

Part D

*Answer two questions.
Essay-weight 4 each.*

31. Discuss the CVD techniques used for the synthesis of carbon nanotubes.
32. Write short notes on quantum wells, quantum dots and quantum wires.
33. Discuss the basic differences between PVD and CVD process.

(2 × 4 = 8)

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH/APRIL 2012**Sixth Semester****Choice Based Course—NANOSCIENCE AND NANOTECHNOLOGY**

(Common for Model-I and Model-II B.Sc. Physics)

Time : Three Hours

Maximum Weight : 25

Part A*Answer all questions.**Objective type questions-weight 1 for each bunch.***Bunch I**

Fill in the blanks :

1. Physical properties of the one dimensional ——— will be different from their bulk behavior.
2. A carbon nanotube is produced by curling a ——— sheet.
3. Unlike carbon atoms, pure silicon cannot form ——— structures.
4. A Josephson junction consists of two superconductors separated by a thin layer of ——— materials.

Bunch II

Choose the correct answer :

5. Typical sizes of atoms are much less than a ———. (Micrometer, Nanometer)
6. The Fermi surface encloses all the ——— in the conduction band that carry electric current. (Protons, Electrons)
7. A photonic crystal consists of a lattice of dielectric particles with separations of the order of the wavelength of ——— light. (UV, Visible)
8. The STM has been used to build nanosized structures atom by atom on the ——— of materials. (Surface, Inner parts).

Bunch III

Choose the correct answer :

9. According to the band structure, metals have ——— filled conduction band. (Completely, Partially)
10. EPR detects ——— electrons in transition ions, with odd number of electrons. (Paired, Unpaired)

Turn over

11. Which of the following material exhibits colossal magneto resistance ?
(La Mn O₃, La-Ca-Mn-O).
12. The quantum corral is a circular array of ——— atoms on a copper surface.
(Gold, Iron)

Bunch IV

Fill in the blanks :

13. Atomic clusters are nanosized objects artificially made out of ——— through different techniques.
14. Locked moment magnetism is due to the ——— of clusters.
15. A quantum wire is a structure such as a copper wire that is long in ——— dimension.
16. Azobenzene molecule can act as a molecular ———.

(4 × 1 = 4)

Part B

*Answer five questions.
(Short answer questions weight 1 each)*

17. What are the features of nanomaterials ?
18. What is fullerene ?
19. Give the tools used in nanotechnology.
20. Why carbon nanotube is considered as elongated fullerene ?
21. Write down the assumptions of Drude model.
22. Briefly explain the mechanical properties of nanostructural materials.
23. Briefly discuss on excitons.
24. Explain the features of MEMSs.

(5 × 1 = 5)

Part C

*Answer four questions.
Short essay/problem, weight 2 each.*

25. Explain the structure of FCC of nanoparticles.
26. Briefly illustrate the role of magnetic clusters in nanoparticle preparation.
27. The Fermi energy of Li is 4.72 eV at T = 0K. Find the density of states at 3 eV.
28. Bottom up technique is more convenient for nano fabrication. Explain.
29. Describe the superconductivity in C₆₀.
30. Give an account on infrared detectors.

(4 × 2 = 8)

Part B (Short Answer questions)*Answer five questions.**Weight 1 each.*

17. Distinguish between isobars and isomers.
18. Explain the significance of binding energy.
19. Sketch the Bainbridge's mass spectrograph.
20. What is half life ? Explain.
21. What is carbon dating ? Give two applications.
22. Explain the Q - value of a nuclear reactor
23. How do hadrons differ from leptons ? Explain
24. What is east - west effect ?

 $(5 \times 1 = 5)$ **Part C (Short Essay /Problems.)***Answer four questions.**Weight 2 each.*

25. Find the density of $^{12}\text{C}_6$ nucleus.
26. Determine the binding energy per nucleon for He_3 and He_4 .
27. How long does it take for 40% of a sample of radon to decay ?
28. Calculate the amount of energy released in the fission process of 1 mg of $^{92}\text{U}^{235}$ if 200 MeV of energy is released per fission.
29. The half life of alpha emitter is ^{210}Po is 138 days. What mass of ^{210}Po is needed for 10 mCi source ?
30. Explain latitude effect of cosmic rays.

 $(4 \times 2 = 8)$ **Part D (Essay)***Answer any two questions.**Weight 4 each.*

31. Discuss the working of a GM counter.
32. Describe the theory of alpha decay.
33. Bring out the classification of elementary particles.

 $(2 \times 4 = 8)$