GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING (01)

BASIC ENGINEERING THERMODYNAMICS

SUBJECT CODE: 2140106

B.E. 4th SEMESTER

Type of Course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: Engineering thermodynamic concepts enabling the definition and analysis of thermodynamic systems are vitally important to the aeronautical engineer

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)	
					PA	ALA	ESE	OEP		
4	1	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Basic Concept of Thermodynamics Thermodynamic system & classification , Properties of substance(like pressure, temperature, volume, heat, work, energy),Various forms of energy (like static energy, kinetic energy, potential energy, internal energy, enthalpy etc..), Concept of enthalpy and entropy , Thermodynamic equilibrium, concept of process and cycles , Quasi-static process, Zeroth Law of Thermodynamics.	7	10 %
2	First law of thermodynamics Joule's experiment-set up & Significance , Law of conservation of energy, , PMM1, First Law of Thermodynamics, its limitations & Application , Energy equation & its application to: i. Non flow process. ii. Open system. iii. Steady flow (Steady flow energy equation –SFEE) Numerical based on SFEE.	9	15
3	Second law of Thermodynamics Concept heat source, heat sink (reservoir), heat engine, heat pump and refrigerator. PMM2, Second law of Thermodynamics Kelvin Planck & Claudius statements, Refrigerator & heat pump, Concept of thermal efficiency and COP (Coefficient of Performance). Concept of Reversible and irreversible processes. Numerical examples based on heat engine, heat pump and refrigerator. Third law of thermodynamics.	9	20
4	Availability, Irreversibility & Thermodynamic Relations Available and unavailable energy, Availability and Irreversibility, Maxwell's equation Helmholtz &Gib's function, Clausius- Claperyon equation, Joule-Thomson coefficient , Numericals	6	10
5	Properties of gases Concept of gas & vapor , Gas laws, Boyle's law, Charle's law,	8	15

	Combined gas law, Gas constant, Relation between Cp and Cv , Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process , Numerical based on different processes .		
6	Vapor power Cycles Concept of vapor and gas cycles , Vapor cycles: Carnot vapor cycle, Rankine cycle, comparison of Carnot and Rankine cycle, calculation of cycle efficiencies, variables affecting efficiency of Rankine cycle, Numericals	6	15
7	Gas power Cycles Concept of air standard efficiency .Carnot gas cycle , Otto ,Diesel & Dual Combustion cycles , Atkinson Cycle , Brayton Cycle : Representation on P-V & T-s diagram, derivation for an air standard efficiency & simple examples based on it	8	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10%	20%	20%	20%	30%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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, McGraw-Hill Education.
2. Fundamentals of Thermodynamics by Borgnakke & Sonntag, 7th Ed. Wiley India (P) Ltd.
3. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Education
4. Engineering Thermodynamics by Gordon Rogers and Yon Mayhew, Pearson Education Ltd.
5. Engineering Thermodynamics by Krieth, CRC Press
6. Engineering Thermodynamics by Jones and Dugan, PHI Learning Pvt. Ltd

Course Outcomes:

After successful completion of course students should be able to

1. Understand basic terms used in thermodynamics.
2. Understand laws of thermodynamics and its applications.
3. Comprehend the concept and applications of energy.
4. Understand various gas and vapor power cycles.
5. Understand the properties of gas..

List of Tutorial:

1. Basic Concept of Thermodynamics
2. First law of thermodynamics
3. Second law of Thermodynamics
4. Availability, Irreversibility & Thermodynamic Relations
5. Properties of gases
6. Vapor power Cycles
7. Gas power Cycles

List of Open Source Software/learning website: http://nptel.iitm.ac.in/courses.php

Major Equipments needed:

Prototype model of heat engine & refrigerator, Scaled model of different cycles & SFEE.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.