GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3142004
Semester – IV
Subject Name: Engineering Thermodynamics

Type of course: Engineering

Prerequisite: Zeal to learn the subject

Rationale: This subject deals with engineering thermodynamics and its applications, which are useful for Mechatronics engineers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Basic Concepts:** Microscopic & macroscopic point of view, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, Thermodynamic equilibrium, Quasi-static process, pure substance, vapour- liquid-solid phase in a pure substance, p-v-t surface, critical and triple point of pure substance.	5
2	**First law of Thermodynamics:** First law for a closed system undergoing a cycle and change of state, Energy-A property of the system, Perpetual motion machine of the first kind, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger, throttling process.	5
3	**Second law of thermodynamics & Entropy:** Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, Perpetual motion machine of the second kind, carnot cycle, carnot's theorem, corollary of carnot theorem, thermodynamic temperature scale. Clausius theorem, the property of entropy, inequality of Clausius, entropy change in a open system, reversible and irreversible process, principle of increase of entropy, Third law of thermodynamics, Entropy and disorder, concept of exergy.	8
4	**Vapour & Gas Power cycles:** Carnot cycle, Rankine cycle, comparison of carnot and rankine cycle, modified rankine cycle, calculation of cycle efficiencies, variables affecting efficiency of rankine cycle. Carnot, Otto, diesel, dual, atkinson and brayton cycle. Comparison of otto, diesel and dual cycles, calculation of air standard efficiencies, mean effective pressure, brake thermal efficiencies, relative efficiencies of I.C. engine.	12

5	**Properties of gases and Mixtures:** Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures.	9

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**30**	**20**	**10**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Engineering Thermodynamics by P.K. Nag, Tata McGraw-Hill , New Delhi
2. Thermodynamics – An Engineering Approach by Yunus Cengel& Boles, Tata McGraw-Hill, New Delhi
3. Fundamental of Engineering Thermodynamcis, by Moran and Shapiro, Publisher: John Wiley & Sons
4. Fundamentals of Thermodynamics by Sonntag, Borgnakke & Van wylen, John Wiley & sons (ASIA) PVT. LTD.

Course Outcomes:

After learning the course the students should be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Understand the knowledge about and basic laws of Thermodynamics with their applications.	20
CO-2	Understand concept of entropy and use the same for analysis of process and cycle.	20
CO-3	Gain the knowledge and basic idea about different power cycles and their analysis.	30
CO-4	Understand concept of ideal gas, compressibility factor, compressibility chart and adiabatic mixing of gases.	30

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List of Tutorials:

Sr. No.	Topic
1	Basic concepts: System, surrounding, boundary, types of boundary, types of system.
2	Basic concepts: Property, state, process, cyclic process, types of properties.
3	Properties of Pure Substance – Use of property table for water.
4	Heat and Work Interaction
5	First Law of Themodynamics – Applied to a Closed System
6	First Law of Themodynamics – Applied to an Open System
7	Second Law of Thermodynamics
8	Entropy
9	Vapor power cycle
10	Gas power cycle

Major Equipment:

NA

List of Open Source Software/learning website:

NPTEL