PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Paper -1: STATISTICAL MECHANICS

Offered to : M.Sc.(PHYSICS)	Course Code : 22PH2T1
Course Type : Core	Course : STATISTICAL MECHANICS
Year of Introduction : 2004	Year of offering : 2022
Year of Revision : 2022	Percentage of Revision : Nil
Semester : II	Credits : 4
Hours Taught : 60 hrs. per Semester	Max.Time : 3 Hours

Course Description:

Statistical Mechanics is a mathematical framework that applies statistical methods and probability theory to large assemblies of microscopic entities. It does not assume or postulate any natural laws, but explains the macroscopic behavior of the nature from the behavior of such ensembles

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Course Objectives:

1. Understand the basic concepts of statistical mechanic, phase space and ensembles
2. Understand theorems and applying conclusions to specific problems related to large group of particles
3. Understand the ensembles and partition function
4. Understand the particle distributions and applications.
5. Apply statistical laws to the stellar object and particles to understand the evolution of universe and to study the properties of matter

Course Outcomes: At the end of this course, students should be able to:

CO1: Understand the basic concepts of statistical mechanics.
CO2: Understand theorems of statistical mechanics.
CO3: Understand the ensembles and partition function.
CO4: Understand the particle distributions and applications.
CO5: Apply statistical laws to the stellar object and particles.

CO - PO MATRIX

	CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
22PH2T1	CO1	H					L	M
	CO2	H					L	M
	CO3	H					L	M
	CO4	H	M				L	M
	CO5		H	M			L	M

Syllabus

Unit	Learning Units	Lecture Hours
I	**Unit-I: Basics of Classical Statistical Mechanics** Introduction, Microstates and Macro states, Phase space, Volume in Phase space, Ensembles-Types of Ensembles, Ensemble average, Liouvilles theorem, Conservation of extension in phase, Equation of motion and Liouville theorem, Equal a prior probability, statistical equilibrium. (CO1)	12
II	**Unit-II: Canonical and Grand Canonical Ensembles** Micro canonical ensemble – Ideal gas in micro canonical ensemble, Gibbs paradox, Canonical ensemble - Ideal gas in canonical ensemble, Grand canonical ensemble - Ideal gas in grand canonical ensemble, Comparison of various ensembles. Equipartition theorem. (CO2)	12
III	**Unit-III: Partition functions** Canonical partition function, Molecular partition function, Translational partition function, Rotational partition function, Vibrational partition function, Electronic and Nuclear partition function, Application of rotational partition function, Application of vibrational partition function to solids. (CO3)	12
IV	**UNIT IV: Ideal Bose -Einstein Gas** Bose-Einstein distribution, Bose-Einstein condensation, thermodynamic properties of an Ideal Bose-Einstein gas, liquid helium, Two-fluid model of liquid Helium II, Super fluid phases of 3He. (CO4)	12
V	**UNIT -V: Ideal Fermi-Dirac Gas** Fermi-Dirac distribution, Degeneracy, electrons in metals, Thermionic emission, Magnetic susceptibility of free electrons, White Dwarfs, Nuclear Matter.	12

Reference Books:

1. Statistical and Thermal Physics, S. LOKANADHAN and R.S. GAMBHIR(PHI).
2. Statistical Mechanics: Theory and Applications, S.K. SINHA (Tata Mc Graw-Hill).
3. Statistical Mechanics, GUPTA AND KUMAR (PragatiPrakashan, Meerut).
4. Statistical Mechanics,by SATYAPRAKASH.
5. Statistical Mechanics, K. HUANG (John Wiley &Sons).