

Subject Code: 1ET1010301	Subject Title: Engineering Thermodynamics
Pre-requisite Subject	Zeal to learn the subject

Course Objective:

This course will help student to

1. To understand the concepts of Energy in general and Heat and Work in particular.
2. To understand the fundamentals of quantification and grade of energy.
3. To apply the laws/concepts of thermodynamics to basic energy systems.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				Total (T+P)
Lecture	Tutorial	Practical	Credit	Theory		Practical		
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
4	-	2	5	70	30	30	20	150

Subject Contents			
Sr. No.	Topic	Total Hours	Weight (%)
01	<p>Introduction and Basic Concepts: Application areas of thermodynamics, Macroscopic and Microscopic viewpoints, Systems and Control volumes, Properties of system, Continuum, State and equilibrium, Processes and cycles, Quasi – static Process, Pure substance, Temperature and Zeroth law of thermodynamics, Heat and thermodynamic Concept of work.</p> <p>First Law of Thermodynamics: Statement, Heat and work calculations, Joules' experiment, Application of first law to flow systems, steady flow energy equation as applied to boiler, condenser, nozzle, turbine, compressor, pump, throttling process, Charging and discharging of tanks, Limitations of first law of thermodynamics, PMM-I.</p>	08	15
02	<p>Second Law of Thermodynamics: Statements and their equivalence, thermal energy reservoirs, concept of heat engine, refrigerator, heat pump and perpetual motion machines, Reversible and irreversible processes, Carnot cycle, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale.</p> <p>Entropy: Concept of entropy, Temperature- entropy plot, Clausius inequality theorem Principle of Increase of entropy, entropy balance, first and second law combined, entropy changes of an ideal gas during reversible processes (non-</p>	10	20

	flow and flow).		
03	<p>Availability: Available and unavailable energy, Available energy (AE) referred to cycle and energy source, Availability in steady flow process, availability in non-flow process, Irreversibility, second law efficiency.</p> <p>Property Relations: Introduction to Maxwell relations, Clausius-Clapeyron equation, volume expansivity and isothermal compressibility, Mayer relation, Joule-Thomson coefficient.</p>	10	20
04	<p>Power Cycles: Vapor Power Cycles: Carnot vapor cycle, Rankine cycle, variables affecting efficiency of Rankine cycle, reheat cycle, Concept of Ideal regeneration, Regenerative cycle</p> <p>Gas Power Cycles: Air standard assumptions, Otto cycle, Diesel cycle, dual cycle, Stirling cycle, Ericsson cycle, Atkinson cycle, Brayton cycle.</p>	18	35
05	<p>Reactive Systems: Combustion, theoretical and actual combustion processes, enthalpy of formation and enthalpy of combustion, Adiabatic flame temperature, first law analysis of reactive system.</p>	08	10

Course Outcome:

The student will be able to

1. Demonstrate understanding of basic concepts of thermodynamics.
2. Differentiate between quality and quantity of energy, heat and work, enthalpy and entropy, etc.
3. Analyze basic power cycles.
4. Apply the laws of thermodynamics to various real life systems.

List of References:

1. Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education.
2. Modern Engineering Thermodynamics by Robert T Balmer, ELSEVIER.
3. Thermodynamics by R K Rajput, Laxmi Publications.
4. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Education
5. Fundamentals of Thermodynamics by Moran & Shapiro.
6. Thermodynamics by C P Arora, McGraw-Hill Education.

List of Practical:

1. Study of steady flow system and its application.
2. To study about entropy.
3. To study about availability and irreversibility.
4. To study about thermodynamic property relation.

5. To study of power producing cycle and comparison of otto, diesel & dual cycle.
6. To study about rankine cycle and modified rankine cycle.
7. Study of reactive systems and their analysis.
8. Trial on rotary air compressor.
9. Trial on multi stage reciprocating air compressor.
10. Study and trial on gas calorimeter.
11. Study and trial on Bomb calorimeter.
12. Flue gas analysis using Orsat apparatus or Gas analyser.
13. Visit to any industry, which uses boiler and submission of detailed report.