Course Syllabus
Gyanmanjari Institute of Technology
Semester- 3

Subject : Engineering Thermodynamics - BETME13303

Type of course: Major(Core)

Prerequisite: Basic Mathematics, Physics, Chemistry

Rationale: Engineering Thermodynamics is the first course on Thermal Science and Engineering. It focuses on heat and work transport among other energy interactions. It is predicated on a few natural rules that are never observed to be broken.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
4	-	2	5	60	30	10	20	30	150

Legends: CI-Classroom 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	**Introduction of Thermodynamics:** • Basics of thermodynamics: • Microscopic & macroscopic point of view • Thermodynamic system and control volume • Thermodynamic properties, processes and cycles • Thermodynamic equilibrium • Quasi-static process • The Zeroth Law of Thermodynamics • Temperature Scale • Significant Terms	3	5%
2	**Laws of Thermodynamics:** **First 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 and throttling process, filling and emptying process • First Law Applied to Non Flow Processes **Second law of thermodynamics**: • Limitations of first law of thermodynamics, • Kelvin-Planck and Clausius statements and their equivalence, PMM2, • Reversible and Irreversible Process, • Carnot theorem, corollary of Carnot theorem, • Thermodynamic temperature scale	12	20%

3	**Entropy & Energy:** **Entropy** : • Introduction • Clausius theorem & Inequality, • Entropy is Property, • Principal of increase of entropy, • Entropy & Irreversibility, • Change of Entropy in Reversible Process & closed System, • Third law of thermodynamics **Energy:** • Introduction, • Exergy (Available Energy) referred to a cycle, • Exergy (availability) of the closed system, • Exergy (availability) of steady flow open system, • Irreversibility and Gouy-Stodola theorem and its applications, • Second law efficiency	15	25%
4	**Power Cycles:** **Vapor Power cycles:** • Carnot vapor cycle, • Rankine cycle, • Comparison of Carnot and Rankine cycle, • Calculation of cycle efficiencies, • Variables affecting efficiency of Rankine cycle, reheat cycle, regenerative cycle, • Feedwater heaters. **Gas Power cycles:** • Terminology Used in Gas Power Cycles, • Recapitulation of Carnot, Otto and Diesel cycle, • Dual cycle • Comparison of Otto, Diesel and Dual cycles, • Brayton cycle	24	40%
5	**Properties of gases and gas mixtures:** • Avogadro's law, • equation of state, • Ideal gas equation, • Vander Waal's equation, • Reduced properties, • Law of corresponding states, • Compressibility chart, • Gibbs-Dalton law, • Internal energy; enthalpy and specific heat of a gas mixtures	6	10%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Online Quizzes and Polls:** Faculty will give quizzes or polls on GMIU portal that assess students' understanding of thermodynamic concepts in real-time.	10
2	**Picture Analysis Survey:** Faculty will assign picture and students will analyze it and will put forward their opinions in form of a report and will upload it to GMIU web Portal.	10
3	**Post Making Task:** Faculty will assign a subject and students will prepare a poster in canva and upload it to 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	20%	30%	50%	-	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand basic terms used in thermodynamics.
CO2	Understand laws of thermodynamics and its applications.
CO3	Comprehend the concept and applications of energy, entropy and exergy.
CO4	Understand various gas and vapor power cycles.
CO5	Understand the properties of gas mixtures.

List of Practicals

Sr. No	Descriptions	Unit No	Hrs
1	To verify the application of first law of thermodynamics	2	4
2	To verify the applications of Steady flow energy equation.	2	4
3	To verify the application of first law of thermodynamics.	2	4
4	To verify the inequality of clausius for thermodynamic system	3	4
5	To verify the application of entropy principle.	3	4
6	To verify exergy destruction in heat transfer process	3	4
7	To verify the applications of thermodynamic cycles.	4	4
8	To verify the Vander wall's equation for gases.	5	2
	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] Thermodynamics - An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Education.

[2] Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education

[3] Engineering Thermodynamics by Gordon Rogers and Yon Mayhew, Pearson Education Ltd.

[4] Engineering Thermodynamics by Jones and Dugan, PHI Learning Pvt. Ltd