R – 1260

Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme under CBCSS

Physics / Physics with Computer Applications

Elective Course

PY 1661.4/PC 1661.5 : NANOSCIENCE AND TECHNOLOGY

[PY 1661.4 (2014 – 2017 Admission)/

PC 1661.5 (2014 Admission onwards)]

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all questions. Each carries **1** mark.

1. What is the size of a nanoelement?

2. Spherical fullerenes are called ——————.

3. Name the two types of carbon nano tubes.

4. 1 Feynman = —————— microns.

5. What are Dendrimers?

6. What is the significance of scaling laws?

7. Name any two carbon based nanomaterials.

P.T.O.

8. What is field emission?

9. What do the slope of N(E)-E graph indicate?

10. What happens to melting point when particle size increases?

<div align="right">(10 × 1 = 10 Marks)</div>

SECTION – B

Answer any eight questions of 2 marks each.

11. What are the key properties of nanomaterials?

12. List out any two significance of nanoscale.

13. Differentiate macroscale, microscale and nanoscale.

14. What are quantum dots?

15. Differentiate fullerenes and nanotubes.

16. Why does the nanoparticles have low melting point?

17. Differentiate top-down and bottom-up techniques.

18. What do you mean by sol-gel process?

19. Why do the magnetic property of nanoparticles differ from bulk materials?

20. Briefly discuss the applications of carbon nanotubes in various fields.

21. Write a note on the importance of nanotubes in chemical reaction.

22. What are quantum cascade lasers?

<div align="right">(8 × 2 = 16 Marks)</div>

SECTION – C

Answer any six questions, not exceeding a paragraph. Each carries 4 marks.

23. Find the exciton Bohr radius for CdSe. Given $m_e = 0.13\ m_0$, $m_h = 0.45\ m_0$ and $\varepsilon = 9.4$.

24. Write a brief note on Surface Plasmon Resonance (SPR).

25. Discuss Chemical Vapour Deposition (CVD) process. What are the different steps in an overall CVD reaction?

26. Using the example of face centered cubic lattice, explain size effects.

27. Briefly discuss the optical and mechanical properties of nanomaterials.

28. With a neat diagram. explain electrodeposition.

29. Write a note on micro matching methods.

30. With a neat diagram, explain the synthesis of carbon nanotubes by laser evaporation.

31. Discuss the operational differences between diode lasers and Quantum Cascade Lasers (QCL).

(6 × 4 = 24 Marks)

SECTION – D

Answer any two questions. Each question carries 15 marks.

32. What are the different methods used to synthesis zero dimensional nanomaterials? Discuss the advantages and disadvantages of each method.

33. Write a brief note on:

    (a) X-ray diffraction

    (b) Infrared spectroscopy

    (c) Scanning probe microscopy.

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34. Discuss carbon nanostructure. Write a brief note on different carbon based nanostructures and its properties.

35. (a) How can you establish that electron act like Fermi gas? What are its properties?

(b) 'Density of states depends on dimensionality' Elucidate the statement. Also discuss the significance of density of states.

(2 × 15 = 30 Marks)