(6 Pages)

Reg. No. : ....

Code No. : 5404   Sub. Code : ZPHE 43

M.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2024.

Fourth Semester

Physics

Elective – NANO PHYSICS

(For those who joined in July 2021–2022)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Select the dimension of a quantum well
   (a) 0   (b) 1
   (c) 2   (d) 3

2. Choose the hybridization of carbon atoms in graphene
   (a) sp^2 (b) sp^3
   (c) sp^4 (d) sp^1

3. An elastic material can regain its shape after the removal of external force
   (a) True   (b) False
   (c) Either or   (d) Neither nor

4. Generally alloy is the mixture of _____ materials
   (a) more than one semiconductors
   (b) more than one metals
   (c) more than one insulators
   (d) more than one superconductor

5. What law is used to find interlayer spacing in X-ray diffraction?
   (a) Snell's law   (b) Ohm's law
   (c) Lenz's law   (d) Bragg's law

6. Select the FTIR region
   (a) 400-4000 nm   (b) 300-700 nm
   (c) 400-4000 Å   (d) 400-4000 cm^{-1}

7. In bottom–top method, the size of the material is
   (a) increased   (b) decreased
   (c) zero   (d) indefinite

8. Bandgap of a nanomaterial can be estimated from

   (a) Bragg's plot

   (b) Thermal plot

   (c) Debye–scherer plot

   (d) Tauc plot

9. What is the abbreviation of RNA?

   (a) Reponucleic acid (b) Rednucleic acid

   (c) Rihonucleic acid (d) Reconucleic acid

10. Photonics is the science of study about

   (a) Sound waves   (b) God particles

   (c) Thunder waves (d) Light waves

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain any two basic methods for the synthesis of nanomaterials with suitable diagram.

   Or

   (b) Write a note on band structure of quantum wells.

12. (a) List out the mechanical properties of nanocomposites.

   Or

   (b) Explain mechanical alloying method with schematic diagram.

13. (a) Explain FTIR spectroscopy briefly.

   Or

   (b) Explain differential scanning calorimetric technique.

14. (a) Write about the electrical behaviour of nanomaterials.

   Or

   (b) Briefly write about electrochemical properties of a nanomaterial.

15. (a) What are the advantages of nanostructured materials in electronics?

   Or

   (b) What are the disadvantages of nanostructured materials in the medicinal field?

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PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain bottom–top and top-bottom synthesis approaches of nanomaterials in detail.

Or

(b) Explain the different types of carbon nanostructures.

17. (a) Deduce stress–strain relationship and explain how it influence the physical properties of nanomaterials.

Or

(b) What is sputtering? Explain the method in detail with neat diagram.

18. (a) What is Bragg's Law and Explain the X-ray diffraction method with diagram?

Or

(b) Explain the working principle of a transmission electron microscope with block diagram.

19. (a) Explain thermophysical properties of nanomaterials briefly.

Or

(b) What are the optical properties of a nanomaterial?

20. (a) List out the application of nanostructured, materials in the biotechnology field.

Or

(b) Explain the applications of nanostructured materials in defence field.

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