

**Subject Code: 01ME1404**  
**Subject Name: Engineering Thermodynamics**  
**B. Tech. Year - II (Semester - 4)**

**Type of course :** Core

**Prerequisite :** Nil

**Rationale :** 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.

**Course Outcome :**

After completion of this course, student will be able to

1. Understand basic concepts of thermodynamics.
2. Apply the laws of thermodynamics to various processes.
3. Apply concepts of entropy and exergy to various processes.
4. Solve thermodynamic problems using steam table and molier charts.
5. Analyze air standard and power generation cycle and compare their performance.

**Teaching and Examination Scheme :**

Teaching Scheme			Credits	Examination Marks					Total Marks
THEORY	TUTORIAL	PRACTICAL		Theory Marks			Practical Marks		
			ESE(E)	IA	CSE	Viva (V)	Term Work (TW)		
3	2	--	5	50	30	20	25	25	150

**Content :**

Sr. No.	Content	Total Hrs.
1	<b>Introduction:</b> Concept of Continuum, Macroscopic and Microscopic approach, Control Volume, Thermodynamic System, Types of Systems, Surrounding, Universe, Boundaries, 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 and Work Transfer.	04
2	<b>Laws of Thermodynamics:</b> Zeroth law, First law for closed system, Internal energy - a property of system, PMM-I, Steady flow energy equation, Application of SFEE: Nozzle, Diffuser, Boiler, Turbine, Pump, Heat Exchanger, Throttling process. Second Law: Limitations of first law, Thermal Energy Reservoir, Heat Engine, Heat	14

	Pump and Refrigerator, Kelvin- Planck and Clausius Statements and their equivalence, PMM- II, Reversibility and Irreversibility, Carnot's theorem & its corollary, Thermodynamic temperature Scale, Third Law of Thermodynamics.	
<b>3</b>	<b>Entropy and Exergy analysis:</b> Clausius Theorem, Entropy-A Property of System, Inequality of Clausius, Causes & types of Irreversibility, Condition for Reversibility, Entropy Change in Irreversible Process, Entropy Change in Various Thermodynamics Process, Principle of increase of entropy, Entropy Generation in Closed and Open System, Entropy and Disorderliness. Concept of Exergy, Dead State, Available and Unavailable Energy, Exergy of a infinite source and finite Body, Exergy Destruction in Heat Transfer Process, Exergy of a Closed System and Steady Flow System, Guoy stodola theorem and its application, Second Law Efficiency.	<b>10</b>
<b>4</b>	<b>Vapour Power and Gas Power Cycle:</b> Carnot cycle, Rankine Cycle, Comparison of Rankine and Carnot Cycle, Efficiency Calculation of Rankine Cycle, Mean Temperature of Heat Addition, Factors Affecting Efficiency of Rankine Cycle, Reheat, Regenerative, Reheat-Regenerative Cycle, Feedwater Heaters. Air standard Efficiency of Otto, diesel and dual cycle, Comparison of Otto, Diesel and Dual Cycle.	<b>14</b>
<b>5</b>	<b>Ideal and real Gas:</b> Composition of gas mixture, molar analysis, gravimetric analysis, P-v-T behavior of gas mixture, ideal gas mixture,	--

### Distribution of Theory Marks

R Level	U Level	A Level	N Level	E` Level	C Level
<b>20</b>	<b>30</b>	<b>25</b>	<b>15</b>	<b>10</b>	--

**Legends: R:** Remember; **U:** Understand; **A:** Apply; **N:** Analyze; **E:** Evaluate; **C:** Create

### Reference books :

1. P.K.Nag, Engineering Thermodynamics, 6<sup>th</sup> edition, McGraw Hill Education, 2017.
2. R. K. Rajput, Engineering Thermodynamics, 5<sup>th</sup> edition, Laxmi Publications, 2019.
3. Y. A. Cengel and M. A. Boles, Thermodynamics an Engineering Approach, 9<sup>th</sup> edition, McGraw Hill Education, 2019.
4. C. Borgnakke and R. Sonntag, Fundamentals of Thermodynamics, 10<sup>th</sup> edition, John Wiley & Sons, 2019.
5. Holman J.P, Thermodynamics, 4<sup>th</sup> edition, McGraw Hill Education, 1988.
6. Jones and Dugan, Engineering Thermodynamics, 1<sup>st</sup> edition, PHI Learning Pvt. Ltd, 1995.
7. Krieth, Engineering Thermodynamics, 2<sup>nd</sup> edition, CRC Press, 1998.

### List of Open Base Software / learning website :

1. <https://nptel.ac.in/courses/112103275>
2. <https://swayam.gov.in/>
3. <https://www.coursera.org>



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