Reg. No:
Date:

Time: $2^{1}/_{2}$Hours   MaxMarks: 70
This question paper contains **two** printed pages and **three** parts

PART A

Answer any **four** of the following. Each question carries 10 marks   (4X10 = 40)

1 a) Discuss briefly the failure of Wien's and Rayleigh-Jeans law to explain black body radiation.
  b) Discuss the failure of classical physics to explain photoelectric effect and give Einstein's explanation.   [5+5]

2   Set up time independent Schrodinger wave equation and explain eigen function and eigen values.   [10]

3   Obtain expressions for energy and zero point energy for a harmonic oscillator   [10]

4 a) Explain G.P.Thomson's experiment on electron diffraction with relevant theory.
  b) What is the physical interpretation of the wave functionψ? Explain Born's interpretation.
                                                                                                                              [8+2]
5 a) Distinguish between normal and anomalous Zeeman effect.
  b) Give the quantum theory of normal Zeeman effect.   [2+8]

6   Discuss the theory of origin of pure rotational spectrum of a molecule and the importance of the spectrum for determining the properties of a molecule   [10]

PART B

  Solve any **four** of the following. Each question carries 5 marks   (4x5=20 marks)

7   Evaluate de Broglie wavelength of Helium nucleus that is accelerated through 500V.
     Mass of proton = Mass of neutron =1.67×10^{-27}kg

8   In a measurement that involved an uncertainty of 0.003% the speed of an electron was found to be 800m/s. Calculate the corresponding uncertainty involved in determining its position. Mass of electron =9.1×10^{-31}kg.

9   A quantum particle confined to one dimensional box of width 'a' is in its first excited state. What is the probability of finding the particle between a/4 to 3a/4 in the box.

10 Evaluate the following commutations:-
     a) $[x, P_x]$ b)$[L_x , P_y]$

11 In the Stern-Gerlach experiment silver atoms traverses a distance of 0.1 m in a nonhomogeneous magnetic field of field gradient 55 Tm^{-1}. If the velocity of the silver atoms is $450ms^{-1}$, calculate the separation between the two trace on the collection plate 0.5m from the pole pieces. Mass of silver atom = 1.79×10^{-25}kg. μ_B = $9.2 \times 10^{-24}JT^{-1}$.

12 Determine the J values which can be formed from 2 electron configuration in the L-S coupling scheme given that l_1=3, S_1=1/2 and l_2 =2 , S_2 =1/2

PART C

Answer any **Five** of the following   (5x2=10)

13 a) Matter waves are not physical waves. Why?

b) Why is the wavenature of matter not apparent to our daily observations?

c) A particle in a potential well can have zero energy according to classical physics while it cannot have zero energy according to quantum mechanics. Explain

d) Justify Bohr's theory regarding non radiating orbits on the basis of the wave mechanical model of the atom.

e) Give an example of an atom for which L=l, S=s and J=j.Explain

f) How many elliptical and circular orbits are there for n=3, according to Sommerfeld atom model?