SILVER OAK UNIVERSITY

College of Technology (01)

Diploma in Mechanical Engineering

Subject Name: Thermodynamics

Subject Code: 1010122221

Semester: 4th

Prerequisite: Zeal to learn the subject

Objective:

To be able to state the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy. To be able to identify and describe energy exchange processes (in terms of various forms of energy, heat and work) in Thermal energy systems.

Teaching and Examination Scheme:

Teaching Scheme					Evaluation Scheme				Total Marks
					Theory		Practical		
L	T	P	Contact Hours	Credit	CIE (TH)	ESE (TH)	CIE (PR)	ESE (PR)	
3	1	0	4	4	40	60	-	-	100

Content:

Unit No.	Contents	Teaching Hours	Weightage %
1	**Basic Concepts of Thermodynamics**: Thermodynamic system and control volume, Microscopic and macroscopic point of view, thermodynamic properties, state of a substance, process and cycle, Thermodynamic equilibrium, Concept of Continuum, Quasi-static process, The Zeroth Law of Thermodynamics, Temperature scales	5	12
2	**First law of Thermodynamics:** First law for a closed system undergoing a cycle and change of state, energy, PMM1, first law of thermodynamics for steady flow process, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger and throttling process, filling and emptying process	6	14
3	**Second law of thermodynamics:** Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, PMM2, causes of irreversibility, Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale	6	14
4	**Ideal gases and processes:** Various ideal gas laws and equations, Characteristic gas equation and	5	12

	universal gas constant, Specific heats and its relationship, Different thermodynamics processes, its representation on P-V, T-S And H-S diagrams, Equations for PVT relationship, work transfer, heat transfer for all above processes.		
5	**Thermodynamic cycles:** 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),comparison between the above cycles on basis of following for Same, heat addition, compression ratio,- pressure and temperature.	7	17
6	**Steam and two-phase system:** Concept of two-phase System, P.V., T.S. and H.S. diagram of pure substance, Steam formation process on above diagrams, Various quality and property of steam and the derivations of expression for enthalpy, entropy and volumes, Use of Steam tables and Molliear charts, Throttling, Determination of steam quality.	7	17
7	**Combustion:** Combustion equations, stoichiometric air fuel ratio, enthalpy of formation, adiabatic flame temperature, determination of calorific values of fuels – calorimeter -Bomb and Junkers gas calorimeter.	6	14

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	To identify the unique vocabulary associated with thermodynamics and explain the basic concepts of thermodynamics	1
CO-2	To state and apply first law of thermodynamics for closed and open systems undergoing different thermodynamic processes and evaluate the feasibility of thermodynamic cycles and processes using second law of thermodynamics	2,3
CO-3	To understand Various ideal gas laws and equations	4
CO-4	To analyse different thermodynamic cycles like gas power, vapor power and refrigeration cycles	5
CO-5	To make elementary calculation of combustion phenomenon and understand the properties of steam	6,7

Teaching & Learning Methodology:

1. Direct instruction
2. Flipped classroom
3. Personalized learning

List of Tutorials:

1. Exercise based on Basis definitions and concept Thermodynamics.
2. Exercise based on First Law of thermodynamics.
3. Exercise based on second Law of thermodynamics.
4. Exercise based on ideal gases, processes and relation of specific heats.
5. Exercise based on comparison on Otto, Diesel and Dual cycles and variables affecting the performance of Rankine cycle
6. Exercise based on VCR system and to determination of its COP
7. Exercise based on Steam and two-phase system
8. Exercise based on Bomb calorimeter and Junker gas calorimeter.

Major Equipment:

1. Mechanical Heat Pump
2. Internal combustion engine
3. Heat exchanger
4. Vapor compression test rig,
5. Bomb calorimeter, Junker gas calorimeter

Books Recommended:

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 – 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.

List of Open Source Software/learning website:

1. https://nptel.ac.in/course.php