COURSE INFORMATION SHEET

Course Code: ME24201
Course Title: Thermodynamics
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: 3 (L: 3 T: 0 P: 0)
Class schedule per week: 3
Class: B. Tech.
Semester / Level: THIRD
Branch: Mechanical Engineering
Name of Teacher:

COURSE OBJECTIVES

This course envisions to impart to students to:

1.	Understand the basics of classical thermodynamics.
2.	Learn the laws of energy conservation and discuss their limitations
3.	Analyze the laws and apply them to different engineering problems.
4.	Formulate different thermodynamics relations for engineering practice.

COURSE OUTCOMES (COs)

After the completion of this course, students will be able to:

CO1	Discuss the basic concepts of thermodynamics.
CO2	Apply the laws of thermodynamics to various flow, non-flow and cyclic systems.
CO3	Evaluate the performance different engineering devices.
CO4	Develop thermodynamics relations for engineering practices.

Dr, Om Prakash

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction: Fundamental Concepts: Macroscopic versus microscopic point of view, definitions of system and surrounding, concept of control volume, thermodynamic state, processes and cycles, point function and path function, quasi-static process, concepts of simple compressible substances, dimensions and units, thermodynamic equilibrium; Zeroth law; ideal gases equation; pure substance and phase, Thermodynamic properties and use of steam tables Thermodynamic definition of work, work done at the moving boundary of a system and other systems , Definition of heat, comparison of Heat and Work.	**8**
Module – II First Law of Thermodynamics: The first law referred to cyclic and non-cyclic processes, concept of internal energy of a system, conservation of energy for simple compressible closed systems; Definitions of enthalpy and specific heats; First law applied to a control volume, general energy equation; steady flow energy equation on unit mass and time basis, application of SFEE for devices such as boiler, turbine, heat exchangers, pumps, nozzles, etc.	**8**
Module – III Second Law of Thermodynamics: Limitations of the first law, concept of a heat engine, heat pump, refrigerator, statements of the second law, their equivalence, Carnot cycle, reversible heat engine, Carnot theorems and corollaries, Concept of reversibility; Internal and external irreversibility, Absolute thermodynamic temperature scale.	**8**
Module – IV Clausius Inequality, entropy, change in entropy in various thermodynamic processes, entropy balance for closed and open systems, Principle of increase-in-Entropy, entropy generation. Concept of reversible work & irreversibility, second law efficiency, Exergy change of a system: closed & open system, Exergy balance equation.	**8**
Module – V Thermodynamics property and relations: Maxwell relations, Clausius-Clapeyron equation, Difference in heat capacities, Ratio of heat capacities, Joule-Thompson coefficient.	**8**

TEXTBOOKS:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons
2. Yonus A Cengel and Michale A Boles, 2002, Thermodynamics: An Engineering Approach, McGraw Hill.

REFERENCE BOOKS:

1. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
2. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
3. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

GAPS IN THE SYLLABUS (TO MEET INDUSTRY/PROFESSION REQUIREMENTS)

Modern computational tools (e.g., MATLAB, EES), sustainability concepts, and integration with contemporary applications such as renewable energy, HVAC systems, and energy management technologies.

POS MET THROUGH GAPS IN THE SYLLABUS: PO 1-5.

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN

Thermodynamic analysis and optimization of real-world energy systems using exergy-based design and analysis.

POS MET THROUGH TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN: PO 1-5, PO 11-12.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

DIRECT ASSESSMENT

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Continuous Internal Assessment	% Distribution
Mid Semester Examination	25
Quiz, Assignment	10 + 10
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4
Continuous Internal Assessment	√	√	√	√
Semester End Examination	√	√	√	√

INDIRECT ASSESSMENT

1. Student Feedback on Course Outcome

COURSE DELIVERY METHODS

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

MAPPING BETWEEN COURSE OUTCOMES AND POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2						1	1			1	1	1	2
CO2	3	2						1	1			1	1	1	2
CO3	3	2	1	1				1	1			1	1	1	2
CO4	3	2						1	1			1	1	1	2

Grading: No correlation – 0, Low correlation - 1, Moderate correlation – 2, High Correlation - 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD 6
CO2	CD1, CD2, CD 6
CO3	CD1, CD2, CD 6
CO4	CD1, CD2, CD 6