FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION

Program: Bachelor in Science *(Honors/ Honors with Research)*		**Semester: VIII**	**Session: 2024-25**
1	Course Code	**PHSC-08**	
2	Course Title	**Quantum Mechanics**	
3	Course Type	**Discipline Specific Course**	
4	Pre-requisite (if any)	**As per Program**	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: ➢ Explore uncertainty relations and states with minimum uncertainty. Learn and apply commutation relationships ➢ Master matrix representation of operators and solve the harmonic oscillator. Comprehend angular momentum in quantum mechanics. ➢ Explore spin angular momentum and Pauli's matrices. Master the concept of Clebsch- Gordon coefficients. ➢ Analyze central force problems and spherically symmetric potentials in 3D. Explore parity, square-well potentials, and hydrogen atom solutions	
6	Credit Value	**04 Credits**	**1 Credit = 15 Hours- Learning & Observation**
7	Total Marks	**Maximum Marks: 100**	**Minimum Pass Marks: 40**

PART – B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Period (60 Hours)

Unit	Topics	No. of Period
I	Super position principle, State with minimum uncertainty product, commutation relationship, completeness and normalization of eigen functions, Dirac-delta function,Bra& Ket notation, matrix representation of an operator, harmonic oscillator and its solutionby matrix method, Heisenberg equation of motion.	15
II	Angular momentum in quantum mechanics, matrix representation of angular momentum, commutation relationships of orbital angular momentum, eigen values and eigen functions of L^2 and L_z, Spin angular momentum: basic introduction, Total angular momentum and its commutation relationship, Pauli`s spin matrices, addition of angular momentum, Clebsch-Gordon coefficients. Applied problem based on momentum and positions.	15
III	Central force problem, spherically symmetric potentials in three dimensions, separation of wave equation, parity, three-dimensional square-well potential and energy levels, the hydrogen atom; solution of the radial equation, energy levels and stationery state wave functions, discussion of bound states, degeneracy.	15
IV	Time- independent perturbation theory, non-degenerate case, first order and second perturbations with the example of an oscillator, degenerate cases, removal of degeneracy in second order, Zeeman effect without electron spin, first-order Stark effect in hydrogen, perturbed energy levels, correct eigen function, occurrence of permanent electric dipole moments.	15

Keywords:	Uncertainty principle, normalization of wavefunction, angular momentum spherically symmetric potential, Time independent perturbation theory, Zeeman effect

Signature of Convener & Members (CBoS) :

10/6/24

PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended -

1. Principles of Quantum Mechanics by R. Shankar
2. Modern Quantum Mechanics" by J. J. Sakurai and Jim Napolitano
3. Introduction to Quantum Mechanics" by David J. Griffiths and Darrell F. Schroeter
4. Quantum Mechanics: A Modern Development" by Leslie E. Ballentine
5. Quantum Mechanics by Leonard I. Schiff

Reference Books Recommended -

1. L. I. Schiff : Quantum mechanics (McGraw-Hill).
2. S. Gasiorowicz, Quantum Physics (Wiley).
3. Landau and Lifshitz : Non-relativistic quantum mechanics.
4. B. Crasemanand Z. D. Powell: Quantum mechanics (Addison Wesley)
5. A. P. Messiah : Quantum Mechanics.
6. J. J. Sakurai : Modern Quantum Mechanics.
7. Mathews and Venkatesa: Quantum Mechanics.
8. G. Aruldhas: Quantum Mechanics (II Edition)

Online Resources (e-books/ learning portals/ other e-resources)

1. All e-books of physics https://www.e-booksdirectory.com/listing.php?category=2
2. Free physics textbook in PDF https://www.motionmountain.net/?gclid=CjwKCAjwmq3kBRB_EiwAjkNDp5v8Yy6xK1s0Kma0VR0AWGlichRwFfCC0-vpZK1jrPoEOAnBq8fcqRoCILsQAvD_BwE
3. Cambridge University Books for Physics https://www.cambridgeindia.org/
4. Books for solving physics problems https://bookboon.com/en/physics-ebooks
5. NPTEL Online courses: https://onlinecourses.nptel.ac.in/noc21_ph05/preview
6. Quantum Mechanics https://archive.nptel.ac.in/courses/115/101/115101107/
7. Quantum Mechanics https://nptel.ac.in/courses/115106066

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2): Assignment/ Seminar (1): Total Marks:	**20+20** **10** **30**	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type, **1 out of 2** from each unit- **4x10 =40 Marks**		

Name and Signature of Convener & Members of CBoS: