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

COURSE TITLE:- STATISTICAL MECHANICS
SEMESTER - III
W.E.F. 2024 - 2025

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: **dated 19 April 2024**

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	:	Second Year
Semester	:	Third
No. of Credits	:	04
Title of the Course	:	Statistical Mechanics
Course Code	:	S601PHT
Name of the Vertical in adherence to NEP 2020	:	Major
Eligibility for Admission	:	Any student admitted to Second year of M.Sc, degree programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra.
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	:	2024 - 2025

Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2024 - 2025)

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

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

Type of Vertical: Major **COURSE CODE: S601PHT**

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	Know the statistical basis of thermodynamics
CLO-02	Understand	Understand the ensembles and concept of phase space
CLO-03	Understand	Understand the Cannonical and Grand Cannonical Ensemble
CLO-04	Understand	Understand the concepts of Quantum Statistics
CLO-05	Apply	Solve problems based on the theory

Syllabus for First Year of Master of Science in Physics

(With effect from the academic year 2024 - 2025)

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

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

Type of Vertical: Major **COURSE CODE: S601PHT**

COURSE CONTENT			
Module No.	**Content**	**Credits**	**No. of Lectures**
Unit 1	The Statistical Basis of Thermodynamics - The macroscopic and the microscopic states, contact between statistics and thermodynamics, the classical ideal gas, The entropy of mixing and the Gibbs paradox, the enumeration of the microstates Elements of Ensemble Theory - Phase space of a classical system, Liouville's theorem and its consequences. The microcanonical ensemble - Examples Quantum states and the phase space	**01**	**15**
Unit 2	The Canonical Ensemble - Equilibrium between a system and a heat reservoir, a system in the canonical ensemble, physical significance of the various statistical quantities in the canonical ensemble, expressions of the partition function, the classical systems, energy fluctuations in the canonical ensemble, correspondence with micro canonical ensemble, equipartition theorem & virial theorem, system of harmonic oscillators, statistics of paramagnetism, thermodynamics of magnetic systems.	**01**	**15**
Unit 3	The Grand Canonical Ensemble - Equilibrium between a system & a particle-energy reservoir, a system in grand canonical ensemble, physical significance of the various Statistical quantities, Examples, Density & energy fluctuations in grand canonical ensemble, correspondence with other ensembles.	**01**	**15**
Unit 4	Formulation of Quantum Statistics - Quantum-mechanical ensemble theory: the density matrix, Statistics of the various ensembles, Examples, systems composed of indistinguishable particles, the density matrix and the partition function of a system of free particles.	**01**	**15**
	Total	**04**	**60**

Reference Books:

1. Thermodynamics & Statistical Mechanics, Greiner, Neise & Stocker, Springer 1995.
2. Introduction to Statistical Physics, Kerson Huang , Taylor and Francis 2001.

3. Thermal and Statistical Physics, F. Reif.
4. Statistical Physics, D Amit and Walecka.
5. Statistical Mechanics, Kerson Huang.
6. Statistical Mechanics, J. K. Bhattacharjee.
7. Statistical Mechanics, Richard Feynman.
8. Statistical Mechanics, Landau and Lifshitz.
9. Thermodynamics, H.B. Callen

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.