GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Mechanical/AgricultureEngineering		
Semester	III	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the batch Admitted in	JULY 2025
Course code	1ME3103	Course Name	Thermodynamics

I. TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course code	Course Title	Teaching & Learning Scheme									Examination Scheme							
			Credit				Actual Contact Hrs/week			SLH	Total Learning Hrs/Week	TH			PR			SLA	Total
			CL	TL	LL	Total	CL	TL	LL			CE	SEE	Total	CE	SEE	Total		
DSC	1ME3103	Thermodynamics	3	0	0	3	3	0	0	3	6	40	60	100	-	-	-	20	120

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**SLA -** Self Learning Assessment	**CE** – Continuous Evaluation
	SEE – Semester End Examination		

II. PRE-REQUISITES

Basic knowledge of Energy, Entropy and Cycles.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

To apply fundamental thermodynamics principles to real-world problems, specifically focusing on energy efficiency, system optimization, and sustainability. The core expected outcome is the ability to move beyond theoretical calculations to practical design, troubleshooting, and analysis of thermal systems.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Identify and explain the essential principles of mathematics, science, and engineering required for studying energy behaviour and conversion processes in thermodynamics.

CO2. Apply the First Law of Thermodynamics to closed systems and solve simple problems.

CO3. Understand ideal gas laws and basic thermodynamic processes used in mechanical engineering Systems.

CO4. Understand the Second Law of Thermodynamics and the concept of entropy with reference to Practical engineering applications.

CO5. Identify and explain the working principles of various gas and vapour power cycles.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 **Basic concepts of thermodynamics**	**TLO 1.1** Define and explain the basic terms related to thermodynamics including engineering, thermodynamics, system, surroundings and boundary.	**1.1** Define the terms Engineering, Thermodynamics, System, Surroundings and Boundary.	**10**	**07**

	TLO 1.2 Identify and classify different types of systems and boundaries and explain the concept of control volume, thermodynamic properties and their units. **TLO 1.3** Distinguish between extensive and intensive properties, and differentiate between path functions and point functions. **TLO 1.4** Explain the concepts of energy, heat, work and enthalpy and their significance in thermodynamic processes. **TLO 1.5** State and explain the Zeroth Law of Thermodynamics, describe its applications and understand the concept of thermodynamic equilibrium.	**1.2** Types of systems, types of boundaries, control volume, thermodynamic properties and their units. **1.3** Define extensive properties and intensive properties, Differentiate Path function and Point function. **1.4** Concept of energy, heat, work and enthalpy. **1.5** Zeroth Law of Thermodynamics and Its Applications; Thermodynamic Equilibrium.		
Unit-2 **First law of thermodynamics**	**TLO 2.1** Understand the basic laws of thermodynamics and their importance. **TLO 2.2** Apply the first law of thermodynamics to closed and open systems to calculate work, heat and internal energy changes. **TLO 2.3** Recognize limitations of the first law and the need for the second law. **TLO 2.4** Solve numerical problems for energy changes in simple thermodynamic devices. **TLO 2.5** Apply knowledge to analyze and improve mechanical devices like pumps, turbines, boilers and compressors.	**2.1** Describe the first law of thermodynamics and explain how Joule's experiment verifies this law. **2.2** Apply the first law of thermodynamics to both closed and open systems. **2.3** The energy contained within a system, known as internal energy is a property of the system. **2.4** Points where the first law of thermodynamics does not provide complete information. **2.5** Derive and discuss the energy equation for steady-flow processes. **2.6** Using the steady-flow energy equation to analyze energy changes in various engineering devices—including nozzles, diffusers, boilers, turbines, compressors, pumps, heat exchangers and throttling processes—supported by basic numerical examples. **2.7**Using the steady-flow Energy equation to analyzeEnergy changes in various Engineering devices- Including nozzles, diffusers, Boilers,turbines,Compressors, Pumps,heat exchangers and	**12**	**08**

		Throttling processes.Numericalproblems based on these.		
Unit-3 **Ideal gases and thermodynamic processes**	**TLO 3.1** Understand the concept of an ideal gas and the relationship between pressure, volume and temperature. **TLO 3.2** State and use the ideal gas equation PV=mRT and understand the universal gas constant. **TLO 3.3** Explain specific heat at constant pressure and constant volume and their relationship. **TLO 3.4** Identify different thermodynamic processes and draw their P–V and T–S diagrams. **TLO 3.5** Use P–V–T equations to solve simple thermodynamics problems.	**3.1** Understand the concept of an ideal gas and derive the relationships between its pressure, volume, and temperature. **3.2** Prove that PV= mRT equation, Relation Between Gas Molecules and Volume and Universal Gas Constant. **3.3** Specific heat at Constant Pressure, Specific heat at Constant Volume and their relationship. **3.4** Different thermodynamic processes along with their graphical representation on P–V and T–S diagrams. **3.5** Equations for P-V-T relationship.	**12**	**10**
Unit-4 **Second law of thermodynamics**	**TLO 4.1** Define basic thermodynamic terms such as source,Sink, Heat Engine, Refrigerator, Heat Pump and Heat Reservoir. **TLO 4.2** Explain the Second Law of Thermodynamics and interpret its meaning using the Kelvin–Planck and Clausius statements. **TLO 4.3** Understand and define performance parameters including thermal efficiency of a heat engine, Coefficient of Performance (COP) of a refrigerator, COP of a heat pump and entropy. **TLO 4.4** Differentiate between heat engine, refrigerator, and heat pump based on their working principles and applications. **TLO 4.5** Apply thermodynamic formulas related to efficiency, COP and entropy in problem-solving. **TLO 4.6** Solve numerical problems related to heat engines, refrigerators, heat pumps, and the Second Law of Thermodynamics.	**4.1** Define Source, Sink, Heat Engine, Refrigerator, Heat Pump and Heat Reservoir. **4.2** Explain the Second Law of Thermodynamics with reference to the Kelvin–Planck and Clausius statements. **4.3** Define Thermal efficiency of heat engine,(C.O.P.)refrigerator,(C.O.P.)heat pump,entropy. **4.4** Solve numerical examples.	**12**	**10**

Unit-5 **Thermodynamic cycles**	**TLO 5.1** Classify different thermodynamic cycles based on their working principle, energy transfer and applications. **TLO 5.2** Differentiate between a thermodynamic process and a cycle, understanding the concept of state changes and cyclic operation. **TLO 5.3** Explain the working of Carnot, Otto, Diesel, Dual, and Brayton (Joule) cycles and represent them accurately on P–V and T–S diagrams. **TLO 5.4** Analyze the advantages, limitations and practical applications of the above cycles in real-world engineering systems. **TLO 5.5** Compare the thermodynamic cycles based on performance parameters such as efficiency, work output and suitability for specific applications. **TLO 5.6** Develop problem-solving skills to apply cycle concepts in numerical examples related to work, heat transferand efficiency. **TLO 5.7** Understand the relevance of these cycles in designing and evaluating engines, power plants and refrigeration systems.	**5.1** Classification of cycle. **5.2** Differentiate between process and cycle. **5.2** Describe the Carnot, Otto, Diesel, Dual and Brayton (Joule) cycles and illustrate each on P–V and T–S diagrams. **5.3** Discuss the drawbacks and practical uses of the above cycles and compare them on the basis of various parameters.	**14**	**10**

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)
• First Law of Thermodynamics Applications: Analyze three different systems (Closed, Open-Steady, and Open-Unsteady). • Second Law of Thermodynamics and Entropy: Solve problems related to Heat Engines, Refrigerators, and Heat Pumps to determine COP and Efficiency. • Thermodynamic Cycles: Analyze the efficiency of power cycles (e.g., Otto, Diesel cycles). **<u>Mini projects</u>** • Appliance Analysis: Each student will select one common household appliance (e.g., Air Conditioner, Refrigerator, or Water Heater). Analyze its thermodynamic cycle, calculate its efficiency/COP, and submit a brief technical report with observations.

IX. LIST OF REFERENCE BOOKS			
Sr.No.	**Title**	**Author**	**Publication**
1	Thermodynamics	R. B. Varia	AtulPrakashan.
2	Thermodynamics	Yunus A. Çengel	Tata McGraw Hill Education Pvt. Ltd.
3	Engineering Thermodynamics by	P. K. Nag	McGraw-Hill Education
4	Applied Thermodynamics	R. C. Patel	Acharya Book Depot
5	Thermodynamics	R. Yadav	Central publishing house
6	Fundamentals of Engineering Thermodynamics	E. Radhakrishna	Prentice Hall of India Pvt. Ltd., New Delhi

X. LINK OF LEARNING WEB RESOURCE	
1	http://www.nptel.iitm.ac.in
2	http://www.thermofluids.net
3	http://www.learnerstv.com/Free-Engineering thermodynamics-Video-lectures-ltv301-Page1.htm
4	http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html
5	http://www.youtube.com/watch?v=kJlmRT4E6R0

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE							
Unit	**Unit Title**	**Aligned COs**	**Learning Hours**	**R-Level**	**U-Level**	**A-Level**	**Total Marks**
1	Basic concepts of thermodynamics	CO1	07	6	4	0	10
2	First law of thermodynamics	CO2	08	2	4	6	12
3	Ideal gases and thermodynamic processes	CO3	10	4	4	4	12
4	Second law of thermodynamics	CO4	10	2	6	4	12
5	Thermodynamic cycles	CO5	10	2	6	6	14
		Grand Total	45	16	24	20	60

XII. COs AND POs AND PSOs MAPPING										
Course Outcomes (COs)	**Programme Outcomes (POs)**							**Programme Specific Outcomes (PSOs)**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	3	3	2	3	3
CO2	3	3	3	2	3	3	3	2	3	3
CO3	3	3	3	2	3	3	3	2	3	3
CO4	3	3	3	2	3	3	3	2	3	3
CO5	3	3	3	2	3	3	3	2	3	3
Legends: -*3- High 2-Moderate/Medium 1-Slight/Low 0-None*										