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

COURSE TITLE:- QUANTUM MECHANICS
SEMESTER-II
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	:	Second
No. of Credits	:	04
Title of the Course	:	Quantum Mechanics – II
Course Code	:	S512PHT
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 TE 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-II **Paper No.– Physics Paper – III**

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

Type of Vertical: Major **COURSE CODE: S512PHT**

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 the course
CLO-02	Understand	Understand the time dependent and independent perturbation theory
CLO-03	Understand	Understand the approximation methods in QM
CLO-04	Apply	Solve problems based on the course
CLO-05	Understand	Recall the quantum mechanical theory of scattering
CLO-06	Understand	Understand basic concepts in relativistic QM

Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2023-2024)

SEMESTER - II **Paper No–Physics Paper–III**

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

Type of Vertical: Major **COURSE CODE: S512PHT**

COURSE CONTENT			
Module No.	**Content**	**Credits**	**No. of Lectures**
Unit 1	***Perturbation Theory:*** Time independent perturbation theory: First order and second order corrections to the energy eigenvalues and eigenfunctions. Degenerate perturbation Theory: first order correction to energy. Time dependent perturbation theory: Harmonic perturbation, Fermi's Golden Rule, sudden and adiabatic approximations, applications. .	**01**	**15**
Unit 2	***Approximation Methods*** 1. Variation Method: Basic principle, applications to simple potential problems, He- atom. 2. WKB Approximation: WKB approximation, turning points, connection formulas, Quantization conditions, applications	**01**	**15**
Unit 3	***scattering Theory*** Laboratory and centre of mass frames, differential and total scattering cross-sections, scattering amplitude, Partial wave analysis and phase shifts, optical theorem, S-wave scattering from finite spherical attractive and repulsive potential wells, Born approximation.	**01**	**15**
Unit 4	1. **Identical Particles:** Symmetric and antisymmetric wave functions, Bosons and Fermions, Pauli Exclusion Principle, slater determinant. 2. **Relativistic Quantum Mechanics** 3. **The Klein Gordon and Dirac equations.** Dirac matrices, spinors, positive and negative energy solutions physical interpretation. Nonrelativistic limit of the Dirac equation.	**01**	**15**
	Total	**04**	**60**

Main references:

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. J. Bjorken and S. Drell, Relativistic Quantum Mechanics, McGraw-Hill (1965).

Additional References

1. W Greiner, Quantum Mechanics: An introduction, Springer, 2004
2. R Shankar, Principles of Quantum Mechanics, Springer, 1994
3. P.M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
4. J.J. Sakurai Modern Quantum Mechanics, Addison-Wessley (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.