15MH205	Fundamentals of Thermodynamics and Heat Transfer			L	T	P	C
				3	0	0	3
Co-requisite:	Nil						
Prerequisite:	Nil						
Data Book / Codes/Standards	Approved steam tables, psychrometric chart and heat and mass transfer data book.						
Course Category	P	Professional Core	Mechanical Engineering				
Course designed by	Department of Mechatronics Engineering						
Approval	32nd Academic Council Meeting held on 23.07.2016.						

Purpose	To impart knowledge of classical thermodynamics and the system surroundings interactions involving work and heat transfer with associated property changes.							
Instructional Objectives		**Student Outcomes**						
At the end of the course, student will be able to								
1.	Identify and describe the energy exchange processes in engineering systems.	a	e					
2.	Apply the first law of thermodynamics to a system of thermodynamic components like heaters, coolers, pumps and turbines.	a	e					
3.	Extrapolate the psychrometric properties and performance of refrigeration and air conditioning systems.	a	e					
4.	Extrapolate the different modes of heat transfer like conduction, convection and radiation.	a	e					
5.	Analyze the heat transfer in refrigeration and air-conditioning systems, internal combustion engine and gas turbine.	a	e					

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
	Unit I: First Law of Thermodynamics	**8**			
1.	Introduction to thermodynamics, statistical and classical approach.	1	C	1	1,2
2.	Thermodynamic system, properties, processes and cycles.	1	C	1	1,2
3.	Thermodynamic equilibrium: Mechanical, chemical and thermal equilibrium, quasi-static process.	1	C	1	1,2
4.	Work and heat transfer, zeroth law of thermodynamics, first law of thermodynamics.	1	C	1	1,2
5.	First law of thermodynamics applied to closed systems: Isobaric, isochoric and isothermal processes.	2	C,D	1,2	1,2
6.	First law of thermodynamics applied to closed systems: Isentropic and polytropic processes.	1	C,D	1,2	1,2
7.	First law of thermodynamics applied to open systems: Steady flow energy equation to boiler, heat exchanger and turbine. Limitations of first law of thermodynamics.	1	C,D	1,2	1,2
	Unit II: Second Law of Thermodynamics	**8**			
8.	Second law of thermodynamics: Kelvin Planck and Clausius statements.	2	C	1,2	1,2
9.	Second law aspects of heat engine, refrigeration and heat pump.	2	C,D	1,2	1,2
10.	Clausius inequality and concept of entropy.	2	C	1,2	1,2
11.	Entropy changes in different thermodynamics processes: Isobaric, isochoric and isothermal processes.	2	C,D	1,2	1,2
	Unit III: Psychrometry, Refrigeration and Air Conditioning	**8**			
12.	Introduction, psychrometric properties-dry air, moist air, dry bulb temperature, wet bulb temperature, dew point temperature, specific humidity.	2	C	3	1,4
13.	Calculations of vapor mixtures, psychrometric processes.	2	C	3	1,4
14.	Elements of refrigeration systems, coefficient of performance.	2	C	3	1,4
15.	Air-conditioning systems: Open and closed system.	2	C	3	1,4
	Unit IV: Fundamentals of Heat Transfer	**8**			
16.	Modes of heat transfer: Conduction, convection and radiation.	1	C	4	3
17.	Fourier law of conduction, general heat conduction equation in cartesian co-ordinates.	2	C,D	4	3
18.	Heat stored in the element, heat generated within the element.	1	C,D	4	3
19.	Conduction through plane wall, cylinders and spherical systems.	2	C,D	4	3
20.	Forced convection and free convection.	2	C	4	3

Session	Description of Topics	Contact hours	C-D-I-O	IOs	Reference
21.	Introduction to IC engine and engine components.	1	C	5	3
22.	Analysis of heat transfer in IC engine.	2	C,D	5	3
23.	Classifications of turbines, merits and applications of gas turbine.	1	C	5	3
24.	Analysis of heat transfer in gas turbine.	2	C,D	5	3
25.	Refrigeration and air-conditioning systems.	1	C	5	3
26.	Analysis of heat transfer in refrigeration and air-conditioning.	2	C,D	5	3
	Assessment	**4**			
27.	Cycle test – I	1			
28.	Cycle test – II	2			
29.	Surprise test /Assignment and Quiz	1			
	Total contact hours	**45**			

Learning Resources	
Sl.No.	**Text Books**
1.	Rajput.R.K., "*Engineering Thermodynamics*", 4th edition, Laxmi Publications (P) Ltd., 2010.
2.	Kumar.D.S., "*Engineering Thermodynamics*", 2nd edition, S.K. Kataria and Sons, 2012.
3.	Holman.J.P, "*Heat Transfer (In SI Units)",* 10th edition, McGraw Hill Education, 2011.
	Reference Books/Other Reading Materials
4.	Yunus A Cengel Michael A Boles, "*Thermodynamics*", 7th edition, Tata McGraw-Hill, 2011.
5.	Nag.P.K., "*Engineering Thermodynamics*", 4th edition, Tata McGraw-Hill, 2008.
6.	Holman.J.P., "*Thermodynamics*", 4th edition, Tata McGraw Hill education, 1988.
7.	Ballaney.P.L., "*Thermal Engineering*", 5th edition, Khanna Publishers, 2010.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
End semester examination weightage:							**50%**