Roll No. .....

(05/25)

15435

M.Sc. EXAMINATION

(Fourth Semester)

PHYSICS

MSC/Phy/4/DSC5-A

Material Science-II

Time : Three Hours *Maximum Marks : 70*

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Briefly explain the band structure of metal, insulator and semiconductor.

   (b) What is the quantum size effect ?

   (c) With the help of clear schematics, briefly differentiate the structure of quantum well, quantum wire and quantum dot.

   (d) Explain the Ball milling methods of preparation of nanostructured materials.

(e) Give some key points about the co-precipitation method for nanostructured materials.

(f) What are the advantages of UV-Vis Spectroscopy techniques ?

(g) Differentiate between Photoluminescence excitation and emission spectroscopy.

2×7=14

Unit I

2. Discuss the broad idea of band structure using the concept of free electron theory. 14

3. Define the density of states in bands of solids. Discuss the variation of density of states with energy. 14

Unit II

4. How particle size of nanomaterials is determined from XRD data ? Elaborate the increase in width of XRD peaks of nano-particles and give its significance. 14

5. Explain Carbon Nanotubes in reference to the following points : 14

(i) Synthesis

(ii) Structure

(iii) Properties

(iv) Applications.

Unit III

6. Describe the following methods of preparation of Nanostructured materials :

(i) Pulsed Laser Deposition

(ii) Sol-gel. 7,7

7. Differentiate between the Ion beam deposition and Chemical Vapour deposition methods of preparation of nanostructured materials. 14

Unit IV

8. Outline the Principle and working of the following characterization tools for nanostructured materials with neat and clean schematics :

   (a) Scanning electron microscopy (SEM)

   (b) Raman Spectroscopy. 7,7

9. With the aid of a suitable diagram, discuss the principle of operation of the following characterization techniques :

   (a) Transmission Electron microscopy

   (b) Fourier Transform Infrared Spectroscopy (FTIS). 7,7

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