



Date: 23-04-2018
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

PART A

Answer **ALL** Questions

(10 x 2 = 20)

1. Write a note on “Nature and Nano”.
2. Write the expression for the total energy of a quantum well.
3. Draw the block diagram of a SEM.
4. Mention the superiority of ion implantation technique over conventional methods.
5. Draw the block diagram of a coupler.
6. What are intramolecular forces?
7. Mention a few allotropes of carbon.
8. Differentiate nanomaterials from bulk materials.
9. What are the applications of fluorescent materials?
10. What type of absorption phenomenon occurs in solar cells?

PART B

Answer any **FOUR** Questions

(4 x 7.5 = 30)

11. Discuss quantum confinement effect along with conditions for weak, moderate and strong confinements.
12. Draw the block diagram of optical data storage device and explain its functions.
13. With neat sketch, discuss the Molecular Beam Epitaxy (MBE) method for synthesizing nanomaterials.
14. Discuss the unusual properties of graphene.
15. The experimental data for the adsorption of nitrogen on alumina at 77.3 K fit in a BET isotherm. The slope and intercept of a plot of $P/[V(P_0-P)]$ and P/P_0 are $2.88 \times 10^{-2} \text{ cm}^{-3}$ and $9.87 \times 10^{-4} \text{ cm}^{-3}$. Area of cross section of N_2 molecule is $16.2 \times 10^{-20} \text{ m}^2$. Calculate V_{mono} and surface area of alumina.
16. Discuss the procedure for synthesizing nanomaterials using CVD method.

PART C

Answer any **FOUR** Questions

(4 x 12.5 = 50)

17. With necessary diagram, explain the principle, construction and working of a Transmission Electron Microscope (TEM).
18. Based on the particle-in-a-box model, discuss the band structure of nanocrystals and solids.
19. Enumerate the scientific revolutions and opportunities at the nanoscale in the fields of energy, drug delivery, environment and heavy industry.
20. a) Discuss the various intermolecular forces existing in different types of solids. (6.5)
b) Explain the different combinations and structures of core-shell nanoparticles. (6)
21. a) Outline the classifications of semiconductor nanocomposites.
b) Describe Langmuir-Blodgett (LB) technique for the synthesis of nanomaterials. (6 + 6.5)
22. a) Discuss the procedure for performing XPS. (7.5)
b) Highlight the applications of photovoltaic device. (5)
