ENGINEERING THERMODYNAMICS

Course Code	19ME3302	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ME	**Course Type**	Theory
Credits	3	**L – T – P**	2 – 1 – 0	**Prerequisites**	NIL
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes		**Levels**
After successful completion of the course, the student will be able to		
CO1	Learn the terminology and basic concepts of thermodynamics and capable of analyzing zeroth and first law of thermodynamics	L1
CO2	Analyze Second law of thermodynamics and working of various devices with heat and work transactions.	L4
CO3	Assess quality and quantity of energy and analyze Exergy	L5
CO4	Recognize and understand different phases of pure substances and familiarize with saturated and superheated steam property tables and charts	L2
CO5	Learn power producing thermodynamic cycles capable of making their analysis and evaluate the relative performance	L1

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1: Low)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2				2	2	2				2	2	2
CO2	3	3				3	3	2				2	2	2
CO3	3	3				3	3	2				2	2	2
CO4	2	2				3	3	2				2	2	2
CO5	3	3				3	3	2				2	2	2

Syllabus		
Unit No.	**Contents**	**Mapped COs**
I	**INTRODUCTION:** Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics. **FIRST LAW OF THERMODYNAMICS:** Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics**.**	CO1
II	**SECOND LAW OF THERMODYNAMICS**: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.	CO2

III	**ENTROPY:** Clausius inequality - Concept of Entropy- entropy equation for different processes and systems, Maxwell relations, TDS equations **AVAILABILITY AND IRREVERSIBILITY**: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes, irreversibility.	CO3
IV	**PROPERTIES OF STEAM AND USE OF STEAM TABLES**: Pure Substances, P-V-T surfaces, dryness fraction, property tables, T-s and h-s diagram (Mollier chart), analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry.	CO4
V	**THERMODYNAMIC CYCLES**: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle, Brayton Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.	CO5

Learning Recourse(s)

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Van Wylen, Fundamentals of Classical Thermodynamics, G.J.John Wylie./ S chand Publications

Reference Book(s)

1. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.
2. P.L.Dhar, Engineering Thermodynamics a generalized approach, Elsevier
3. J.B.JonesandG.A.Hawkins,IntroductiontoThermodynamics, 2/e, John Wiley & Sons,2012.
4. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
5. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley,2009
6. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

e-Resources & other digital material

1. https://nptel.ac.in/courses/112/105/112105266/
2. https://nptel.ac.in/courses/112/105/112105220/
3. https://nptel.ac.in/courses/101/104/101104067/
4. https://nptel.ac.in/courses/101/104/101104063/
5. https://nptel.ac.in/courses/103/104/103104151/