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

COURSE CONTENT

ENGINEERING THERMODYNAMICS								
III Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMED07	**Core**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		
Prerequisite: Applied Physics								

I. COURSE OVERVIEW:

Thermodynamics is the science that deals with the relationship between heat and work and those properties of systems that bear relation to heat and work. General laws of energy transformations concerning all types of systems, mechanical, electrical and chemical may fall within the purview of this science. It is a science basedon a number of empirical laws formed by experimentation from which all predictions concerning the physical behavior of the system may be deduced by logical reasoning. The findings have been formalized into the various laws of thermodynamics. The power cycles and refrigeration cycle based on thermodynamic system is studied. The students are familiarizing with standard charts and tables.

II. COURSE OBJECTIVES:

The students will try to learn

I. The fundamental knowledge on concepts of physics and chemistry for obtaining the axiomatic principles usingthermodynamic co-ordinates.
II. The thermodynamic disorderness in the real time physical systems like external/internal heat engines, heatpumps to get the measure of performance characteristics.
III. The performance characteristics of open and closed systems of thermodynamic cycles for effective delineationof real time applications.
IV. The thermodynamic cycles such as power and refrigerant cycles yields to alternative solutions to conserve theenvironment

III. COURSE OUTCOMES:

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

CO 1 Recall the basic concepts of thermodynamic properties and working principles of remember energy conversions in physical systems by laws of thermodynamics
CO 2 Summarize the equivalence of two statements of second law of thermodynamics and understand the entropy concepts for typical engineering problems
CO 3 Explain the properties of pure substances and steam to emit relevant inlet and exit Understand conditions of thermodynamic work bearing systems
CO 4 Apply the significance of partial pressure and temperature to table the performance Apply parameters of ideal gas mixtures
CO 5 Identify the properties of air conditioning systems by practicing psychrometry chart Apply and property tables
CO 6 Illustrate the working of various air standard cycles and work out to get the Understand performance characteristics

IV. COURSE CONTENT:

MODULE-I: BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (10)

System, control volume, surrounding, boundaries, universe, types of systems, macroscopic and microscopic viewpoints, concept of continuum, thermodynamic equilibrium, state, property, process, cycle, reversibility, quasi

static process, irreversible process, causes of irreversibility, various flow and non-flow processes ,energy in state and in transition, types-work and heat, point and path function, Zeroth law of thermodynamics, concept of quality of temperature, Principles of thermometry, reference points, constant volume gas thermometer, ideal gas scale, Joule's experiment, first law of thermodynamics, PMM1, corollaries first law applied to a process, applied to a flow system, steady flow energy equation.

MODULE-II: SECOND LAW OF THERMODYNAMICS (10)

Thermal reservoir, heat engine, heat pump, parameters of performance, second Law of thermodynamics, Kelvin Planck and Clausius statements and their equivalence, Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, thermodynamic scale of temperature, Clausius inequality, Entropy, principle of Entropy increase, availability and irreversibility, thermodynamic potentials, Gibbs and Helmholtz functions, Maxwell relations, Clapeyron equation, elementary treatment of the Third Law of thermodynamics.

MODULE –III: PURE SUBSTANCES &GAS LAWS (09)

Phase transformations, T-S and H-S diagrams, P-V-T surfaces, triple point at critical state properties during change of phase, dryness fraction, Mollier charts, various thermodynamic processes and energy transfer, steam calorimeter.

Gas Laws: Equation of state, specific and universal gas constants, throttling and free expansion processes, Vander Waals equation

MODULE –IV: MIXTURES OF PERFECT GASES (10)

Mole fraction, mass friction, gravimetric and volumetric analysis, volume fraction, Dalton's law of partial pressure, Avogadro's laws of additive volumes, and partial pressure, equivalent gas constant, internal energy, enthalpy, specificheats and entropy of mixture of perfect gases; psychometric properties, dry bulb temperature, wet bulb temperature, dew point temperature, thermodynamic wet bulb temperature, specific humidity, relative humidity, saturated air, vapour pressure, degree of saturation, adiabatic saturation, Carrier's equation, Psychometric chart.

MODULE –V: POWER CYCLES (09)

Otto, Diesel, Dual combustion cycles, description and representation on P-V and T-S diagram, thermal efficiency, mean effective pressures on air standard basis, comparison of cycles.

V. TEXT BOOKS:

1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill, 6th edition, 2017.
2. Yunus Cengel, Michael A. Boles, "Thermodynamics-An Engineering Approach", Tata McGraw Hill, 8th edition,2017.
3. D.S. Kumar., "Engineering Thermodynamics", S.K. Kataria and Sons, 2014.

VI. REFERENCE BOOKS:

1. R.K. Rajput., "Engineering Thermodynamics", 4th edition, Laxmi Publications, 2016.
2. Mahesh M Rathore., "Thermal Engineering", Tata McGraw Hill Publishers, 2013.
3. Y. V. C. Rao, "An Introduction to Thermodynamics", Universities Press, 3rd edition, 2013.
4. K. Ramakrishna, "Engineering Thermodynamics", Anuradha Publishers, 2nd edition, 2011.
5. Holman. J.P, "Thermodynamics", Tata McGraw Hill, 4th edition, 2013.

VI. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II

9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation