

GUJARAT TECHNOLOGICAL UNIVERSITY

MANUFACTURING ENGINEERING (34) THERMO DYNAMICS AND THERMAL ENGINEERING. SUBJECT CODE: 2143406 B.E. 4th SEMESTER

Type of course: Theoretical + Practical (Regular)

Prerequisite: To impart the importance of thermal science aspects in the field of Manufacturing Engineering

Rationale: To study about various principles involved in thermodynamics and thermal engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks					Total Marks	
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M) PA ALA		PA (V) ESE OEP			PA (I)
3	0	2	5	70	20	10	20	10	20	150

Sr. No.	Content	Total Hrs	% Weightage
1	BASIC CONCEPTS OF THERMODYNAMICS Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Pure substances – Phase change processes of pure substances – Property diagrams – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.	8	20%
2	FIRST AND SECOND LAW OF THERMODYNAMICS First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy - Change in Entropy – Carnot principles – 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 and Brayton cycle.	10	20%
3	AVAILABILITY, IRREVERSIBILITY AND THERMAL RELATION: Available and unavailable energy, available energy referred to a cycle, availability in non-flow and steady flow systems, reversibility and Irreversibility. Maxwell’s equation, T-ds equations, difference in heat capacities, ratio of heat capacities, Helm-holtz and Gibbs function, Internal Energy relations, Clausius- Claperyon equation, Joule-Thomson coefficient.	14	20%
4	GASES AND VAPOUR MIXTURES Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton’s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.	07	20%

5	HEAT TRANSFER Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation	06	20%
----------	--	-----------	-----

Suggested Specification table with Marks (Theory):

R Level	U Level	A Level	N Level	E Level

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.

Course Outcome:

To understand the technical aspects involved in various turbines, refrigeration and to know about various thermal approaches.

TEXT BOOKS

1. “Thermodynamics an Engineering Approach” Yunus A. Cengel and Michael A.Boles, Tata McGraw hill, Fourth edition, 2004.
2. “Fundamentals of Engineering Thermodynamics” Michael J.Moran, Howard N.Shapiro, John Wiley & Sons, Fourth editon, 2000.
3. “A Text book of Engineering Thermodynamics” R.K.Rajput, Laxmi publication (P) Ltd. Third Edition, 2007.
4. “Engineering Thermodynamics” P.K.Nag, Tata McGraw hill, Third edition, 2005
5. “A course in Thermal engineering” S.Domkundwar, C.P.Kothandaraman, Dhanpat Rai & co (p) Ltd, Fifth edition

REFERENCES

List of Experiments:

S.No.	LIST OF EXPERIMENTS
1.	Study of determination of Calorific Value of Fuels by using different calorimeters.
2.	Determinations of exhaust gas analysis by using Orsat Apparatus.
3.	Determination of Dryness fraction by using different Calorimeters.
4.	Determination of Air Standard Cycle .
5.	Study of Solar Energy device.
6.	I.C. engine valve timing diagram.
7.	I.C. engine port timing diagram
8.	I.C. engine performance test on single cylinder 4 stroke diesel engine.

9. Morse test on 4 - cylinder 4 - stroke petrol engine evaluation of engine friction by conducting.
10. Performance test on single cylinder 2 – stroke petrol.

Design based Problems (DP)/Open Ended Problem:

All above performance are to be carried out in the laboratory and students will prepare experiments and note down reading and conclusion. They can prepare for calibration and compare results with existing and with alternate methods of measurements. At least 5 open ended problems are proposed for better understanding the subject and to apply real life application.

The projects are listed below:

1. Valve timing and Port timing of I.C Engines.
2. Performances of 2 stroke and 4 stroke engines.
3. Determination of dryness fraction
4. Determination of Calorific Value

Major Equipments:

1. Solar Energy Device
2. 4 Stroke Diesel Engine
3. 4 Stroke Petrol Engine
4. Orsat Apparatus
5. Calorimeters

List of Open Source Software/learning website:

1. <http://nptel.ac.in/courses/112106138>

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.