ME205	Thermodynamics	L-T-P-Cr-CH: 3-1-0-4-4	Prerequisites: N/A

Objectives:

i. To introduce the students to basic thermodynamic laws
ii. Familiarize the students to the idea to be able to heat, work and thermal efficiency and state the different forms of energy.
iii. To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow.
iv. Orient the students towards ability to estimate thermodynamic properties of substances in gas and liquid states.
v. To be able to apply ideal cycle analysis.

Contents:

Introduction and basic concepts: Basic definitions, thermodynamic systems and control volumes, properties, states, thermodynamic equilibrium, change of state, processes and cycles **(3 lectures+ 1 tutorial)**
Temperature: Zeroth law, thermometers and thermocouple, international temperature scale Energy transfer: Work transfer, pdV and other types of work transfer, heat transfer, specific heat at constant pressure and volume, latent heat, comparison of heat and work **(4 lectures+2 tutorials)**
Properties of pure substance: Definition, p-v, T-s and h-s diagram of pure substance (water), properties of steam, use of steam tables and charts (Mollier diagram) **(3 lectures+ 2 tutorials)**
First law of thermodynamics: First law for a closed system undergoing a cycle and change of state , internal energy, enthalpy, PMM-I, limitations of first law, non-flow and flow processes; steady state, steady flow and transient flow processes; application of first law to steady flow process, steady flow energy equation(SFEE) **(6 lectures+ 4 tutorials)**
Second law of thermodynamics: Kelvin Plank statement, Claussius statement, Irreversibility, Carnot Cycle, Corollaries of Carnot's theorem, Applications of Second Law to closed and open systems, heat engine, heat pump and refrigerator, PMM-II, entropy, Claussius theorem, Claussius inequality, T-ds Relations, entropy principle and its application, entropy generation in closed and open system, absolute entropy and third law of thermodynamics **(7 lectures+ 5 tutorials)**
Availability: Definition, quality concept of energy, Reversible work and irreversibility, Exergy balance in closed and open system, Second law efficiency, Guoy Stodola theorem **(4 lectures+ 3 tutorials)**
Introduction to IC Engines: Introduction to Power Cycle: Carnot, Rankine and Modified Rankine Cycle. **(2 lectures+ 2 tutorials)**

(Total: 29 lectures + 19 tutorials)

Evaluation Plan:

Test No.	Marks	Duration (minutes)
I	10	30
II (Major I)	30	90
III	10	-
IV (Major II)	50	120
Total Marks	100	

All the tests will be held as per the schedule notified by the Controller of Examinations, Tezpur University

Course Outcomes:

CO1: Acquire the knowledge of various thermodynamic laws and apply to various processes and real system.
CO2: Evaluate energy exchange processes in terms of various forms of energy, heat and work.
CO3: Apply the steady-flow energy equation to a system of thermodynamic components viz pumps, turbines, compressors etc. to estimate required balance of heat, work and energy flow.
CO4: Apply the concept of entropy and other thermodynamic properties for various processes
CO5: Identify the use of properties of pure substances and gas mixtures in real thermodynamic problems
CO6: Understand the interrelationship between thermodynamics cycles

Textbooks:

1. Cengel, Y. A. and Boles, M. A. *Thermodynamics, an Engineering Approach*, McGraw-Hill Education, 2014, 8th edition.
2. Nag, P.K. *Engineering Thermodynamics*, Tata McGraw Hill, 2013, 5th edition.

Reference Books:

1. Borgnakke, C. Sonntag, R.E. *Fundamentals of Thermodynamics*, John Wiley & Sons, 2014, 8th edition.
2. Moran,M.J., Shapiro,H.N., Boettner,D.D. & Bailey, M.B., *Principles of Engineering Thermodynamics*, S.I. version, John Wiley & Sons, 2011, 8th edition.