Syllabus for Master of Science

Physics

Subject Code: 02PY0507

Subject Name: Thermodynamics and Statistical Mechanics

M.Sc. Year-II, Sem-III

Objective: To interpret the fundamental concepts of staistical thermodynamics, classical statistical mechanics and its applications.

Credits Earned: 4 Credits

Course Outcomes: After completion of this course, post graduate will be able to

- Recognize various aspects and scopes of statistical thermodynamics
- Apply the usefulness of micro-canonical, canonical and grand canonical ensembles.
- Identify the application aspects of statistical mechanics
- Apply knowledge of physics to become successful in national level examinations like NET, SLAT, GATE etc.
- Engage in research in the field of pure and applied physics and involve in life-long learning

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva (V)	Term work (TW)	
4	0	0	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**Statistical Basics of Thermodynamics-I** Scope and aim of statistical mechanics. Review of the ideas of phase space, Liouville's equation and Liouville's theorem. Macroscopic and Microscopic states, Statistical ensemble	**12**
2	**Statistical Basics of Thermodynamics-II** Postulate of equal a priori probability, Probability calculations, Sharpness of the probability distribution, Dependence of the density of states on the external parameters, Equilibrium between interacting systems, Ising model, super fluidity, black body radiation and Planck's distribution law.	**12**
3	**Classical Statistical Mechanics** Stationary ensembles: Micro canonical, canonical and grand canonical ensembles. Partition function formulation. Fluctuation in energy and particle. Calculation of mean values and fluctuations in a canonical ensemble and Grand-canonical ensemble.	**14**
4	**Applications of Statistical Mechanics-I** Classical partition functions and their properties, Calculations of thermodynamic quantities, Ideal monoatomic gas, Gibbs paradox	**10**
5	**Applications of Statistical Mechanics-II** Equipartition theorem and its Simple applications. i) Mean kinetic energy of a molecule in a gas ii) Brownian motion. Evaluation of the partition function, Partition function for diatomic molecules, Equation of state for an ideal gas.	**12**
	Total Hours	**60**

References:

1. Fundamentals of Statistical and Thermal Physics, - F. Reif, McGrawHill International Edition (1985)
2. Fundamentals of Statistical Mechanics, B.B. Laud, New Age International Publication (2003)
3. Statistical Mechanics, R.K. Pathria, Bufferworgh Heinemann (2nd Edition) (2006)
4. Statistical Mechanics, K. Huang, John Willey and Sons (2nd Edition) (1987)
5. Statistical and Themal Physics: An introduction, By Loknathan, S., Gambhir, R.S. PHI Lesrning Pvt. Ltd. (2008)

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.