

M.Sc.(Physics) (CBCS Pattern) Sem-III  
**PSCPHYT11-2 - Paper-XI - Core Elective E1.2**  
**Nanoscience and Nanotechnology-I**

P. Pages : 1

Time : Three Hours



**GUG/W/22/11299**

Max. Marks : 80

- Notes : 1. All questions are compulsory.  
2. All questions carry equal marks.

**Either:**

1. a) Explain the density of states of zero-, one-, two- and three-dimensional materials. **8**  
b) What is quantum confinement effect? How it is affected on material behavior in quantum wells, wires and dots. **8**

**OR**

- e) Discuss free electron theory in nanomaterials. Highlight its features. **8**  
f) State and Explain Debye-Scherrer formula to determine particle size of nanomaterials. **8**

**Either:**

2. a) Explain Langmuir-Blodgett method of synthesis of Nanomaterials. **8**  
b) Explain synthesis of Nanomaterials through Laser Ablation and Laser Pyrolysis method. **8**

**OR**

- e) Discuss high energy ball milling process of nanomaterial synthesis. **8**  
f) Explain synthesis of semiconductor nanomaterials by colloidal route method with the help of an example. **8**

**Either:**

3. a) Demonstrate the operation of nano indentation using an Atomic Force Microscope and enumerate its applications. **8**  
b) State the necessary conditions for diffraction and explain the experimental set-up of powder diffraction unit. **8**

**OR**

- e) How does Transmission Electron Microscope work, state its use in microscopy, advantages and disadvantages. **8**  
f) Discuss the importance of Vibration Sample Magnetometer for analyzing the magnetic material with an example. **8**

**Either:**

4. a) What is the basic difference between metal and semiconductor nanoclusters. Give suitable examples. **8**  
b) How are the electrical properties of nanomaterials different from that of the bulk materials? **8**

**OR**

- e) Discuss the structure of Carbon Nanotubes elaborating the fabrication of CNTs. **12**  
f) How are the thermal properties of nanomaterials different from that of the bulk materials? **4**

5. All questions are compulsory:  
a) How is Raman spectra used to determine the particle size of nanomaterials. **4**  
b) Explain Combustion synthesis method, giving its merits and demerits. **4**  
c) Write a short note on Spintronics. **4**  
d) Write brief note on – Core shell Structure. **4**

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