

FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART – A: INTRODUCTION

Program: Bachelor in Science (Diploma/ Degree/ Honors)		Semester: III	Session: 2024-25
1	Course Code	PHSC-03T	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	<p>After going through the course, the student should be able to:</p> <ul style="list-style-type: none"> □ Demonstrate a deep comprehension of the fundamental principles of thermodynamics, including concepts such as energy, entropy and laws of thermodynamics. □ Apply the laws of thermodynamics to analyze and solve problems related with energy transfer, heat engines, refrigeration system and other thermodynamic processes. □ Analyze basic aspects of kinetic theory and transport phenomenon in gases. 	
6	Credit Value	03 Credits	1 Credit= 15 Hours for Learning & Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass Marks: 40

PART – B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	<p>Historical background: A brief historical background of thermodynamics and statistical physics in the context of India and Indian culture, Contribution of S. N. Bose in Statistical mechanics.</p> <p>Laws of Thermodynamics: Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, various Thermodynamical Processes, Work Done during Isothermal and Adiabatic Processes, Reversible & irreversible processes. Second law of thermodynamics & Entropy, Carnot's cycle, Carnot's theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics.</p>	12
II	<p>Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy and Gibbs function. Maxwell's relations & applications, Clausius- Clapeyron Equation, Expression for ($C_p - C_v$), C_p/C_v, TdS equations, Thermodynamic energy equation- change in internal energy of an ideal and Vander Waal's gas, Joule-Thompson Effect, Cooling by adiabatic demagnetization.</p>	11
III	<p>Kinetic Theory of Gases: Maxwellian distribution of speeds in an ideal gas: distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values, Molecular Collision and Mean Free Path.</p> <p>Transport Phenomena in gases: Viscosity, Conduction and Diffusion, Law of equipartition of energy.</p>	11
IV	<p>Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Stefan Boltzmann Law, Newton's law of cooling from Stefan Boltzmann's law. Wien's displacement law and Rayleigh-Jeans Law (Only qualitative). Planck's radiation Law, Deduction of Wien's distribution law and Rayleigh- Jeans Law from Planck's law. Experimental verification of Planck's radiation law.</p>	11
Keywords:	Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic Relations Kinetic Theory of Gases, Distribution of Velocities, Molecular Collisions, Real Gases, Laws of radiation	

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PART – C: LEARNING RESOURCES**Text Books, Reference Books and Others****Text Books**

1. Heat and Thermodynamics: Singhal, Agrawal and Satya Prakash, Pragati Prakashan 1984
2. Physics (Part-2): Editor, Prof. B.P.Chandra, M.P. Hindi Granth Academy
3. Unified Physics –II, R.P.Goyal, Shival Agrawal & Sons
4. Unified Physics –II. NovboddhPrakashan

Reference Books

1. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
2. Energy Science in Vedas: A Treatise on Vedic Thermodynamics and Free Energy (Exploring Lost Science and Technology in Vedas), Ramesh Kumar Mineria; Priya Veda Publications

Online Resources (e-books/ learning portals/ other e-resources)

1. Basics of thermodynamics
<https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8>
2. Thermodynamics <https://www.youtube.com/watch?v=E9cOAMhFUz0>
3. Second law of thermodynamics https://www.youtube.com/watch?v=F_fIGosPY8o
4. NPTEL Online Lectures: <https://archive.nptel.ac.in/courses/115/105/115105129/>
5. <https://archive.nptel.ac.in/courses/115/106/115106090/>
6. <https://bsc.hcverma.in/course/penopcyc>
7. Vedic Science and Thermodynamics : <https://www.puranavedas.com/vedic-physics/>
8. <https://www.amazon.in/Vedic-Physics-Raja-Ram-Mohan/dp/0968412009?asin=1988207045&revisionId=&format=4&depth=2>
9. <https://ia903100.us.archive.org/3/items/wholelottabooks/The%20Astronomical%20Code%20of%20the%20Rgveda%20-%20Shubash%20Kak.pdf>

PART – D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks: 100 Marks****Continuous Internal Assessment (CIA): 30 Marks****End Semester Examination (ESE): 70 Marks**

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2): 20 20 Assignment/ Seminar (1): 10 Total Marks: 30	Better marks out of the two Test / Quiz+ marks obtained in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x 1 = 10 Mark; Q2. Short answer type- 5x4 = 20 Marks Section B: Descriptive answer type, 1 out of 2 from each unit- 4x10 = 40 Marks	

Name and Signature of Convener & Members of CBoS:








