4. (a) What is Physical Vapour Deposition (PVD)? How is PVD advantageous over Chemical vapour deposition (CVD)? (6)

   (b) How will you relate chamber pressure to the mean free path? (4)

   (c) Explain any one physical technique of deposition of a thin film. (5)

5. (a) Calculate density of states for 1D, 2D and 3D. (12)

   (b) What is the difference between MEMS and NEMS? Explain one application of each. (3)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5896 **H**

Unique Paper Code : 2224002008

Name of the Paper : Nano Physics

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

Semester : IV

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 any **four** questions in all.
3. Question No. **1** is compulsory.
4. Symbols have their usual meanings.

1. Attempt any **five** of the following : (5×3=15)

(a) What do you understand by crystalline and amorphous nature of solids? Give suitable example for each.

(b) Give difference between top down and bottom up approaches for synthesis of nanostructures.

(c) Discuss the significance of Schrodinger's equation in quantum mechanics and how it describes the behaviour of particles in terms of wave functions.

(d) What is the significance of vapour pressure of material being vaporised in a thermal evaporation technique?

(e) Explain Ball Milling.

(f) Write down the name of three synthesis methods of nanomaterials which requires vacuum atmosphere.

(g) A particle with mass m is in an infinite square well potential with walls at $x = -L/2$ and $x = L/2$. Write the wave functions for the states $n = 1$, $n = 2$ and $n = 3$.

2. A proton is confined in an infinite square well of width 10 fm. (The nuclear potential that binds protons and neutrons in the nucleus of an atom is often approximated by an infinite square well potential.)

(a) Derive the expression for the energy.

(b) Calculate the energy and wavelength of the photon emitted when the proton undergoes a transition from the first excited state ($n = 2$) to the ground state ($n = 1$).

(c) In what region of the electromagnetic spectrum does this wavelength belong? (8,5,2)

3. (a) Discuss the concept of time and length scales in the context of electron behavior in nanostructured materials. (8)

(b) How do these scales differ from those observed in macroscopic systems, and what are their implications on electron transport properties? (7)