Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-4(Diploma)

Subject: Thermal Engineering-1- DETME14208

Type of course: Major

Prerequisite: Engineering Physics, Mathematics

Rationale: Thermodynamics explores energy transfer and transformation, crucial in fields like power generation and engineering. It covers core concepts like systems, processes, cycles, and equilibrium, guided by the laws of thermodynamics, which govern energy conservation and efficiency. These principles are applied to components like turbines, boilers, and compressors to optimize energy use. Understanding ideal gases and steam properties further aids in designing efficient systems for industrial applications, focusing on maximizing efficiency and minimizing energy loss for sustainable practices.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI- Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs	% Weightage
1	**Fundamental Ideas in Thermodynamics** Introduction, Application of Thermodynamics, Microscopic and Macroscopic Point of View, Properties of Thermodynamics, State, Path, Process, Cycle, Thermodynamic System, Thermodynamic Equilibrium, Quasi-static Process, Pure Substance, Heat and Work. **Laws of Thermodynamics** Zeroth Law of Thermodynamics, First Law for a Cyclic Process, First Law Applied to Process, PMM1, Internal Energy: A Property of the System, First Law of Thermodynamics for Steady Flow Process, Steady Flow Energy Equation Applied to Nozzle, Diffuser, Boiler, Turbine, Compressor, Pump, Heat Exchanger, Limitations of the First Law of Thermodynamics, Kelvin-Planck and Clausius Statements and Their Equivalence, PMM2, Reversible and Irreversible Process, Statement of the Third Law of Thermodynamics.	15	35
2	**Ideal Gases and Thermodynamic Processes** Concept of Ideal Gas, Boyle's Law, Charle's Law and Gay-Lussac Law for Ideal Gases, Characteristic Gas Equation and Universal Gas Constant, Specific Heats of Gas and Their Relationship, Thermodynamic Processes and Their Representation on P-V (Pressure Volume) and T-S (Temperature-Entropy) Diagrams: (i) Constant Volume Process, (ii) Constant Pressure Process, (iii) Constant Temperature Process, Equations of P-V-T Relationship.	8	15
3	**Steam Formation, Properties & Generators** Concept of Ideal Gas, Boyle's Law, Charle's Law and Gay-Lussac Law for Ideal Gases, Characteristic Gas Equation and Universal Gas Constant, Specific Heats of Gas and Their Relationship, Thermodynamic Processes, Its Representation on P-V (Pressure-Volume) and T-S (Temperature-Entropy) Diagrams: (i) Constant Volume Process, (ii) Constant Pressure Process, (iii) Constant Temperature Process, Equations of P-V-T Relationship.	11	25
4	**Steam Prime Movers,Condensers, and Cooling Towers** Steam Turbine: Concept, Classifications, Construction and Working of Impulse and Reaction Turbine, The Necessity of Compounding and Its Types; Steam Condensers: Concept, Functions and Classification, Construction and Working of Surface Condensers, Condenser Efficiency; Cooling Towers: Concept, Function and Classification.	11	25

Continuous Assessment (ALA):

Sr. No	Active Learning Activities	Marks
1	**Problem Solving Activity** Solve the problems related to laws of thermodynamics for steady flow process and upload solutions on GMIU web portal	10
2	**Poster Making** Prepare a poster on ideal gas law and thermodynamic process and upload it on GMIU web portal	10
3	**Quiz Activity** Identify Correct answer from multiple choice options on Steam Generators & Prime Movers. Quiz will be done on GMIU web portal	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	25%	35%	40%	-	-	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply thermodynamic principles to analyze and optimize energy systems efficiently.
CO2	Understand ideal gases and thermodynamic processes using fundamental gas laws.
CO3	Analyze steam properties and boiler systems in thermal power plants.
CO4	Understand steam turbines, condensers, and cooling towers' principles and functions.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1	**Demonstration of Open, Closed, and Isolated Systems:** Explore the characteristics and differences between open, closed, and isolated systems using practical examples.	1	02
2	**Application of Steady Flow Energy Equation:** Apply the steady flow energy equation to analyze components like nozzles, diffusers, boilers, turbines, compressors, pumps, and heat exchangers.	1	04
3	**Illustration of Pressure-Temperature Relationship:** Demonstrate and analyze the relationship between pressure and temperature in thermodynamic systems.	2	04
4	**Demonstration of Steam Boilers:** Study the construction, working, and operation of various types of steam boilers.	2	04
5	**Demonstration of Boiler Mountings and Accessories:** Understand the functions and significance of boiler mountings and accessories in steam generation.	3	04
6	**Demonstration of Various Steam Turbines:** Examine the working and applications of different types of steam turbines.	4	04
7	**Demonstration of Steam Condensers:** Showcase the operation and role of steam condensers in a steam power plant.	4	04
8	**Demonstration of Cooling Towers:** Explore the function and working principles of cooling towers in thermal systems.	4	04
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment.
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Engineering Thermodynamics by Yunus A. Cengel , Tata McGraw Hill

[2] A Textbook of Thermal Engineering by R S Khurmi& J K GuptaS. Chand & Co.

[3] Heat Engines by C.S.Shah& N.C.Pandya , CharotarPubli.House

[4] Thermal Engineering by R K Rajput, Laxmi.Publications

[5] Engineering Thermodynamics | by P. K. Nag | McGraw Hill