October 2025
B.A./B.Sc.
Third Semester
DISCIPLINE SPECIFIC ELECTIVE – 2
PHYSICS
Course Code: PHD 5.21 (B)
(Nano Materials & Application)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. Discuss the size dependence properties of nanomaterials. What are the induced effects due to increase in surface area of nanoparticles? 10+4=14

2. Derive the solution of Schrödinger's equation for a particle in a potential box. 14

UNIT–II

3. With the help of neat sketch, explain scanning electron microscope (SEM) for characterisation of nanomaterials. 14

4. Discuss physical vapour deposition (PVD) with a neat diagram citing e-beam evaporation and sputtering. 14

UNIT–III

5. Explain with a neat sketch, the impact of SnO_2 based coupling on photocatalytic self-cleaning properties. Briefly discuss surface plasmon resonance (SPR). 14

6. Give a detail account of quantum size effect and optical absorption. 14

UNIT–IV

7. Discuss in detail about electrical conductivity of nanomaterials. 14

8. What are Frenkel defects? Derive an expression for the equilibrium concentration in formation of a Frenkel defect. 2+12=14

UNIT-V

9. Write a note on each of the following: 7×2=14
   (a) Micro-electromechanical systems (MEMS)
   (b) Nanoelectromechanical systems (NEMS)

10. What is a carbon nanotube? Explain the various applications of carbon nanotubes. 14