FIRST-YEAR OF MASTER OF SCIENCE PHYSICS REVISED SYLLABUS ACCORDING TO CBCS NEP2020

COURSE TITLE:-QUANTUM MECHANICS – I
SEMESTER - I
W.E.F. 2023-2024

RECOMMENDED BY THE BOARD OF STUDIES IN PHYSICS
AND
APPROVED BY THE ACADEMIC COUNCIL

Devrukh Shikshan Prasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal.Sangmeshwar, Dist. Ratnagiri-415804, Maharashtra, India

Academic Council Item No: **03 dated 8 July 2023**

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangmeshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Master of Science
Name of the Department	:	Physics
Name of the Class	:	First Year
Semester	:	First
No. of Credits	:	04
Title of the Course	:	Quantum Mechanics - I
Course Code	:	S503PHT
Name of the Vertical in adherence to NEP 2020	:	Major
Eligibility for Admission	:	BSc in Physics
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	PG
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2023-2024

Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2023-2024)

SEMESTER - I **Paper No.– Physics Paper – III**

Course Title: Quantum Mechanics - I **No. of Credits - 04**

Type of Vertical: Major **COURSE CODE: S503PHT**

Learning Outcomes Based on BLOOM's Taxonomy:

After completing the course, the learner will be able to…

Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Remember	Recall the basic concepts of quantum Mechanics
CLO-02	Understand	Understand the basic postulates of quantum mechanics
CLO-03	Understand	Understand the application of Schrodinger equation to various problems
CLO-04	Understand	Understand the formalism of quantum mechanics
CLO-05	Understand	Understand application to three dimensional problems, degeneracy and angular momentum
CLO-06	Apply	Solve textbook problems in quantum mechanics related to the topics in the course

Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2023-2024)

SEMESTER - I **Paper No.–Physics Paper–III**

Course Title: Quantum Mechanics-I **No. of Credits - 04**

Type of Vertical: Major **COURSE CODE: S503PHT**

COURSE CONTENT			
Module No.	**Content**	**Credits**	**No. of Lectures**
01	**Review of concepts:** Postulates of quantum mechanics, observables and operators, measurements, state function and expectation values, the time-dependent Schrodinger equation, time development of state functions, solution to the initial value problem. The Superposition principle, commutator relations, their connection to the uncertainty principle, complete set of commuting observables. Time development of expectation values, conservation theorems and parity.	**01**	**15**
02	**Wave packet:** Gaussian wave packet, Fourier transform. **Schrodinger equation solutions: 1-D problems:** General properties of one dimensional Schrodinger equation, Particle in a box, Harmonic oscillator by raising & lowering operators and Frobenius method, unbound states, 1-D barrier problems, finite potential well. **Formalism:** Linear Vector Spaces & operators, Dirac notation, Hilbert space, Hermitian operators & their properties, Matrix mechanics: Basis & representations, unitary transformations, energy representation. Schrodinger, Heisenberg & interaction picture.	**01**	**15**
03	**Schrodinger equation solutions: 3-D problems:** Orbital angular momentum operators in cartesian & spherical polar coordinates, commutation & uncertainty relations, spherical harmonics, two particle problem-coordinates relative to centre of mass, radial equation for a spherically symmetric central potential, hydrogen atom, eigenvalues & radial eigenfunctions, degeneracy, probability distribution.	**01**	**15**
04	**Angular Momentum:** Ladder operators, eigenvalues & eigenfunctions of L^2 & L_z using spherical harmonics, angular momentum & rotations. Total angular momentum J; LS coupling;	**01**	**15**

	eigenvalues of J^2 & Jz. Addition of ang momentum, coupled & uncoupled representation of eigenfunctions, Clebsch Gordan coefficient for $j_1 = j_2 = ½$ and $j_1 = 1$ and $j_2 = ½$. Angular momentum matrices, Pauli spin matrices, spin eigenfunctions, free particle wave function including spin, addition of two spins.		
	Total	**04**	**60**

Reference Books:-

1. Richard Liboff, Introductory Quantum Mechanics, 4th edition, Pearson.
2. D J Griffiths, Introduction to Quantum Mechanics 4th edition
3. A Ghatak and S Lokanathan, Quantum Mechanics: Theory and Applications, 5th edition.
4. N Zettili, Quantum Mechanics: Concepts and Applications, 2nd edition, Wiley.
5. W Greiner, Quantum Mechanics: An introduction, Springer, 2004
6. R Shankar, Principles of Quantum Mechanics, Springer, 1994
7. P.M.Mathews & K.Venkatesan, A Textbook of Quantum Mechanics, TMH
8. J. J. Sakurai Modern Quantum Mechanics, Addison-Wesley (1994).

Access to the Course

The course is available for all the students admitted for Master of Science in Physics.

Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

Pattern of Evaluation

The Examination/Evaluation pattern shall be framed by the Board of Examination with its final approval from the Academic Council of the College.