INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

THERMAL ENGINEERING SYSTEMS								
IV Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMED13	**Core**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Engineering Thermodynamics								

I. COURSE OVERVIEW:

Applied Thermodynamics is science intended to introduce concepts and working principles of internal combustion engines which are widely used in different industrial applications such as automobile, agriculture, industry for transport, water pumping, electricity generation, earth moving and for supply mechanical power. This course also deals with working principles of compressors and refrigeration systems in various fields of engineering.

II. 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.

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.
CO 2 Select normal and abnormal combustion which affects the importance of flame front and flame propagation and knocking of engine variables
CO 3 Apply the testing and performance of an internal combustion engine such as fuel consumption, power, efficiencies to draw heat balance sheet.
CO 4 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 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.
CO 6 Outline the basic concepts of refrigeration and vapor compression refrigeration systems with superheating and sub cooling to find out COP of refrigeration.

IV. COURSE CONTENT:

MODULE - I: IC ENGINES (09)

Four and two stroke engine, SI and CI engines, valve and port timing diagrams, fuel injection systems for SI and CI engines, ignition systems, cooling and lubrication system of IC engines.

MODULE -II: COMBUSTION IN SI ENGINES AND CI ENGINES (10)

Combustion in SI 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,

antiknock additives. Combustion in CI Engines: Four stages of combustion, delay period and its importance, effect of engine variables, diesel Knock.

MODULE -III: PERFOMANCE OF ENGINES AND COMPRESSORS (10)

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.

Classification of compressors: fans, blower and compressor, positive displacement and dynamic types, reciprocating and rotary types

MODULE -IV: CENTRIFUGAL AND AXIAL COMPRESSORS (09)

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 (10)

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, use of p-h charts for calculations.

V. TEXT BOOKS:

1. P. K. Nag, “Engineering Thermodynamics”, Tata McGraw Hill, 4th edition, 2020.
2. V. Ganesan, “I.C. Engines”, Tata McGraw-Hill, 3rd edition, 2019.
3. B. John Heywood, “Internal Combustion Engine Fundamentals”, Tata McGraw-Hill, 2nd edition, 2020.
4. R.K. Rajput, “Thermal Engineering”, Lakshmi Publications, 1st edition, 2019.

VI. REFERENCE BOOKS:

1. Mathur, Sharma, “IC Engines”, Dhanpat Rai & Sons, 3rd edition, 2019.
2. Pulkrabek, “Engineering Fundamentals of IC Engines”, Pearson Education, 2nd edition, 2019.
3. Rudramoorthy, “Thermal Engineering”, Tata McGraw-Hill, 5th edition, 2019.
4. C. P. Arora, “Refrigeration and Air Conditioning”, Tata McGraw-Hill Education, 3rd edition, 2019.
5. J. B. Jones, R. E. Dugan, “Engineering Thermodynamics”, Prentice Hall of India Learning, 1st edition, 2019.

VII. ELECTRONIC RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_me120/preview
2. https://archive.nptel.ac.in/courses/112/103/112103316/

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech-talk 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. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)