

THERMODYNAMICS

Course Code	23ES1302	Year	II	Semester	I
Course Category	Engineering Science	Branch	ME	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	-
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes: Upon successful completion of the course, the student will be able to

COs	Statements	Skill	Blooms Level	UNIT
CO1	Understand the importance of thermodynamic properties related to conversion of heat energy into work.	Understand	L2	1,2,3,4,5
CO2	Apply the Zeroeth and First Law of Thermodynamics.	Apply	L3	2
CO3	Understand Second Law of Thermodynamics.	Understand	L2	3
CO4	Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations	Analyze	L4	4
CO5	Evaluate the efficiency of the cycle and COP of refrigerating systems and psychrometry properties and processes.	Evaluate	L5	5

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2				2			1		2	3	2
CO 2	3	3	2				2			1		2	3	2
CO 3	3	3	2				2			1		2	3	2
CO 4	3	3	2				2			1		2	3	2

Syllabus

UNIT	Contents	Mapped COs
I	Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility.	CO1

II	Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroeth Law of Thermodynamics – PMM-I, Joule’s Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.	CO1 CO2
III	Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot’s principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.	CO1 CO3
IV	Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.	CO1 CO4
V	Gas power cycles:: Otto, Diesel, Dual Combustion cycles- Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles. Introduction to Refrigeration and Air Conditioning: Working of Air, VCR system Components, COP Refrigerants.Psychrometric properties & processes, sensible and latent heat loads, Sensible Heat Factor.	CO1 CO5

Learning Resources
<p>Text Books:</p> <ol style="list-style-type: none"> 1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013. 2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995. 2. Y.A.Cengel&M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010. 3. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011. 4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.
<p>e- Resources& other digital material:</p> <ul style="list-style-type: none"> • https://www.edx.org/learn/thermodynamics. • https://archive.nptel.ac.in/courses/112/106/112106310. • https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s • https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg.-Thermal-Engineering-1_Abhijit-Samant.pdf • https://www.coursera.org/learn/thermodynamics-intro

