TM244449W

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2024

2020, 2021 ADMISSIONS SUPPLEMENTARY

M. Sc. Physics SEMESTER IV - ELECTIVE COURSE

PH4E03TM20 - Nanostructures and Materials Characterisation

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Outline the significance of heterostructures in electronics.
2. Explain the term Unipolar lasers.
3. Explain molecular beam epitaxy in nanomaterial synthesis.
4. Explain the terms Neel's temperature, blocking temperature and magnetic anisotropy.
5. Discuss superhydrophobic effect.
6. Explain the significance of LPDA in spectrophotometers.
7. Briefly explain quantum efficiency of fluorescence. Suggest any two ways to increase the efficiency of fluorescence.
8. Write notes on any two possible reasons for broadening of XRD peaks.
9. Scanning Tunneling microscopy is so unique that it can be used both for imaging and fabrication of certain types of nanostructures. Explain.
10. While electron beam strikes any material, a variety of processes can take place. Explain any three of them.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. Highlight the importance of quantum dots and quantum wires in electronics.
12. Explain chemical vapor deposition technique with the help of a schematic diagram.
13. Explain the vibrational and mechanical properties of CNT.
14. Illustrate the structure of SWNT with the help of circumferential vector.
15. Illustrate the principle of thermal lens spectroscopy.
16. Define fluorescence quenching and hence explain static and dynamic quenching.
17. Derive Debye Scherrer formula. What errors are possible in crystallite size measurements?
18. Using a schematic diagram, explain the working principle of the technique used in identifying the magic numbers of nanoclusters of copper.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Using a schematic diagram, explain how Electron Beam Lithography results in smaller feature sizes in quantum structures used in electronics.
20. Explain the principle of GMR and hence illustrate spin valve transistors.
21. Briefly discuss the theoretical and chemical aspects of fluorescence.
22. Give a detailed description of mass spectrometry explaining how mass spectra can be correlated to magic numbers and molecular structures.