COURSE CONTENT

THERMAL ENGINEERING - I								
IV Semester: /ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2540321	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

Thermal Engineering-1 introduces the fundamentals of power cycles and internal combustion engines, covering their classification, working principles, and performance evaluation. It explores combustion processes in SI and CI engines, emphasizing fuel properties and abnormal combustion. Testing methods, performance analysis, and preparation of heat balance are discussed. The course also covers compressors, including reciprocating, rotary, centrifugal, and axial flow types, with focus on operation, efficiency, and performance

Course Objectives:

1. Explain the Components of IC Engines and systems.
2. Analyze the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
3. Understand and evaluate the performance analysis of the major components and systems of IC engines and their applications.
4. Explore to the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5. Understand the significance of gas turbines in real context in power generation.

Course Outcomes: After Completion of the Course, Students should be able to

1. Elaborate the working principles of IC Engine systems and its classification.
2. Explore the combustion stages of SI and CI engines, and factors influence for better combustion.
3. Evaluate the testing and performance parameters of IC engines.
4. Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.
5. Understand the working principle of gas turbine and its classification with thermodynamic analysis.

UNIT - I: Otto, Atkinson, Diesel and Dual Cycles, Description and representation on P-V and T-S Diagrams, Performance Parameters: Mean Effective Pressure and Thermal efficiency evaluation on Air standard basis, Comparison of Cycles, Actual Cycles and Comparison with ideal cycles Classification of IC Engines, Working principles of two and four stroke engines, SI and CI engines, Valve and Port Timing Diagrams.

UNIT - II: Types of SI engines, Engine systems, Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry. Normal Combustion and abnormal combustion in SI engines, Importance of flame speed and effect of engine variables, Abnormal combustion, Pre-ignition and knocking in SI Engines, Fuel requirements and fuel rating, Anti-knock additives, Combustion chamber requirements.

UNIT - III: Types of CI Engines, Four stages of combustion in CI engines, Delay period and its importance, Effect of engine variables, Diesel Knock, Need for air movement, Suction, Compression and combustion induced turbulence in Diesel engines, Open and divided combustion chambers and fuel injection, Diesel fuel requirements and fuel rating.

UNIT - IV: Parameters of performance, Measurement of cylinder pressure, Fuel consumption, Air intake, Exhaust gas composition, Brake power, Determination of frictional losses and indicated power, Performance test, Heat balance sheet and chart.

UNIT - V: Classification of compressors, Fans, Blowers and Compressors, Positive displacement and dynamic types, Reciprocating and rotary types.
Reciprocating Compressors: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance volume, Staged compression, under cooling, saving of work, Minimum work condition for staged compression.
Rotary Compressors: Rotary Compressors (Positive displacement type): Roots Blower, Vane sealed compressor, Mechanical details and principle of working, Efficiency considerations.
Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation, Velocity and pressure variation. Energy transfer, Impeller blade shape, Losses, Slip factor, Power input factor, Pressure coefficient and adiabatic coefficient, Velocity diagrams and power.
Axial Flow Compressors: Mechanical details and principle of operation, Velocity triangles and energy transfer per stage degree of reaction, Work done factor, Isentropic Efficiency, Pressure rise calculations, Polytropic efficiency.

TEXT BOOKS:

1. I.C. Engines, V. Ganesan, Mc Graw Hill, 4th Edition, 2010.
2. Thermal Engineering, Mahesh M Rathore, Tata Mc Graw Hill, 2010

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists, Eastop and McConkey, Pearson, 5th Edition, 1993.
2. Fundamentals of Classical Thermodynamics, Vanwylen G.J and Sonntag R.E., Wiley Eastern, 2nd Edition, 1978.
3. Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill, 2nd Edition, 2018.

ELECTRONIC RESOURCES:

1. **https://www.mechanicalbooster.com/2017/10/air-standard-otto-diesel-dual-cycle.html**
2. **https://www.mechanicalbooster.com/2018/01/spark-ignition-engine.html**
3. **https://www.mechanicalbooster.com/2018/01/compression-ignition-engine.html**
4. **https://www.mechanicalbooster.com/2017/10/performance-of-ic-engine.html**
5. **https://www.mechanicalbooster.com/2018/04/classification-of-compressors.html**

ATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)