Dr Bishwaranjan 23/11/2023 (10)

National Institute of Technology, Hamirpur
End-Term Examination

Program Name - B.Tech (7th Sem)

Course Name – Physics of Nanosystems
Course Code – PH-412

Maximum Marks – 50
Total Time: 3 Hours

1. At time $t = 0$, a particle is represented by the wavefunction

$\Psi(x,0) = Ax/a$, *if* $0 \le x \le a$
$= A(b-x)/(b-a)$, *if* $a \le x \le b$
$= 0$, *otherwise*
where A, a and b are constants.

(a) find A in terms of a and b.
(b) Sketch $\Psi(x,0)$ as a function of x.
(c) What is the expectation value of x? (2+2+4)

2. Using the time independent Schrodinger equation for the Dirac-delta potential well (a) Derive the expression for the bound state wavefunction. (b) Sketch $\Psi(x)$ as a function of x. (5+2)

3. What is the basic difference between the light microscopy and the electron microscopy? Name any four types of electron microscopes? (1+1)

4. Briefly discuss about the Scanning Tunneling Microscopy (STM) with the diagram. (8)

5. Discuss a few differences between the Scanning Electron Microscope (SEM) and the Transmission Electron Microscope (TEM). (5)

6. What are the two main nanomaterial fabrication techniques? Discuss about these two fabrication techniques with examples. (1+4.5+4.5)

7. What is Atomic Force Microscopy (AFM)? How does AFM work? Mention a few advantages and disadvantages of AFM over SEM. (1+5+2+2)