COURSE CODE	COURSE TITLE	L	T	P	C
1151AE105	AERO ENGINEERING THERMODYNAMICS	2	2	0	3

Course Category:

Programme core

a. Preamble :

The course provides an introduction to the elementary concepts of thermodynamics, First law of thermodynamics and Energy, second law, Entropy and energy, Ideal and real gases and non-reactive ideal gas mixtures and general thermodynamic property relations. The course aims at developing the problem solving skills with both theoretical and engineering oriented problems in basic thermodynamics.

b. Prerequisite Courses:

- Basic Mechanical Engineering

c. Related Courses:

- Aircraft Gas Turbine Propulsion
- Propulsion Lab
- Heat Transfer
- Turbomachinery

d. Course Educational Objectives :

- To develop understanding on the concepts of first and second law of thermodynamics and their application in designing the engineering systems
- To analyse various air standard cycles and to solve the problems related to that.
- To discuss in detail, the operations of air conditioning and refrigeration systems and air compressors

e. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Apply first law of thermodynamics to solve typical problems	K3
CO2	Apply second law of thermodynamics to solve typical problems	K3
CO3	Perform air standard analyses of internal combustion engines by modeling the engines as Otto Cycle, Diesel Cycle, Dual Cycle and Brayton cycle	K3
CO4	Apply theoretical and mathematical principles to vapour compression and vapour absorption refrigeration systems.	K3
CO5	Estimate the performance of air compressors	K2

f. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**L**		**H**		**L**	**M**	**H**	**L**	**H**		
CO2	**H**	**L**		**H**		**L**	**M**	**H**	**L**	**H**		
CO3	**H**	**L**		**H**		**L**	**M**	**H**	**L**	**H**		
CO4	**H**	**L**		**H**		**L**	**M**	**H**	**L**	**H**		
CO5	**H**	**L**		**H**		**L**	**M**	**H**	**L**	**H**		

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I BASIC CONCEPTS AND FIRST LAW L-6 T-6

Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics- concept of temperature and heat, internal energy, specific heat capacities, enthalpy - concept of ideal and real gases. First law of thermodynamics - applications to closed and open systems - steady flow processes with reference to various thermal equipment's.

UNIT-II SECOND LAW AND ENTROPY L-6T-6

Second law of thermodynamics – kelvin Planck and Clausius statements of second law. Reversibility and irreversibility - Carnot theorem. Carnot cycle, reversed Carnot cycle, efficiency, COP - thermodynamic temperature scale - Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNIT III AIR STANDARD CYCLES L-6T-6

Otto, Diesel, Dual combustion and Brayton combustion cycles – Air standard efficiency - Mean effective pressure – Actual and theoretical PV, TS diagrams of two stroke and four stroke IC Engines.

UNIT IV REFRIGERATION AND AIR CONDITIONING L-6T-6

Principles of refrigeration, Air conditioning - Heat pumps - Vapour compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants.

UNIT V AIR COMPRESSORS L-6T-6

Classification and working principle of compressors (Descriptive Treatment). Isothermal and Isentropic efficiency of air compressors.

Total Periods: 30 + 30 = 60

h. Learning Resources

i. Text Books:

1. Yunus A Cengel / Michael A Boles, "Thermodynamics - An Engineering Approach", (SI Units), Tata Mc Graw Hill India, 7th edition, Special Indian Edition 2011.
2. P K Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi, 6th Edition, 2008.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall India, 2005

ii. References:

1. Yadav R., "Thermodynamics and Heat Engines", Vol 1, Central Publishing House, 2011.
2. Jones J.B and Dugan R.E., "Engineering Thermodynamics", Prentice Hall of India, 2010.
3. Roy Choudry T., "Basic Engineering Thermodynamics", Second Edition, Tata McGraw Hill, 2012.