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Reg. No.................................

Name.......................................

M.Sc. DEGREE (C.S.S.) EXAMINATION, MAY 2020

Fourth Semester

Faculty of Science

Branch II—Physics—Pure Physics—Elective–C—Material Science

PH 4M E3/PH 4E C3—NANOSTRUCTURES AND CHARACTERIZATION

(Common with Branch D—M.Sc. Physics—Material Science)

(2012 Admission onwards)

Time : Three Hours   Maximum Weight : 30

Part A (Short Answer Questions)

Answer any **six** *questions.*
Weight 1 *each.*

1. What is meant by Coulomb Blockade ?

2. What is a Quantum Well ?

3. Give an account of the applications of Carbon nanotubes.

4. Comment on shielding effect of CNT.

5. What are the properties of porous silicon ?

6. Sketch the experimental set-up to measure electrical conductivity of a 2-D array of gold.

7. Explain the concept of FTIR.

8. Compare the working of STM and AFM.

9. What are the applications of ESR ?

10. Explain spin-spin coupling.

$(6 \times 1 = 6)$

Part B (Short Essay/Problems)

Answer any **four** *questions.*
Weight 2 *each.*

11. Explain the working of Quantum dot lasers.

Turn over

12. What are the advantages of MEMS devices ?

13. Explain the mechanism of single-electron tunneling.

14. Discuss Chill Block Melt Spinning method.

15. Briefly explain the working of TEM.

16. How does the local barrier height depend on tunning current in STM ?

$(4 \times 2 = 8)$

Part C (Essay Type Questions)

Answer **all** *questions.*
Weight 4 each.

17. (a) What are Supra-molecular Switches ? How are they fabricated ? Explain their working.

Or

(b) Explain the various conduction mechanisms in nano-materials.

18. (a) Explain the synthesis, failure mechanism and mechanical properties of solid-disordered nano-structures.

Or

(b) What are the properties of CNT ? How are they useful in the fabrication of fuel cells and chemical sensors ?

19. (a) Explain in detail Electron Spin Resonance spectrometry.

Or

(b) Explain the basic principle of STM. How is the surface structure studied using STM ?

20. (a) Explain the principle of mass spectrometer. What are its applications ?

Or

(b) Explain in detail NMR spectrometry. What are its uses ?

$(4 \times 4 = 16)$