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B.Sc. (Hons.) Physics (Semester – 5th)
NANO MATERIALS AND APPLICATIONS
Subject Code: BPHYD1513
Paper ID: [19131527]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:
   a. What is most famous quote in nanotechnology by a great scientist R. Feynman? Write three important properties of nanoparticles.
   b. What is the magnification of polarizing microscope and electron microscope?
   c. What is Scherer formula to calculate the crystallite size?
   d. What is *Xerogel?*
   e. What is a quantum confinement phenomenon?
   f. Write few areas where nanomaterials are being used in our daily life.
   g. How the size of nanomaterials is measured.
   h. Differentiate between *Sol* and *Gel* process.
   i. What is Coulomb blockade effect?
   j. What are excitons?

Section – B **(5 marks each)**

Q2. What do you understand by 0D and 2D nanomaterials? Give proper examples.

Q3. Describe the pulse laser deposition (PLD) method with diagram used for synthesis of nanoparticles. Discuss its merits and demerits.

Q4. What are quantum dots? What is the effect of size of quantum dots on the band gap? Show with proper diagram.

Q5. Discuss the excitons in direct and indirect band gap semiconductors.

Q6. How the presence of defect in nanoscale materials, affects the strength of materials. How materials properties can be enhanced?

Section – C **(10 marks each)**

Q7. (a) Discuss physical vapor deposition method to prepare the nanomaterials.
(b) Discuss the main features of TEM, diagram and explain the functioning of each components. Why TEM is usually preferred for nanomaterials characterizations?

Q8. (a) Discuss dye synthesized solar cell. Explain the role of dyes in solar cell. What are the advantages of dye synthesized solar cell based devices.
(b) What are magnetic quantum dots? How the color change in QDs.

Q9. (a) What are MEMS and NEMS? Discuss the main advantages of the MEMS and NEMS.

(b) Differentiate between the hetro structure and nanostructure?