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)**	After going through the course, the student should be able to: • 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

TotalNo.of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**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. **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.	12
II	**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.	11
III	**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. **Transport Phenomena in gases**: Viscosity, Conduction and Diffusion, Law of equipartition of energy.	11
IV	**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.	11

Keywords:	Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics,Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic RelationsKinetic 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, Shivlal Agrawal &Sons
4. Unified Physics –II. NovbodhPrakashan

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_flGosPY8o***
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: 100Marks
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 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

10/6/24

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COURSE CURRICULUM

PART – A: INTRODUCTION

Program:Bachelor in Science (Diploma/ Degree/ Honors)		Semester: III	Session: 2024-25
1	Course Code	PHSC- 03P	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Core Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	➢ Lab Proficiency: Thermometers, pressure gauges, calorimeters, heat transfer apparatus, experimental setup, data acquisition. ➢ Hands-on Learning**: Heat transfer, work done, entropy, phase transitions, experiments. ➢ Data Analysis: Experimental data, theoretical discrepancies, analysis. ➢ Predictive Skills: Thermodynamic behavior, varying conditions, experimentation. ➢ Theory-Practice Integration: Theoretical knowledge, practical lab work, synthesis, applications.	
6	Credit Value	01 Credit	1 Credit = 30 HoursLaboratory Work
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20

PART – B: CONTENT OF THE COURSE

TotalNo.of learning-Training/performance Periods -30 Periods (30 Hours)

Sr. No.	Objects (At least 10 of the following or related Experiments)	No. of Periods
1	To determine the thermal conductivity of a non-conducting material by Lee's disc method.	30
2	To study the variation of thermo emf across two junctions of a thermocouple with temperature.	
3	To verify Newton's law of cooling.	
4	To determine the temperature co-efficient of resistance by Platinum resistance thermometer.	
5	To determine the coefficient of thermal conductivity(k) of a rubber tube.	
6	To study the heat efficiency of an electric kettle with varying voltage.	
7	To determine the ratio of specific heat at constant pressure and constant volume (γ=Cp/Cv) of air Clement and Desorme's method.	
8	To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.	
9	To study the variation of thermos-Emf of thermos couple with Difference of Temperature of its Two Junctions.	
10	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.	
11	Measurement of Planck's constant using black body radiation.	
12	To determine Stefan's Constant.	

Keywords:	Thermal conductivity, Thermocouple, Newton's law of cooling, Temperature coefficient of resistance, Heat efficiency, Specific heat ratio, Mechanical equivalent of heat, Planck's constant

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PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. Unified Practical Physics B.Sc II : R P Goyal, Shivlal Agrawal &Sons Publications

Reference Books Recommended-

1. Practical Physics by C.L. Arora
2. Practical Physics by S.L. Gupta and Vijay Kumar
3. Advanced Practical Physics for Students by B.L. Worsnop and H.T. Flint

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

Link for e-Books for Physics Practicaland Virtual labs

1. Thermal Physics and Statistical Mechanics: Laboratory Collectionhttps://egyankosh.ac.in/handle/123456789/67450
2. Virtual Lab :https://vlab.amrita.edu/index.php?sub=1&brch=194
3. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1
4. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=4
5. https://srmap.edu.in/seas/physics-virtual-lab/
6. https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab
   https://www.pbslearningmedia.org/resource/lsps07-sci-phys-thermalenergy/thermal-energy-transfer/#.WdJiOJIrLIU

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment(CIA):15 Marks
EndSemester Exam(ESE):35 Marks

Continuous InternalAssessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance –**05** Total Marks - **15**	Better marks out of the two Test / Quiz **+Marks** obtained in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory Performance: On spot Assessment** **Performed the Task based on lab. work - 20 Marks** **Spotting based on tools & technology (written) – 10 Marks** **Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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