



**LESSON PLAN**

Course Code	Course Title	Semester	Branch	Conduct Periods /Week	A.Y	Date of commencement of Semester	
23ME3T01	THERMODYNAMICS	III	Mechanical Engineering	5	2025-26	14 -07 -2025	
COURSE OUTCOMES							
CO1	Describe the basic concepts of thermodynamics. [K2]						
CO2	Explain the importance of thermodynamic properties related to conversion of heat energy into work. [K3]						
CO3	Apply the Zeroeth and First Law of Thermodynamics. [K3]						
CO4	Apply second law of thermodynamics and general thermodynamic property relations to solve problems. [K3]						
CO5	Analyze the properties of pure substances with P-V, P-T, T-S and h-s diagrams, Steam calorimetry, Phase Transformations.[K4]						
CO6	Analyze the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads. [K4]						
UNIT	Out Comes/ Blooms Level	Ref. No.	Topics/Activity		Text Book /Reference	Conduct Hour	Delivery Method
I	CO1 Describe the basic concepts of thermodynamics. [K2]	Introduction: Basic Concepts					Chalk& Talk, PPT, Flipped class room (active learning Method )
		1.1	Introduction, Importance of thermodynamics		$T_1$ & $T_2$	1	
		1.2	Thermodynamics System, boundary, Surrounding, Universe		$T_1$ & $T_2$	1	
		1.3	Types of Systems control volume		$T_1$	1	
		1.4	Control volume		$T_1$ & $R_1$	1	
		1.5	Macroscopic and Microscopic viewpoints		$T_1$ & $R_1$	1	
		1.6	Concept of Continuum		$T_2$ & $R_2$	1	
		1.7	Thermodynamic Equilibrium		$T_2$ & $R_2$	1	
		1.8	State, Property, Process, Cycle		$T_1$ & $T_2$	1	
		1.9	Reversibility – Quasi static Process		$T_1$ & $T_2$	1	
		1.10	Irreversible Process, Causes of Irreversibility		$T_1$ , & $R_1$	1	
Total					10		
II	CO2: Explain the importance of thermodynamic properties related to	Ideal Gas Laws:					Chalk& Talk, &PPT, Videos. Think, pair share
		2.1	Energy in State & in Transition – Types , Work and Heat		$T_1$ & $T_2$	1	
		2.2	Point function and Path function		$T_1$ & $R_1$	1	
		2.3	Zeroeth Law of Thermodynamics – concept of temperature		$T_1$ & $R_1$	1	
		2.4	Principles of thermometry – reference points, Constant volume gas thermometer		$T_1$ & $R_1$	1	

	conversion of heat energy into work. [K3]  & <b>CO3:</b> Apply the Zeroeth and First Law of Thermodynamics. [K3]	2.5	Principle of First law of thermodynamics, Joule's Experiment.	T <sub>1</sub> & R <sub>1</sub>	1	(active learning Method )
		2.6	First law for a closed system undergoing a change of state, Energy: property of the system	T <sub>1</sub> & R <sub>1</sub>	1	
		2.7	Different forms of stored energy, Internal Energy. PMM-1	T <sub>1</sub> & R <sub>1</sub>	1	
		2.8	First law applied for a Non flow processes-properties-end states-heat transfer-work transfer-change in internal energy- Constant Volume process, Constant Pressure process & Constant temperature process	T <sub>1</sub> & R <sub>1</sub>	1	
		2.9	Adiabatic & Polytropic processes	T <sub>1</sub> & R <sub>1</sub>	1	
		2.10	First law applied to a flow system - Steady Flow Energy Equation SFEE Applications.	T <sub>1</sub> & R <sub>1</sub>	1	
		2.11	Enthalpy, Limitations of the First Law	T <sub>1</sub> & R <sub>1</sub>	1	
		2.12	Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.	T <sub>1</sub> & R <sub>1</sub>	1	
		2.13	Problems	T <sub>1</sub> & R <sub>1</sub>	2	
	Content Beyond the Syllabus	2.14	Vander Waals' equation of a real gas	T <sub>1</sub>	1	
<b>Total</b>					<b>15</b>	
	<b>CO4:</b> Apply second law of thermodynamics and general thermodynamic property relations to solve problems. [K3]	<b>Second Law of Thermodynamics</b>				Chalk& Talk, &PPT, Videos, Quiz
		3.1	Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements	T <sub>1</sub> & T <sub>2</sub>	1	
		3.2	Kelvin-Planck and Clausius Statements Equivalence / Corollaries	T <sub>1</sub> & R <sub>1</sub>	1	
		3.3	PMM-II, Carnot's principle, Carnot cycle and its specialties	T <sub>1</sub> & R <sub>1</sub>	1	
		3.4	Thermodynamic scale of temperature,	T <sub>1</sub> & T <sub>2</sub>	1	
		3.5	Clausius Inequality	T <sub>1</sub> & T <sub>2</sub>	1	
		3.6	Entropy, Principle of Entropy Increase – Energy Equation	T <sub>1</sub> & R <sub>1</sub>	1	
		3.7	Availability and Irreversibility	T <sub>1</sub> & R <sub>1</sub>	1	
		3.8	Thermodynamic Potentials, Gibbs and Helmholtz Functions,	T <sub>1</sub> & R <sub>1</sub>	1	
		3.9	Maxwell Relations	T <sub>1</sub> & T <sub>2</sub>	1	
		3.10	Elementary Treatment of the Third Law of Thermodynamics & Problems	T <sub>1</sub> & T <sub>2</sub>	1	
		3.11	Problems	T <sub>1</sub> & T <sub>2</sub>	3	
<b>Total</b>					<b>13</b>	
<b>IV</b>	<b>CO5:</b> Analyze the properties of pure substances with P-V, P-T, T-S and h-s	<b>Properties of Pure Substances</b>				Chalk& Talk, &PPT, Videos, Think, pair share
		4.1	Definitions- Sensible heat, Latent heat, Phase Transformation	T <sub>1</sub> & T <sub>2</sub>	1	
		4.2	Formation of Steam, P-V diagram, P-T diagram,	T <sub>1</sub> & T <sub>2</sub>	1	
		4.3	T-S diagram and h-s diagram or Mollier Chart.	T <sub>1</sub> & T <sub>2</sub>	1	
		4.4	PVT Surface with three-dimensional view, phase diagram and p-v diagram	T <sub>2</sub> & R <sub>1</sub>	1	



	diagrams, Steam calorimetry, Phase Transformations.[K4]	4.5	Triple point and critical point, Properties of steam, Dryness Fraction	$T_1$ & $R_1$	1	(active learning Method )
		4.6	Property Tables and Mollier diagram	$T_1$ & $R_1$	1	
		4.7	Steam Calorimetry	$T_1$ & $T_2$	1	
		4.8	Various Thermodynamic Processes applied to steam - Energy Transfer – Constant pressure process.	$T_1$ & $T_2$	1	
		4.9	Isothermal process & Adiabatic process	$T_1$ & $T_2$	1	
		4.10	Problems with steam tables	$T_1$ & $T_2$	2	
		4.11	Problems with mollier chart	$T_1$ & $T_2$	1	
Total					12	
V	CO6: Analyze the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads. [K4]	Refrigeration Cycles				
		5.1	Introduction to Refrigeration: working of Air refrigeration cycle - Bell- Coleman Cycle P-V & T-S diagrams - and Coefficient of performance	$T_1$ & $T_2$	1	Chalk& Talk, &PPT, Flipped class room (active learning Method
		5.2	Vapour compression refrigeration cycle with P-h & T-S diagrams, VCR system Components and Coefficient of performance	$T_1$ & $T_2$	1	
		5.3	Refrigerants –types – properties	$T_1$ & $T_2$	1	
		5.4	Introduction to Air Conditioning- Psychrometric properties	$T_1$ & $T_2$	1	
		5.5	Psychrometric chart, Psychrometric processes	$T_1$ & $T_2$	1	
		5.6	characterization of sensible and latent heat loads	$T_1$ & $T_2$	1	
		5.7	load concepts of SHF.	$T_1$ & $T_2$	1	
		5.8	Requirements of human comfort and concept of effective temperature	$T_2$ & $R_1$	1	
		5.9	comfort chart	$T_2$ & $R_1$	1	
		5.10	Types of air conditioning systems	$T_2$ & $R_1$	1	
		5.11	Air conditioning - load calculations, RSHF, GSHF & ERSHF	$T_2$ & $R_1$	1	
		5.12	Problems on Psychrometric properties	$T_2$ & $R_1$	2	
		5.13	Problems on load calculations	$T_2$ & $R_1$	2	
Total					15	
CUMULATIVE PROPOSED PERIODS					65	

**Text Books:**

S.No	Authors, Book Title, Edition, Publisher, Year of Publication
T1	P.K Nag, Engineering Thermodynamics, 6 <sup>th</sup> Edition, McGraw-Hill Publication, 2020
T2	Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics 10 <sup>th</sup> Edition, John Wiley & Sons 2022.





**Reference Books:**

S.No	Authors, Book Title, Edition, Publisher, Year of Publication
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R1	R.K Rajput, A Textbook Of Engineering Thermodynamics, 5th Edition, Lakshmi Publication, 2016.
R2	P.Chattopadhyay, Engineering Thermodynamics, 2 <sup>th</sup> Edition, Oxford Higher Edn Publ, 2015
R3	C P Arora, Refrigeration and Air-conditioning - 4 <sup>th</sup> Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2021.

#### Web Details

W1	<a href="https://nptel.ac.in/courses/112105123/1">https://nptel.ac.in/courses/112105123/1</a>
W2	<a href="https://nptel.ac.in/courses/112105123/2">https://nptel.ac.in/courses/112105123/2</a>
W3	<a href="https://nptel.ac.in/courses/112105123/3">https://nptel.ac.in/courses/112105123/3</a>
W4	<a href="https://nptel.ac.in/courses/112105123/6">https://nptel.ac.in/courses/112105123/6</a>
W5	<a href="https://nptel.ac.in/courses/112105123/7">https://nptel.ac.in/courses/112105123/7</a>
W6	<a href="https://nptel.ac.in/courses/112105123/15">https://nptel.ac.in/courses/112105123/15</a>

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Principal