



## **C.U.SHAH UNIVERSITY – Wadhwan City**

**FACULTY OF:** - Technology and Engineering (Diploma Engineering)

**DEPARTMENT OF:** - Mechanical Engineering

**SEMESTER:** - III                      **CODE:** - 2TE03TDY1

**NAME OF SUBJECT:** - Thermodynamics

### **Teaching & Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme					Evaluation Scheme						
		Th	Tu	Pr	Total	Credit	Theory				Practical (Marks)		
							Sessional Exam		University Exam		Internal		University
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr
<u>2TE03TDY1</u>	Thermodynamics	03	00	00	03	03	30	1.5	70	03	----	----	----
													<b>100</b>

### **1. Objective: -**

Thermodynamics is a science of energy transfer and its effect on physical properties of substances. It is based upon observations of common experiences of energy (mainly heat) transfer. Thermodynamic laws have been formulated based on these experiences. In this course, work and heat transfer with changes in associated properties is studied based on laws of thermodynamics. This course will provide an understanding of the basic principles of thermodynamics which is must for understanding of major fields of mechanical engineering and technology notably in steam and nuclear power plants, internal combustion engines, gas turbines, air conditioning, refrigeration, gas dynamics, jet propulsion, compressors and energy conversion in different devices.

### **2. Prerequisites: -**

- ☐ The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency
- ☐ Apply basic concepts, laws and principles of thermodynamics to use and select equipments/devices/machines working on these basics.

### **Course outline: -**

Sr. No.	Course Contents	No. of Hours
1	<b>Basic Concepts of Thermodynamics:</b> Definition of Thermodynamics, Thermodynamics System-System, boundary and surroundings, Closed system, Open system, Isolated system, Adiabatic system, Homogeneous system, Heterogeneous system, Macroscopic and Microscopic points of View- Pure substance, Thermodynamics Equilibrium, State, Process, Cycle, Point Function, Path Function, Temperature, Zeroth law of thermodynamics, Pressure, Specific volume, Reversible and Irreversible Process, Energy, Work and Heat, Definition of Pure Substance	<b>06</b>
2	<b>First law of Thermodynamics:</b> Definition “Conservation of Energy”, Joule’s Experiments, First law of Thermodynamics, Energy-A Property of System, PMM-I, The Perfect Gas, The characteristic equation of Gas, Specific heats, Joule’s law, Relation between specific heats, Enthalpy, Ratio of specific heats. Application of First Law of Thermodynamics to Non-flow or Closed System, Application of First Law to Steady Flow Process, Energy Relations for Flow Process, Engineering Application Steady Flow Energy Equations-Water turbine, Steam or gas turbine, Centrifugal water pump, Centrifugal compressor, Reciprocating compressor, Boilers, Condenser, Evaporators, Steam nozzle. Unsteady Flow Process, Examples.	<b>06</b>

3	<b>Ideal gases and thermodynamic processes:</b> Various ideal gas laws, Characteristic gas equation and Universal gas constant, Specific heats & their relationship, Different thermodynamic processes, their representation on P-V (Pressure-Volume) and T-s (Temperature-Entropy) diagram, Equations for PVT relationship, work transfer, heat transfer internal energy (without derivations).	10
4	<b>Second law of Thermodynamics:</b> Limitation of First Law of Thermodynamics, Introduction of Second law of Thermodynamics, Performance of Heat Engine and Reversed Heat Engine, Reversible Process, Statements of Second Law of Thermodynamics-Clausius statement, Kelvin-Planck statement, Equivalence of Clausius statement to Kelvin-Planck Statements, PMM-II, Thermodynamics Temperature, Clausius Inequality, Carnot Cycle, Carnot's Theorem, Corollary of Carnot's Theorem, Entropy-Introduction, Entropy-A property of system, Change of entropy in reversible process, Entropy and irreversibility, Change of entropy in universe, Characteristics of entropy, Third law of Thermodynamics, Examples.	10
5	<b>Thermodynamic Cycles:</b> Concept of air Standard efficiency, General assumptions for deriving air-standard efficiency, Classification of cycles, Carnot (only gas) cycle, Otto, Diesel and Dual Combustion cycle, Brayton cycle, Refrigeration cycles- Reversed Carnot cycle, Reversed Brayton cycle, Limitations and applications of above cycles, Expression for thermal efficiency of above cycles (Examples), Comparisons between the above cycles on basis of following for same- Heat addition,- Compression ratio,- Pressure and temperature.	10

**Suggested List of Student Activities: -**

- ☐ Identify and list real situations which work on: Zeroth law, First law of thermodynamics, and Second law of thermodynamics.
- ☐ Prepare charts of diesel, dual and gasoline cycles. Tabulate main points of differences between them.
- ☐ Write the specifications of domestic refrigerator available at your home and I.C. Engine of any two wheelers. Also draw & explain cycle on which domestic refrigerator and I.C. Engine works.
- ☐ Prepare chart of p-v & p-h diagram for refrigeration cycle.
- ☐ Prepare chart for different thermodynamics process with the help of p-v, t-s, and h-s diagram.

**Special Instructional Strategies: -**

Real life examples, Demonstration of real systems, Movies/Animations, Numerical etc.

**Suggested Learning Resources : -**

**(A) List of Books: -**

- Thermodynamics -R. Yadav , CPH.
- Thermodynamics for Engineers- M.L. Mathur, Dhanpatrai & sons.
- Heat Engines -C.S. Shah & N.C. Pandya, Charotar Publi. House.
- Elements of Heat Engines Vol. I&II -R.C. Patel & Karamchandani , Acharya Book Depot.
- Thermodynamics –SAAD, Prentice-Hall.
- Engineering Thermodynamics- 2nd edition -P. K. Nag , McGraw Hill Education
- Applied Thermodynamics -R.C. Patel , Acharya Book Depot.
- Thermodynamics- Gupta , Pearson.

**(B) List of Software/Learning Websites: -**

- <http://www.nptel.iitm.ac.in/video.php?subjectId=112105123>(IIT-B Vidéo lectures)
- <http://www.thermofluids.net/>
- <http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm>
- <http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html>
- <http://www.youtube.com/watch?v=Xb05CaG7TsQ>
- <http://www.youtube.com/watch?v=aAfBSJObd6Y>
- <http://www.youtube.com/watch?v=DHUwFuHuCdW>
- <http://www.youtube.com/watch?v=kJlMRT4E6R0>
- <http://www.youtube.com/watch?v=GKqG6n6nAmg>