APPLIED THERMODYNAMICS-I

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB09	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The students will try to learn:

I. The concepts related to the operation of internal combustion engines based upon the fundamental engineering sciences of thermodynamics.

II. The techniques for improving the efficiencies and performance of compressors and refrigeration systems retained to practical applications such as irrigation, air conditioning and refining oil and gas.

III. The performance of Heat Engines in real-time applications by applying the various testing parameters of an engine (Brake power, Torque)

COURSE OUTCOMES:

AT the end of the course, students will be able to:

CO 1 Classify **the fuel injection and ignition system pretend to the application of combustion chamber types such as T-head and overhead.**

CO 2 **Identify the basic components of an IC Engine and the working of a 2-stroke and 4- Stroke engines relate to Gasoline and diesel fuels.**

CO 3 **Explain the maintenance procedures and operational characteristics applicable to the cooling and lubrication system in IC Engines**

CO 4 **Select normal and abnormal combustion which affects the importance of flame front and flame propagation and knocking of engine variables.**

CO 5 **Outline the fuel rating, anti-knock additives system, and fuel quality requirements that are pretending to the emissions (control the pollutant formation) of SI and CI engines.**

CO 6 **Experiment with the testing and performance of an Internal combustion engine such as fuel consumption, power, efficiencies, and heat balance sheet.**

CO 7 **Explain the principle of operation related to the working of fan, blowers and compressors and their applications in industries/ factories and how do they differ with each other.**

CO 8 **Solve the performance of air compressors and solve numerically related to the performance of single and multi stage compressors.**

CO 9 **Recall all the variations of the velocity triangles pertaining to the analyses of a centrifugal compressor.**

CO 10. **Explain the basic concepts of refrigeration and vapor compression refrigeration systems with superheating and sub cooling to find out COP of refrigeration.**

CO 11. **Summarize the properties of various refrigerants used in refrigeration system to enhance better performance with minimal losses**

CO 12. **Develop to optimize the forthcoming engine designs for specific sets of constraints (fuel economy, performance, emissions)**

MODULE-I	IC ENGINES,FUEL INJECTION AND LUBRICATION SYSTEMS	Classes: 09
I. C Engines: Four and two stroke engine, SI and CI engines, valve and port timing diagrams, fuel injection systems for SI engines, fuel injection systems for CI engines, ignition systems, cooling and lubrication system, fuel properties and combustion, Stoichiometry.		
MODULE-II	**COMBUSTION IN SI AND CI ENGINES**	**Classes: 09**
Combustion in SI engines and CI engines: Normal combustion and abnormal combustion, importance of flame speed and effect of engine variables, type of abnormal combustion, pre-ignition and knocking, fuel requirements and fuel rating, anti-knock additives, combustion chamber, requirements, types; Combustion in CI Engines: Four stages of combustion, delay period and its importance, effect of engine variables, diesel Knock, need for air movement, open and divided combustion chambers and nozzles used, fuel requirements and fuel rating		
MODULE-III	**TESTING AND PERFORMANCE,COMPRESSORS**	**Classes: 09**
Testing and performance: 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. Compressors: Classification, of compressors, fans, blower and compressor, positive displacement and dynamic types, reciprocating and rotary types.		
MODULE-IV	**ROTARY AND AXIAL CENTRIFUGAL COMPRESSORS**	**Classes: 09**
Rotary, dynamic and axial flow (positive displacement): Roots blower, vane sealed compressor, mechanical details and principle of working efficiency considerations; Centrifugal compressors: mechanical details and principle of operation, velocity and Pressure variation, Energy transfer, impeller blade shape-losses, slip factor, and power input factor, pressure coefficient and adiabatic coefficient, velocity diagrams, 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.		
MODULE-V	**REFRIGERATION**	**Classes: 09**
Refrigeration: Mechanical refrigeration and types, units of refrigeration, air refrigeration system, details and principle of operation, applications of air refrigeration, vapour compression refrigeration systems, calculation of COP, effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants, vapour absorption system, mechanical details, working principle, use of p-h charts for calculations.		
Text Books:		
1. Ganesan, "I.C. Engines", Tata McGraw-Hill, 3rd Edition, 2011 2. B. John Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill, 2nd Edition,2011. 3. K. Rajput, "Thermal Engineering", Lakshmi Publications, 1st Edition, 2011.		
Reference Books:		
1. Mathur, Sharma, "IC Engines", DhanpatRai& Sons, 3rd Edition, 2008. 2. Pulkrabek, "Engineering Fundamentals of IC Engines", Pearson Education, 2nd Edition, 2008. 3. Rudramoorthy, "Thermal Engineering", Tata McGraw-Hill, 5th Edition 2003. 4. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education, 3rdEdition, 2013.		
Web References:		
1. https://nptel.ac.in/courses/112102103/16 2. https://nptel.ac.in/courses/112107078/37		