

4822

4

- (b) What do you understand by the integer quantum Hall effect? How is it different from the classical Hall effect? (10)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4822

J

Unique Paper Code : 2224002008

Name of the Paper : Nano Physics

Name of the Course : B.Sc. Hons. - (Physics)_NEP:
UGCF-2022

Semester : IV / VI (GE Paper)

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all.
3. Question No. 1 is compulsory.
4. All questions carry equal marks.
5. Symbols have their usual meanings.

P.T.O.

1. Attempt any **five** questions : (3×5=15)

(a) What is nanotechnology? What are the various nanoscales in length and time?

(b) Write a short note on the Sol-gel Method.

(c) What is the difference between top-down and bottom-up approaches? Which one is better and why?

(d) How is ballistic transport different from diffusive transport?

(e) Why do quantum confinement effects become more prominent in lower-dimensional systems?

(f) Sketch and label a schematic diagram of a single-electron transfer device.

2. (a) Derive an equation for the density of states for a 3-D nanostructure. (6)

(b) How does reducing the dimensionality affect the electronic, optical, and magnetic properties of a material? Explain with examples. (9)

3. (a) Let a particle of mass m and energy E be incident on a step potential given by :

$$V(x) = \begin{cases} 0, & x < 0 \\ V_0, & x > 0 \end{cases}$$

Using the Schrodinger equation, derive the expression for the reflection and transmission coefficients for the case of a particle having energy E more than V_0 . (10)

(b) How are nanoparticles used in targeted drug delivery? (5)

4. (a) Give the detailed construction and working of any one of the physical vapor deposition techniques. (10)

(b) Explain the phenomenon of one-dimensional conductance quantization observed in split-gate devices. (5)

5. (a) What is a 2D Electron Gas? Explain its formation with an example in any structure of choice. (5)