marks : **60** **Duration:3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Differentiate between top down process and bottom up process.
2. Discuss the importance of error analysis in drawing meaningful conclusions from experimental data. Provide an example where error analysis is crucial.
3. What are the applications of DSC?
4. Differentiate between Infrared Spectroscopy and Raman Spectroscopy.
5. Differentiate between SEM and TEM.
6. What are the various microscopic techniques?
7. Write short notes on Radiography.
8. Explain the technique of thermoluminescence.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Explain the general principles of linear model analysis. Provide a step-by-step breakdown of how linear models are used in statistical analysis, including assumptions and interpretations. 6

OR

10. Compare and contrast two experimental techniques commonly used for self-assembly in nanotechnology. Provide detailed explanations of their principles and applications. 6

MODULE II

11. Explain how thermo-reflectance thermometry works and its applications in experimental settings. 6

OR

12. Briefly explain the principle behind the temperature measurement of different experimental techniques. 6

MODULE III

13. Provide a detailed explanation of the principles underlying each technique of DSC, TG and DTA, including the instrumentation setup and the physical phenomena they measure. 6

OR

14. Compare and contrast the methodologies of thermogravimetry (TG), differential scanning calorimetry (DSC), and differential thermal analysis (DTA) as techniques for thermal analysis. 6

MODULE IV

15. Compare NMR and ESR Spectroscopy with a suitable example and application. 6

OR

16. Explain the principle and working of ESR Spectroscopy. 6

MODULE V

17. Provide examples of applications where AFM is employed to study surface morphology, characterize nanomaterials, and investigate biological samples, highlighting its versatility in nanoscience and nanotechnology research. 6

OR

18. Provide examples of SEM applications in semiconductor research and industry, highlighting its role in elucidating microstructural features, defect analysis, and device performance evaluation. 6

MODULE VI

19. With the help of a neat sketch, explain the instrumentation for x-ray spectroscopy. 6

OR

20. Explain with principle the working of Electron Spectroscopy for Chemical Analysis (ESCA) 6

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