Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-5 (Diploma)

Subject: Thermal Engineering II-DETME15215

Type of course: Professional Core

Prerequisite: Thermal Engineering I

Rationale: This syllabus provides a strong foundation in Internal Combustion Engines, Gas Turbines, and Heat Transfer by integrating theory with practical applications. It covers engine operation, fuel systems, cooling, ignition, lubrication, and performance analysis, essential for automotive, power generation, and industrial applications. The inclusion of gas turbines enhances understanding of aviation and energy systems, while heat transfer principles support engine design and efficiency improvements. This course bridges theory and real-world challenges, preparing students for careers in thermal and automotive engineering.

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	
4	0	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.

GYANMANJARI INNOVATIVE UNIVERSITY BHAVNAGAR

Course Content:

Unit No	Course content	Hrs.	% Weightage
1	**Internal Combustion Engines:** Air standard, Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; advantages of I.C. engines over external combustion engines; classification of I.C. engines; neat sketch of I.C. engine indicating component parts; Function of each part and materials used for the component. Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.	15	25
2	**I.C. Engine Systems:** Fuel system of Petrol engines; Principle of operation of simple and Zenith carburetors; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system - air-cooling, water-cooling system with thermo siphon method of circulation and water-cooling system with radiator and forced circulation. Comparison of air cooling and water-cooling system; Ignition systems – Battery coil ignition and magneto ignition. Comparison of two systems; Types of lubricating systems used in I.C. engines with line diagram; Types of governing of I.C. engines their applications; Objective of super charging. Brake power; Indicated power; Frictional power; brake and indicated mean effective pressures; brake and indicated thermal efficiencies; mechanical efficiency; simple numerical problems on performance of IC engines.	25	35
3	**Gas turbines:** Air-standard Brayton cycle; description with p-v and t-s diagrams; gas turbines classification: open cycle gas turbines and closed cycle gas turbines; comparison of gas turbine with reciprocating i.c. engines and steam turbines. applications and limitations of gas turbines; general lay-out of open cycle constant pressure gas turbine; p-v and t- s diagrams and working; general lay-out of closed cycle gas turbine; p-v and t-s diagrams and working.	10	20
4	**Heat transfer**: Various modes of heat transfer. Conduction heat transfer- Fourier's law- explanation thermal conductivity, heat transfer through a plain wall and composite wall. Convection heat transfer, Newton's law of convection, Free and force convection, Radiation heat transfer, Blackbody concept, emissivity, refractivity, absorptivity, Stefan and Boltzmann's law. Simple numerical examples based on above.	10	20

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**I.C. engine part** Each group will be assigned a specific I.C. engine part to purchase from a second-hand garage, disassemble, and examine its components. They will identify and explain the function, materials, and role of each part in engine performance. Students will present their findings and prepare a brief report with photos and diagrams. The report, in PDF format, should be uploaded to the GMIU web portal.	10
2	**Heat Transfer Rate** Each group of students will conduct an experiment to measure heat transfer through a given material. Using Fourier's law, they will calculate the heat transfer rate of the material. Students will then analyze heat transfer through a plain wall, measuring the temperature differences across various materials. The findings, including calculations and observations, should be compiled into a brief report with diagrams and uploaded to the GMIU web portal.	10
3	**Automobile Model Specification** Each group of students will be assigned a specific automobile company (e.g., Maruti Suzuki, Honda, etc.). They will research and compile a list of models offered by the company, categorized under different variants like LXI, VXI, ZXI, LDI, VDI, and ZDI. The group will gather detailed specifications, features, and other relevant information for each model. Students will then create a PDF document summarizing the models, specifications, and other details, and upload it to the 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	30 %	30 %	20 %	10 %	10 %	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the working, components, and comparisons of IC engine cycles and types.
CO2	Learn I.C. engine systems, including fuel, cooling, ignition, lubrication, governing, and performance parameters.
CO3	Study Brayton cycle, gas turbine types, and their working, comparisons, and applications.
CO4	Observe heat transfer modes, laws of conduction, convection, and radiation.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	**Preparatory Activity:** - Student will recall and write basic thermodynamic units.	All	2
2	**Demonstrate working of I.C. Engine:** -Demonstrate working of two stroke and four stroke engines.	1	4
3	**Demonstration of IC engine parts:** - Demonstrate and explain dismantling, assembling, working and inspection of fuel pump, fuel injector, carburetor and multipoint fuel injection system	1	4
4	**Valve timing diagram:** Write specifications of IC engine undertaken for valve timing diagram. Perform and record angles and strokes. Prepare valve timing diagram.	1	4
5	**Perform test and prepare heat balance sheet of Petrol Engine:** - Write specifications of IC engine undertaken for test. Observe and record test parameters. Derive required parameters- Indicated Power (IP), Break Power (BP), fuel consumption for varying load, efficiency,	2	4
6	**Perform test and prepare heat balance sheet of diesel Engine:** - Write specifications of IC engine undertaken for test. Observe and record test parameters. Derive required parameters- Indicated Power (IP), Break Power (BP), fuel consumption for varying load, efficiency,	2	4
7	**Demonstrate various gas turbines and its components.**	3	2
8	**Determine the overall heat transfer coefficient and LMTD of a heat exchanger.**	4	4
9	**Industrial visit:** Student will visit and prepare industrial visit report.	All	2
		Total	30

Instructional Method:

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

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 laboratory.

Reference Books:

[1] A Course in Thermal Engineering by S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai

[2] Thermal Engineering by R. K. Rajput, Laxmi Publication.

[3] Thermal Engineering by P.L. Ballaney, Khanna Publishers.

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