GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: THERMODYNAMICS
(Code: 3331902)

Diploma Programme in which this course is offered	Semester in which offered
MECHANICAL ENGINEERING	3rd Sem

1. RATIONALE

Thermodynamics is a science of energy transfer and its effect on physical properties of substances. It is based upon common observation of common experiences which have been formulated in thermodynamic laws. The system surrounding interaction involving work and heat transfer with associated properties changes, approaches of laws of thermodynamics have been emphasised. This course will provide a mature approach to the basic principles of thermodynamics which will function as foundation in applications in major fields of mechanical engineering and technology notably in steam and nuclear power plants, internal combustion engines (I.C.Engines), gas turbines, air conditioning, refrigeration,gas dynamics, jet propulsion, compressors and energy conversion in different devices

2. COMPETENCY

- **Apply basic concepts, laws and principles of thermodynamics to use equipments/devices/machines working on these basics.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	0	3	70	30	00	00	100

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit;**ESE**-End Semester Examination; **PA** -Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Basic Concepts of Thermodynamics**	1a.Identify a thermodynamic property and use it with appropriate units. 1b. Explain Zeroth law of thermodynamics.	1.1 Introduction. 1.2 Thermodynamic systems-concept, terminology associated, classification, concept of continuum. 1.3 Thermodynamics properties & their units. 1.4 Concept of energy, heat, work and power- types & simple examples. 1.5 Zeroth law of thermodynamics. 1.6 Temperature measurement-units and devices/instruments used.
Unit – II **First law of thermodynamics**	2a.Explain first law of thermodynamics. 2b. Apply first law of thermodynamics to real life situations.	2.1 Joule's experiment-set up & significance. 2.2 Law of conservation of energy. 2.3 First law of thermodynamics with reference to i. Closed system. ii. System undergoing a change of state. iii. Open system. 2.4 Energy equation & its application to i. Non flow process. ii. Open system. iii. Steady flow (Steady flow energy equation -SFEE) 2.5 Limitations of first law of thermodynamics.
Unit – III **Ideal Gases and Thermodynamic Processes**	3a. Explain various ideal gas laws & thermodynamic processes. 3b. Calculate amount of heat transfer, work transfer & internal energy associated with the process.	3.1 Various ideal gas laws. 3.2 Characteristic gas equation and Universal gas constant. 3.3 Specific heats & their relationship. 3.4 Different thermodynamic processes, their representation on P-V and T-s diagram. 3.5 Equations for PVT relationship, work transfer, heat transfer, internal energy. 3.6 Simple numerical examples based on above.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – IV Second law of thermodynamics	4a. Describe second law of thermodynamics. 4b. Apply second law of thermodynamics on real life problems. 4c. Appreciate importance of entropy.	4.1 Concept and real life examples of heat source, heat sink (reservoir), heat engine, heat pump and refrigerator. 4.2 Second law of thermodynamics - Kelvin-Plank statement - Clausius statement. - Equivalence of above two statements. - Corollary 4.3 Concept of thermal efficiency and Coefficient of performance. 4.4 Concept, importance and examples of entropy. 4.5 Concept of reversibility and irreversibility of thermodynamic processes, causes of irreversibility. 4.6 Carnot cycle, representation on P-V, T-s diagrams, derivation, examples.
Unit – V Thermodynamic Cycles	5a. Identify thermodynamic processes in a cycle. 5b. Plot various cycles on property diagram 5c. Derive expression for efficiency. 5d. Solve simple examples of power producing cycle.	5.1 Concept of air standard efficiency. 5.2 Otto, Diesel & Dual Combustion cycle - Representation on P-V & T-s diagram, derivation for air standard efficiency & simple examples. - Limitations, applications & comparison of above cycles based on different parameters. 5.3 Refrigeration cycles: Reversed Carnot cycle, Reversed Brayton cycle - Representation on P-V & T-s diagram & expression for COP.

5 SUGGESTED SPECIFICATIONTABLE WITH HOURS & MARKS(THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**BASIC CONCEPTS OF THERMODYNAMICS**	05	04	03	03	10
II	**FIRSTLAW OF THERMODYNAMICS**	07	03	03	04	10
III	**IDEAL GASES AND PROCESSES**	10	04	06	06	16
IV	**SECONDLAW OF**	10	04	07	05	16

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	THERMODYNAMICS					
V	**THERMODYNAMIC CYCLES**	10	04	06	08	18
Total		**42**	**19**	**25**	**26**	**70**

Notes:

1. This specification table shall be treated as only general guideline for students and Teachers. The actual distribution of marks in the question paper may vary from above Table.
2. If mid SEM test is part of continuous evaluation, unit numbers I, II and unit III upto 3.4 point are to be considered.

6. SUGGESTED LIST OF STUDENT ACTIVITIES

Assignments:

1. Identification & study of thermodynamic systems in real situation.

2. Find & list reasons of irreversibility in thermodynamic system.

Charts:

1. Prepare Charts of various cycles like diesel, duel and gasoline. Indicate main points of difference between the.

2. Prepare chart of p-v & p-h diagram for refrigeration cycle.

3. Prepare chart for different thermodynamics process with the help of p-v, t-s, h-s diagram.

Mini projects:

1. Write the specification of refrigerator/ I C Engine etc.

2. Draw & explain cycle on which refrigerator/ I C Engine works.

3. Compare Ideal and actual cycle of refrigerator/ I C Engine and put your observations for differences.

4. State different reasons for differences.

7. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr. No.	Title of Books	Author	Publication
1.	Thermodynamics	R. Yadav	CPH
2.	Thermodynamics for Engineers	M.L. Mathur	Dhanpatrai & sons
3.	Heat Engines	C.S. Shah & N.C. Pandya	Charotar Publi. House
4.	Elements of Heat Engines Vol. I&II	R.C. Patel & Karamchandani	Acharya Book Depot
6.	Thermodynamics	SAAD	Prentice-Hall

7.	Engineering Thermodynamics- 2nd edition	P. K. Nag	McGraw Hill Education
8.	Applied Thermodynamics	R.C. Patel	Acharya Book Depot
9.	Thermodynamics	Gupta	Pearson

(B) List of Software/Learning Websites

1. http://www.nptel.iitm.ac.in/video.php?subjectId=112105123(IIT-B Video lectures)
2. http://www.thermofluids.net/
3. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm
4. http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html
5. http://www.youtube.com/watch?v=Xb05CaG7TsQ
6. http://www.youtube.com/watch?v=aAfBSJObd6Y
7. http://www.youtube.com/watch?v=DHUwFuHuCdw
8. http://www.youtube.com/watch?v=kJlmRT4E6R0
9. http://www.youtube.com/watch?v=GKqG6n6nAmg

8. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. Shri Shah Atul S., Associate Dean, Gujarat Technological University and Sr. Lecturer in Mechanical Engineering, Government Polytechnic Waghai
2. Shri D. M. Trivedi, Lecture in Mechanical Engineering, K.J. Polytechnic, Baruch
3. Shri S. R. Pareek, Head of Department, Mechanical Eng, Tolani F. G. Polytechnic, Adipur
4. Shri M. N. Patel, Lecturer in Mechanical Engg, Government Polytechnic, ChhotaUdepur

Coordinator and Faculty Members from NITTTR Bhopal