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Total No. of Printed Pages: 1

Total No. of Questions: [09]

B.Sc. (Hons.) Physics (Semester – 5th)
NANO MATERIALS AND APPLICATIONS
Subject Code: BPHYD1-513
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) For a particle in a box, show that the fractional difference in the energy between adjacent energy levels is $\Delta E_n/E_n = (2n+1)/n^2$
- b) Explain with example the size dependent properties of nanomaterials.
- c) What are the shortcomings of ball mill technique for synthesis on nanomaterials?
- d) How dielectric constant of nano particles vary with size?
- e) Write the Scherrer equation for particle size determination.
- f) Draw the density of state v/s energy graph for bulk, quantum well and wire.
- g) What is Quantum computing?
- h) The band gap of a direct band semiconductor is 4.2 eV. What will be the frequency of band to band luminescence radiations emitted by it?
- i) Write a short note on NEMS (Nano Electromechanical Systems).
- j) Explain how magnetic dots are used for data storage.

Section – B

(5 marks each)

- Q2. Discuss about hydrothermal method used in the synthesis of nanomaterials.
- Q3. Why optical microscope is not suitable for characterization of nanomaterials? How resolution is different from magnifying power?
- Q4. Differentiate between tunneling and hopping conduction.
- Q5. Explain how properties of carbon nano tube structures lead it to be used in (i) Display devices (ii) Fuel Cell.
- Q6. Briefly explain Chemical Vapor Deposition of carbon nanotubes.

Section – C

(10 marks each)

- Q7. Derive the expression for wave function and the energy states for a particle confined in one dimensional infinite potential well. Why lowest possible is not zero? 10
- Q8. Outline the principle and working of Transmission TEM with its use in analysis of nanoparticles. 10
- Q9. (a) Using energy level diagram explain the formation of excitons.
(b) Describe the different types of sensors based on optical, electrochemical and biological properties of nanometer 7, 3