

Name of the Course: T. Y. B. Sc. Physics Major Course 7
MJ - 7: Thermal & Statistical Physics (2 Credits)

Sr. No.	Heading	Particulars
1	Description the course (Including but Not limited to)	: Introduction, relevance, Usefulness, Application, interest, connection with other courses, demand in the industry, job prospects etc.
2	Vertical	: Major /Minor/Open Electives /Skill Enhancement / Ability Enhancement/Indian Knowledge System
3	Type	: Theory
4	Credits	: 2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	Hours Allotted	: 30 Hours
6	Marks Allotted	: 50 Marks
7	Course Objectives (CO): The students are expected to:	
	CO 1.	to develop a fundamental understanding of thermal interactions, adiabatic processes, thermodynamic potentials, and Maxwell's relations
	CO 2.	Study the basics of the quantum and classical theories of specific heat of solids.
	CO 3.	develop a strong foundation in classical and quantum statistical distributions such as Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics.
	CO 4.	understand the basic concept of probability, independent events and various kinds of statistical distributions.
	CO 5.	get exposure to important ideas of statistical mechanics.
8	Course Outcomes (OC): After successful completion of the course, the student will be able to:	
	OC 1.	explain and apply the concepts of thermal interactions, entropy, thermodynamic potentials, and use maxwell's relations to solve thermodynamic problems
	OC 2.	compare the classical, Einstein, and Debye theories of specific heat and interpret the temperature dependence of heat capacity in solids.
	OC 3.	understand statistical distributions like Maxwell Boltzmann Distribution, Bose Einstein Distribution, Fermi Dirac Distribution etc.
	OC 4.	acquire fundamental knowledge of probability.
	OC 5.	understand problem solving skills in all the topics covered.
9	Modules / Units: - There will be One Module / Unit Per Credit	
	Module I / Unit I: Thermal Physics (15 Hours)	
	Thermal & Adiabatic Interactions: Thermal Interactions, Canonical distributions, Entropy of a system in a Heat Bath, Adiabatic interactions & Enthalpy, Magnetic work, Thermodynamic potentials, Maxwell's Thermodynamic relations, the difference $C_p - C_v$.	
	LG: 2.1, 2.3, 2.5,2.7, 4.3,4.7 ,4.8,4.9	
	Specific Heat of Solids: Thermal vibrations- Frequencies, Thermal Vibrations-Amplitude, Specific Heats of Solids, The Einstein Theory, The Debye Theory, Electronic Specific Heat.	
	AB: 19.1,19.2,19.3,19.4,19.5,19.8	
	Module II / Unit II: Statistical Physics: (15 Hours)	

	The probability of a distribution, The most probable distribution, Maxwell-Boltzmann statistics, Molecular speeds. Bose-Einstein statistics, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results. AB:15.2, 15.3,15.4, 15.5, 16.1,16.4,16.5, 16.6 Microstates and configurations, derivation of Boltzmann distribution, dominance of Boltzmann distribution, physical meaning of the Boltzmann distribution law, definition of the canonical ensemble. ER:13.1,13.2,13.4, 14.1											
10	Reference Books: 1. AB: Perspectives of Modern Physics: Arthur Beiser, (Mc Graw Hill International). 2. LG: Statistical and Thermal Physics, An Introduction (Prentice Hall of India 1991) by S. Lokanathan and R. S. Gambhir 3. ER: Thermodynamics, Statistical Thermodynamics and Kinetics: T. Engel and P. Reid (Pearson). Additional References Books: 1. A Treatise on heat: Saha and Srivastava (Indian press, Allahabad) 2. Statistical Physics: F. Reif (Berkeley Physics Course, McGraw Hill) 3. Introductory Statistical Mechanics: R. Bowley and M. Sanchez (Oxford Science Publications). 4. An Introduction to Thermal Physics: D. V. Schroeder (Pearson).											
11	Internal Continuous Assessment: 40% (20 Marks)	External Assessment: (60%) (30 Marks)										
12	Continuous Evaluation through: Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc. (at least 3)	Evaluation: through Exam at the End of the Semester / Term.										
13	Format of Question Paper for Semester End Examination Total Marks: 30 Marks Duration: One Hour <table border="1"> <tr> <td rowspan="2">Module I / Unit-I 15 Marks</td><td>Q.1 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory</td><td>10 Marks</td></tr> <tr> <td>Q.1 B) Attempt any One (Each carry 05 Marks) i) Problem / Theory ii) Problem</td><td>05 Marks</td></tr> <tr> <td rowspan="2">Module I / Unit-II 15 Marks</td><td>Q.2 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory</td><td>10 Marks</td></tr> <tr> <td>Q.2 B) Attempt any One (Each carry -5 Marks) i) Problem / Theory ii) Problem</td><td>05 Marks</td></tr> </table>		Module I / Unit-I 15 Marks	Q.1 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory	10 Marks	Q.1 B) Attempt any One (Each carry 05 Marks) i) Problem / Theory ii) Problem	05 Marks	Module I / Unit-II 15 Marks	Q.2 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory	10 Marks	Q.2 B) Attempt any One (Each carry -5 Marks) i) Problem / Theory ii) Problem	05 Marks
Module I / Unit-I 15 Marks	Q.1 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory	10 Marks										
	Q.1 B) Attempt any One (Each carry 05 Marks) i) Problem / Theory ii) Problem	05 Marks										
Module I / Unit-II 15 Marks	Q.2 A) Attempt any Two (Each carry 05 Marks) i) Theory ii) Theory iii) Theory iv) Theory	10 Marks										
	Q.2 B) Attempt any One (Each carry -5 Marks) i) Problem / Theory ii) Problem	05 Marks										