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	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

Applied thermodynamics is the science of relationship between heat, work, and systems that analyze energy processes. The aim of this course is to apply the thermodynamic cycles, develop the power from a heat engines for various industrial and domestic applications. It makes use of the properties of thermodynamics to transform heat into work. Gasoline and diesel engines, jet engines, and steam turbines that generate electricity are all examples of heat engines. The proper understanding of compressors and refrigeration in various fields of engineering is addressed. Thus there is great relevance for this course for mechanical engineers.

II. OBJECTIVES:

The course should enable the students to:

- **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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Classify** the fuel injection and ignition system to pretend the application of combustion chamber types such as T-head and overhead.	Understand
CO 2	**select** normal and abnormal combustion which affects the importance of flame front and flame propagation and knocking of engine variables	Remember
CO 3	**Experiment** with the testing and performance of an Internal combustion engine such as fuel consumption, power, efficiencies, andheat balance sheet.	Apply
CO 4	**Explain** the principle of operation related to the working of fan, blowers and compressors and their applications in industries/ factoriesand how do they differ with each other.	Understand
CO 5	**Solve** numerically related to the performance of all the variations in the velocity triangles pretended to single and multi-stage air compressors with industrial applications.	Apply
CO 6	**Outline** the basic concepts of refrigeration and vapor compression refrigeration systems with superheating and sub cooling to find out COP of refrigeration.	Understand

IV. SYLLABUS:

MODULE-I	IC ENGINES	Classes: 09

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 ENGINES AND CI ENGINES	Classes: 09

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	PERFOMANCE OF ENGINES AND COMPRESSORS	Classes: 09
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. Classification, of compressors, fans, blower and compressor, positive displacement and dynamic types, reciprocating and rotary types.		
MODULE-IV	**CENTRIFUGAL AND AXIAL COMPRESSORS**	**Classes: 09**
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, poly-tropic efficiency.		
MODULE-V	**REFRIGERATION**	**Classes: 09**
Mechanical refrigeration and types, units of refrigeration, air refrigeration system, details and principle of operation, applications of air refrigeration, vapor compression refrigeration systems, calculation of COP, effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants, vapor absorption system, mechanical details, working principle, use of p-h charts for calculations.		

Text Books:

1. V. 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. R.K. Rajput, "Thermal Engineering", Lakshmi Publications, 1st Edition, 2011.

Reference Books:

1. Mathur, Sharma, "IC Engines", Dhanpat Rai & 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, 3rd Edition, 2013.

Web References:

1. http://www.newworldencyclopedia.org/entry/Internal_combustion_engine
2. http://www.nptel.ac.in/courses/112106133/#
3. https://www.grc.nasa.gov/www/k-12/airplane/engopt.html

E-Text Books:

1. http://www.link.springer.com/book/10.1007%2F978-3-319-12304-22.