

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM

Course Title: Thermodynamics and Hydraulics  
(Code: 3320201)

Diploma Programmes in which this course is offered	Semester in which offered
Automobile Engineering	Second Semester

#### 1. RATIONALE

The laws of Thermodynamics and Hydraulics are used in almost every industry and also in everyday life. The consumer items like vehicle, refrigerators, compressors, heat exchangers etc are based on second law of thermodynamics and Carnot cycle. Therefore, a diploma engineer in automobile is expected to understand the laws of conversion of heat energy into work or power, laws of thermodynamics and its applications in industries and day today life. The course is intended to develop the basic understanding as well as the competency to understand fluid behaviour and its properties with its concepts in the operation of automotive engines.

#### 2. COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- i. **Explain thermodynamic principles, compressible flow and fundamental of heat transfer**
- ii. **Apply fluid laws and find out the behavior/ properties of the fluid for a given condition.**

#### 3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme (3 Hrs)				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
3	2	0	5	70	30	00	00	<b>100</b>

**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. DETAILED COURSE CONTENTS:**

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit – I</b> <b>BASIC OF THERMODYNAMICS</b>	1a.Explain common terms related to thermodynamic system.	1.1 Thermodynamic system 1.2 Properties of substance like pressure, temperature, volume, heat, work, energy.
	1b.Describe the properties of system, form of energy, work and heat.	1.3 Thermodynamic processes & cycles 1.4 Work and heat transfer i Difference between heat and work ii Understanding of work transfer, displacement work, other types of work transfer- electric work, shaft work, pedal(stirring) work, flow work iii Heat transfer, specific heat, latent heat 1.5 Various forms of energy like static energy, kinetic energy, potential energy internal energy, enthalpy etc.
	1c. Explain concept of enthalpy and entropy.	1.6 Concept of enthalpy and entropy
<b>Unit– II</b> <b>LAWS OF THERMODYNAMICS</b>	2a.Describe various laws of thermodynamic to different situation.	2.1 Zeroth Law of Thermodynamics 2.2 First Law of Thermodynamics, its limitations & Application to flow processes. (No numerical) 2.3 Second law of Thermodynamics Kelvin Planck & Clausius statements, Refrigerator & heat pump
	2b. Describe Reversible and irreversible processes.	2.4 Concept of Reversible and irreversible processes
	2c. Explain working principles of heat engine	2.5 Heat Engine 2.6 Concept of Available energy referred to a cycle
<b>Unit– III</b> <b>IDEAL GASES AND PROCESSES :</b>	3a.Explain ideal gas laws and thermodynamic processes. 3b. Draw thermodynamic processes on P-V & T-S diagram	3.1 Ideal gas laws and equation 3.2 Specific heat of ideal gas 3.3 Various thermodynamic processes like constant pressure, constant volume, constant temperature etc.
<b>Unit– IV</b> <b>THERMODYNAMIC CYCLES :</b>	4a.Describe operation of Thermodynamic cycles and their importance.	4.1 Different air standard cycles and their importance- Carnot cycle, Otto cycle, Diesel cycle, Dual cycle.
	4b.Calculate work done and efficiency of different thermodynamic cycles for a given data.	4.2 Determine work done and efficiency of above cycles. 4.3 Applications of different thermodynamic cycles.

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit- V FUNDAMENTALS OF HYDRAULICS</b>	5a. Describe different properties of the fluid	5.1 Properties of Fluid. 5.2 Fluid statics -concept, definitions of total pressure and centre of pressure, buoyant force and criteria for stability of floating body. Pascal's law.
	5b. Use fluid laws to measure various fluid properties.	5.3 Fluid dynamics- Types of flow, continuity equation, Bernoulli's theorem, Euler's equation of motion 5.4 Flow through simple pipes –pressure drop in pipes. 5.5 List of various instruments used for measuring various fluid properties.
<b>Unit- VI FLUID CONTROL SYSTEM AND PUMPS</b>	6a. Describe Fluid control system	6.1 Concept and need of control system
	6b. Explain the working and application of different types of pumps. 6c. Determine the efficiency of various pumps using appropriate formula.	6.2 Types of pumps 6.3 Working of reciprocating pumps 6.4 Working of Centrifugal pumps 6.5 Comparison of RC of CF pumps. 6.6 Simple problems on pumps.

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Basic of Thermodynamics	6	04	04	00	08
2.	Laws of Thermodynamics	6	02	06	02	10
3.	Ideal Gases and Processes	6	04	03	03	10
4.	Thermodynamic Cycles	6	02	05	04	11
5.	Fundamentals of Hydraulics	10	06	07	04	17
6.	Fluid Control System	08	03	06	05	14
	<b>Total</b>	<b>42</b>	<b>21</b>	<b>31</b>	<b>18</b>	<b>70</b>

**Legends:** R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

**Note:** 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.

## 6. SUGGESTED LIST OF PRACTICAL/EXERCISES

-----Not Applicable -----

## 7. SUGGESTED LIST OF STUDENT ACTIVITIES:

Following is the list of student activities:

- Course/topic based seminars
- Internet based assignments
- Teacher guided self learning activities
- Course/library/internet
- lab based mini-projects

**8. SUGGESTED LEARNING RESOURCES:****A. List of Books**

Sr. No.	Author	Title of Books	Publication
1	Mathur.M.L. and Gupta.S.C.	Thermodynamic for Engineers	Metropolitan Book Company-1985
2	Shah.C.S. and Pandya.N.C.	Heat Engines	Charotar Publishing House Pvt. Ltd
3	Ballaney.P.L.	Heat Engines	Khanna Publications
4	Khurmi.R.S.	Fluid Mechanics and Hydraulics	S.Chand publication
5	Patel.R.C. & Pandya.A.D.	Hydraulics & Hydraulic machinery	Acharya Book Depot ( 1967)

**B. List of Software/Learning Websites**

- i. <http://www.animations.physics.unsw.edu.au/jw/AC.html>
- ii. <http://en.wikipedia.org/wiki/Transformer>
- iii. <http://www.alpharubicon.com/altenergy/understandingAC.htm>
- iv. <http://www.howstuff.com>

**9. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculty Members from Polytechnics:**

1. **Prof. M. J. Pathak**, H.O.D., Auto. Dept. Sir Bhavsinhji Poly. Inst., Bhavnagar.
2. **Prof. Shyam Verghese**, H.O.D., Auto. Dept. JNK Polytechnic, Amreli
3. **Prof. D. A. Dave**, H.O.D., Auto. Dept. Sir Bhavsinhji Polytechnic Inst., Bhavnagar.
4. **Prof. M. N. Vibhakar**, Lecturer, Auto. Dept. DR.S&SS Gandhi Polytechnic, Surat
5. **Prof. A. C. Suthar**, Lecturer, Auto. Dept. MLIDS Polytechnic, Bhandu

**Coordinator & Faculty Members from NITTTR; BHOPAL:**

1. **Dr. K. K. Jain**; Professor and Head Mechanical Engineering Department
2. **Dr (Mrs.) Vandana Somkumwar**, Associate Professor, Dept. of Mechanical Engineering