

Enrollment No: _____

Exam Seat No: _____

C. U. SHAH UNIVERSITY

Summer Examination-2022

Subject Name : Quantum Mechanics

Subject Code : 4SC06QUM1

Branch: B.Sc. (Physics)

Semester: 6

Date: 02/05/2022

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1	Attempt the following questions:	(14)
	a) $[x, p_x] = \text{_____}$	01
	b) State the Pauli's exclusion principle.	01
	c) What is normalization condition?	01
	d) What is called a in equation $A f(x) = a f(x)$?	01
	e) Define commutator.	01
	f) Write the schrodinger wave equation for oscillator.	01
	g) What is the operator for the energy?	01
	h) Give some examples of fermions.	01
	i) Give the expression for Bohr magneton.	01
	j) Write the main difference between Normal Zeeman and Anomalous Zeeman Effect.	01
	k) Write Heisenberg's uncertainty principle.	01
	l) Explain: Principle quantum number.	01
	m) What do you mean by symmetric wave function?	01
	n) Define: Identical particles.	01

Attempt any four questions from Q-2 to Q-8

Q-2	Attempt all questions	(14)
	a) Derive one dimensional time dependent schrodinger equation for free particle.	07
	b) Describe the particle in a one dimensional potential well of infinite depth.	07
Q-3	Attempt all questions	(14)
	a) Derive the spherical polar coordinates of angular momentum.	09
	b) Explain operator for momentum.	05
Q-4	Attempt all questions	(14)
	a) Derive Schrodinger wave equation in the form of spherical polar coordinates.	08
	b) A wave function $\psi(x) = A e^{ikx}$ is normalized over the region $-a \leq x \leq a$,	03



- then $A = ?$
- c) Show that the wave equation $\psi(x,t) = A \cos(kx - \omega t)$ does not satisfy time dependent schrodinger wave equation for a free particle. **03**
- Q-5 Attempt all questions (14)**
- a) Explain physical interpretation of ψ and current density. **07**
- b) Explain: Separation of variables. **07**
- Q-6 Attempt all questions (14)**
- a) Explain Zeeman effect in details. **08**
- b) Explain all four quantum numbers in brief. **06**
- Q-7 Attempt all questions (14)**
- a) Explain: Stern Gerlach experiment. **07**
- b) Explain: LS coupling. **07**
- Q-8 Attempt all questions (14)**
- a) Write a note on Vector model of atom. **07**
- b) Explain: Fine structure of hydrogen atom. **07**

