

Subject Code:01ME0404
Subject Name: Engineering Thermodynamics
B.Tech. Sem- IV
Type of course: Engineering Science

Prerequisite: Nil

Rationale: Engineering Thermodynamics is the introductory course on Thermal Science and Engineering. It comprises the understanding of certain natural laws and energy interaction prominently heat and work transfer.

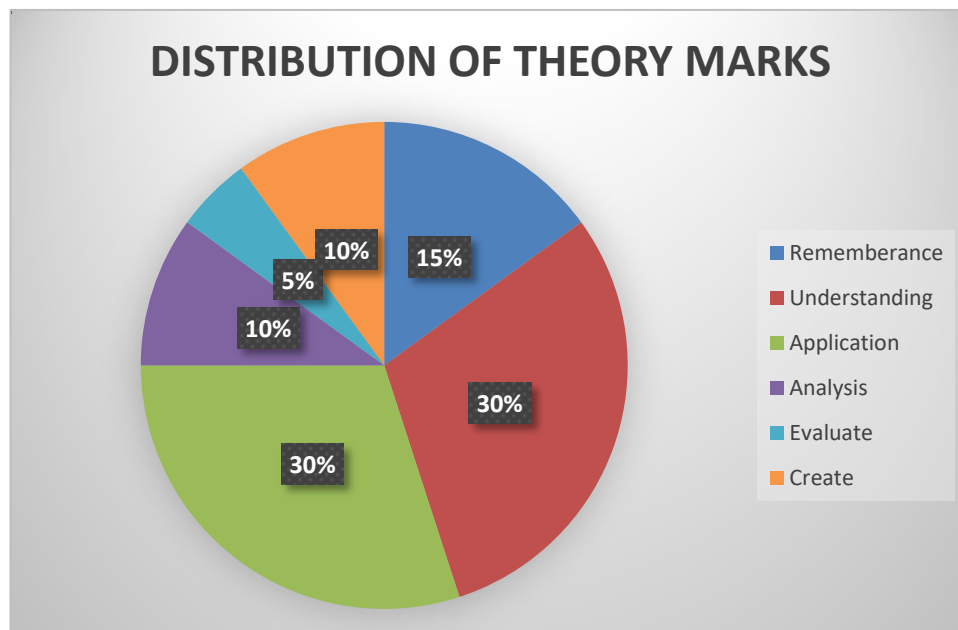
Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term work (TW)	
4	2	0	5	50	30	20	25	25	150

Content:

Sr. No.	Content	Total Hrs	%Weight age
1.	Introduction: Concept of Continuum, Macroscopic and Microscopic Viewpoints, Thermodynamic System and Control Volume, Surrounding, Boundaries, Universe, State, Point and Path Function, Thermodynamic Properties, Process, Cycle, Quasi – Static Process, Thermodynamic Equilibrium. Pure Substance, Vapour Liquid- Solid Phase in a Pure Substance. Energy- Work - Pdv Work and Other Types of Work Transfer, Free Expansion Work, Heat and Heat Capacity.	4	8
2.	Laws of Thermodynamics: Zeroth law of thermodynamics, Joule’s Experiment-First law of thermodynamics, First law applied to non-flow process, Energy, Specific Heat Capacities, Enthalpy, PMM-I, First law applied to Flow Process, Mass and Energy balance in simple steady flow process. Application of first law of thermodynamics, Limitations of the First Law Second Law of thermodynamics: Thermal Reservoir, Heat Engine, Heat pump - Performance factors, Kelvin-Planck and Clausius Statements and their equivalence, PMM-II, Reversibility and Irreversibility, Causes of Irreversibility, Types of Irreversibility, Condition for reversibility, Carnot Cycle, Reverse Carnot cycle, Carnot’s theorem and its corollaries, Absolute Thermodynamic Temperature scale, Third law of thermodynamics.	12	22

3.	Entropy: Clausius theorem, Entropy-A Property of system, Inequality of Clausius, Causes of entropy change, Entropy change in various thermodynamics process, Principle of increase of entropy and its applications, Entropy generation in open and closed system, Entropy and Disorder.	6	12
4.	Availability: Concept of exergy, Available and Unavailable energy, exergy of a source and finite body, exergy destruction in heat transfer process, Dead state, Availability and irreversibility in open and closed systems, Second law efficiency.	6	12
5.	Vapour power and Gas power cycle: Carnot Vapour cycle, Rankine cycle, Comparison of Carnot and Rankine cycle, Efficiency of Rankine cycle, Mean temperature of heat addition, Variables affecting efficiency of Rankine cycle, Reheat, Regenerative, Reheat-Regenerative cycle, Feedwater heaters. Air standard efficiency and comparison of Otto, diesel and dual cycle.	16	30
7.	Ideal and Real Gases: Properties of ideal and real gases, equation of state, ideal gas equation, Avogadro's law, Vander Waal's equation of state, reduced properties, law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy, enthalpy and specific heat of gas mixtures.	8	16



References Books:

1. P.K.Nag, Engineering Thermodynamics, McGraw Hill Education
2. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications
3. E.Rathakrishnan Fundamentals of Engineering Thermodynamics, PHI,2005
4. Y. A. Cengel and M. A. Boles, Thermodynamics an Engineering Approach, McGraw Hill Education
5. G. Van Wylen, R. Sonntag and C. Borgnakke, Fundamentals of Classical Thermodynamics, John Wiley & Sons
6. Holman J.P, Thermodynamics, McGraw Hill Education
7. Krieth, Engineering Thermodynamics, CRC Press
8. Jones and Dugan , Engineering Thermodynamics , PHI Learning Pvt. Ltd.
9. M. Achuthan, Engineering Thermodynamics, PHI Learning Pvt. Ltd.

Steam Tables/Data book

1. R.S.Khurmi, Steam table with Mollier chart, S.Chand,2008

Course Outcome:

After learning the course the students should be able to:

1. Understand basic terms used in thermodynamics.
2. Understand the laws of thermodynamics and their significance
3. Apply the principles of thermodynamics for the analysis of thermal systems
4. Understand various vapor power cycles.
5. Understand the properties of gas mixtures

List of Open Source Software/learning website:

1. <http://nptel.iitm.ac.in/courses.php>