LESSON PLAN

Course Code	Course Title	Semester	Branche	Conduct Periods /Week	A.Y	Date of commencement of Semester
23ME3T01	THERMODYNAMICS	III	Mechanical Engineering	5	2024-25	22 -07 -2024

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, NPTEL ,
		1.1	Introduction, Importance of 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		**Ideal Gas Laws:**			Chalk& Talk, &PPT, Videos.
		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	T_1& R_1	1	

	related to conversion of heat energy into work. [K3] & **CO3:** Apply the Zeroeth and First Law of Thermodynamics. [K3]		points, Constant volume gas thermometer			
		2.5	Principle of First law of thermodynamics, Joule's Experiment.	T_1& R_1	1	
		2.6	First law for a closed system undergoing a change of state, Energy: property of the system	T_1& R_1	1	
		2.7	Different forms of stored energy, Internal Energy. PMM-1	T_1& R_1	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_1& R_1	1	
		2.9	Adiabatic & Polytropic processes	T_1& R_1	1	
		2.10	First law applied to a flow system - Steady Flow Energy Equation SFEE Applications.	T_1& R_1	1	
		2.11	Enthalpy, Limitations of the First Law	T_1& R_1	1	
		2.12	Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.	T_1& R_1	1	
		2.13	Problems	T_1& R_1	2	
	Content Beyond the Syllabus	2.14	Vander Waals' equation of a real gas	T1	1	
			Total		**15**	
	CO4: Apply second law of thermodynamics and general thermodynamic property relations to solve problems. [K3]	**Second Law of Thermodynamics**				
		3.1	Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements	T_1& T_2	1	Chalk& Talk, &PPT, Videos
		3.2	Kelvin-Planck and Clausius Statements Equivalence / Corollaries	T_1& R_1	1	
		3.3	PMM-II, Carnot's principle, Carnot cycle and its specialties	T_1& R_1	1	
		3.4	Thermodynamic scale of temperature,	T_1 & T_2	1	
		3.5	Clausius Inequality	T_1 & T_2	1	
		3.6	Entropy, Principle of Entropy Increase – Energy Equation	T_1& R_1	1	
		3.7	Availability and Irreversibility	T_1& R_1	1	
		3.8	Thermodynamic Potentials, Gibbs and Helmholtz Functions,	T_1& R_1	1	
		3.9	Maxwell Relations	T_1 & T_2	1	
		3.10	Elementary Treatment of the Third Law of Thermodynamics & Problems	T_1 & T_2	1	
		3.11	Problems	T_1 & T_2	3	
				Total	**13**	
IV	**CO5:** Analyze the properties of pure substances with P-V, P-	**Properties of Pure Substances**				
		4.1	Definitions- Sensible heat, Latent heat, Phase Transformation	T_1 & T_2	1	Chalk& Talk, &PPT, Videos, seminar
		4.2	Formation of Steam, P-V diagram, P-T diagram,	T_1 & T_2	1	
		4.3	T-S diagram and h-s diagram or Mollier Chart.	T_1 & T_2	1	

	T, T-S and h-s diagrams, Steam calorimetry, Phase Transformations.[K4]	4.4	PVT Surface with three-dimensional view, phase diagram and p-v diagram	T_2& R_1	1	
		4.5	Triple point and critical point, Properties of steam, Dryness Fraction	T_1& R_1	1	
		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	**CO5**: Analyze the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads. [K4]	**Refrigeration Cycles**				Chalk& Talk, &PPT, Videos
		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	
		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, 6th Edition, McGraw-Hill Publication, 2020
T2	Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics 10th Edition, John Wiley & Sons 2022.

Reference Books:

S.No.	Authors, Book Title, Edition, Publisher, Year of Publication
R1	R.K Rajput, A Textbook Of Engineering Thermodynamics, 5th Edition, Lakshmi Publication, 2016.
R2	P.Chattopadhyay, Engineering Thermodynamics, 2th Edition, Oxford Higher Edn Publ, 2015
R3	C P Arora, Refrigeration and Air-conditioning - 4th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2021.
Web Details	
W1	https://nptel.ac.in/courses/112105123/1
W2	https://nptel.ac.in/courses/112105123/2
W3	https://nptel.ac.in/courses/112105123/3
W4	https://nptel.ac.in/courses/112105123/6
W5	https://nptel.ac.in/courses/112105123/7
W6	https://nptel.ac.in/courses/112105123/15

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