

THERMODYNAMICS

III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AMEB04	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60	
I. COURSE OVERVIEW:								
<p>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 based on 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.</p>								
II. OBJECTIVES:								
The course should enable the students to:								
<p>I The fundamental knowledge on concepts of physics and chemistry for obtaining the axiomatic principles using thermodynamic co-ordinates.</p> <p>II The thermodynamic dis-orderness in the real time physical systems like external/internal heat engines, heat pumps to get the measure of performance characteristics.</p> <p>III The performance characteristics of open and closed systems of thermodynamic cycles for effective delineation of real time applications.</p> <p>IV The thermodynamic cycles such as power and refrigerant cycles to yield alternative solutions to conserve the environment.</p>								
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 energy conversions in physical systems by laws of thermodynamics.			Remember				
CO 2	Summarize the equivalence of two statements of second law of thermodynamics and the entropy concepts for typical engineering problems.			Understand				
CO 3	Explain the properties of pure substances and steam to emit relevant inlet and exit conditions of thermodynamic work bearing systems.			Understand				
CO 4	Apply the significance of partial pressure and temperature to table the performance parameters of ideal gas mixtures.			Apply				
CO 5	Identify the properties of air conditioning systems by practicing psychrometry chart and property tables.			Apply				
CO 6	Illustrate the working of various air standard cycles and work out to get the performance characteristics.			Understand				
IV. SYLLABUS:								
MODULE-I	BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS				Classes: 09			
<p>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, PMMI Joule's experiments, first law of thermodynamics, corollaries first law applied to a process, applied to a flow system, steady flow energy equation.</p>								

MODULE-II	SECOND LAW OF THERMODYNAMICS	Classes: 09
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, elementary treatment of the Third Law of thermodynamics.		
MODULE-III	PURE SUBSTANCES	Classes: 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. Equation of state, specific and universal gas constants, throttling and free expansion processes, deviations from perfect gas model, Vander Waals equation of state.		
MODULE-IV	MIXTURES OF PERFECT GASES	Classes: 09
Mole fraction, mass fraction, 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, specific heats 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, vapor pressure, degree of saturation, adiabatic saturation, Carrier's equation, Psychometric chart.		
MODULE-V	POWER CYCLES	Classes: 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, introduction to Brayton cycle and Bell Coleman cycle.		
Text Books:		
1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill, 4 th Edition, 2008. 2. Yunus Cengel, Michael A. Boles, "Thermodynamics-An Engineering Approach", Tata McGraw Hill, 7 th Edition, 2011.		
Reference Books:		
1. J. B. Jones, R. E. Dugan, "Engineering Thermodynamics", Prentice Hall of India Learning, 1 st Edition, 2009. 2. Y. V. C. Rao, "An Introduction to Thermodynamics", Universities Press, 3 rd Edition, 2013. 3. K. Ramakrishna, "Engineering Thermodynamics", Anuradha Publishers, 2 nd Edition, 2011. 4. Holman. J.P, "Thermodynamics", Tata McGraw Hill, 4 th Edition, 2013.		
Web References:		
1. http://www.livescience.com/50776-thermodynamics.html 2. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf		
E-Text Books:		
1. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf 2. http://www.ebookdownloadz.net/2014/08/engineering-thermodynamics-by-pknag.html		