APPILIED THERMODYNAMICS

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME007	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the construction and working of internal combustion engines, compressors and refrigeration systems.
II. Develop the concept of ideal and real working of thermodynamic cycles for performance evaluation.
III. Understand the subsystems of internal combustion systems.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand main idea and importance behind the 2-S and 4-S IC engines.
2. Analyze the working of the basic components in the IC engine
3. Understand the combustion process and also how it does affect the performance of the IC engines.
4. Apply the thermodynamic principles in the design of an IC engines
5. Formulate and perform the procedures required for the maintenance and operation of IC engine
6. Compare different IC engines and develop a system which meets the requirement
7. Knowledge of Fuel Requirements and Fuel Rating.
8. Testing and Performance of I.C Engines.
9. Analyze the working of the basic components in the Compressors and Refrigeration systems.
10. Apply the thermodynamic principles in the design of Compressors and refrigeration system.
11. Formulate and perform the procedures required for the maintenance and operation of compressors and refrigeration systems.
12. Compare different compressors and refrigeration systems and develop a system which meets the requirements.
13. Understand the process of pressure enthalpy charts that are used in the Refrigeration systems.
14. Introduction to concepts of power and refrigeration cycles. Their efficiency and coefficients of performance.
15. Ability to use modern engineering tools, software and equipment to analyze energy transfer in required air-condition application.
16. Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.

UNIT 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.

UNIT 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

UNIT 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.

UNIT 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.

UNIT 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. 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. 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, 3rdEdition, 2013.

Web References:

1. http://www.uobabylon.edu.iq/uobColeges/ad_downloads/4_1293_515.pdf
2. http://ebooks.library.cornell.edu/k/kmoddl/toc_heywood1.html

E-Text Books:

1. https://drive.google.com/file/d/0B7raaoEF40D7eEJIR1VoODJodFE/edit.
2. http://royalmechanicalbuzz.blogspot.in/2015/04/appliedthermodynamics-by-vganesan-ebook-pdf.html.
3. https://docs.google.com/file/d/0B5dLUIZfysmqMXBhakRyODhublU/edit.
4. https://archive.org/details/appliedthermodynamics00mckarich.