THERMAL ENGINEERING

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AME013	Core	3	-	-	3	30	70	100
Contact Classes: 60	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

1. Understand ideal and air standard vapor cycle and evaluate the performance in open systems like steam power plant, gas turbine etc.
2. Analyses different air standard cycles specifically related to IC engines and solve problems on the intricacies of performance of the cycle
3. Understand the direction law and concept of entropy increase of the universe.

COURSE LEARNING OUTCOMES (CLOs):

1. Discuss the basic concepts of thermodynamics in the analysis for Carnot vapor power cycle
2. Determine the efficiency and output of a basic and modern Rankine cycle steam power plant from given data.
3. Determine the efficiency of a modified Rankine cycle including superheat, reheat, and regeneration techniques
4. Discuss the concept of stoichiometric analysis of fuels and combustion.
5. Discuss different types of steam generators and its working principles.
6. Discuss mountings and accessories of boilers.
7. Understand the working of different types of steam nozzles and its applications, conditions for maximum discharge of steam through it.
8. Classify different types of steam turbines and working of impulse turbine and its performance parameters and methods of compounding to reduce rotor speed of an impulse turbine.
9. Explain the blade shapes, and calculate work output of typical turbine stages with its velocity diagrams.
10. Demonstrate different types of condensers and its working principles.
11. Recognize the different gas turbine arrangements, their advantages and disadvantages and different applications application.
12. Applying the relation between gas turbine design, application and environment
13. Applying the basic thermodynamic and heat transfer principles in performance calculation of industrial gas turbines
14. Recognizing the differences of a real cycle (from the theoretical ones)
15. Carry out performance calculations of real Gas turbines
16. Examine the effect of various design parameters on the GT performance (pressure ratio, temperature ratio, pressure drop, polytrophic efficiency ...etc.).
17. Explain the fundamentals of jet propulsion and basic propulsion cycle
18. Examine the effect of various design parameters of the jet propulsion performance and its efficiency etc.
19. Discuss the concepts of Rocket propulsion and its classification.

UNIT-I	BASIC CONCEPTS OF RANKINE CYCLE
Rankine cycle schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance, regeneration and reheating. Combustion: fuels and combustion, adiabatic flame temperature, stoichiometry, flue gas analysis.	
UNIT-II	**BOILERS AND STEAM NOZZLES**
Boilers: Classification, working principles with sketches including, high pressure boilers, mountings and accessories, working principles, steam nozzles: Function of nozzle, applications, types, flow through nozzles, thermodynamic analysis.	
UNIT-III	**STEAM TURBINE AND CONDESERS**
Steam turbines: Classification, impulse turbine, mechanical details, velocity diagram, effect of friction, power developed, axial thrust, blade or diagram efficiency, condition for maximum efficiency; Reaction turbine: Mechanical details, principle of operation, thermodynamic analysis of a stage, degree of reaction, velocity diagram, Parson's reaction turbine, condition for maximum efficiency. Steam condensers: Requirements of steam condensing plant, classification of condensers, working principle of different types.	
UNIT-IV	**GAS TURBINES**
Gas turbines: Simple gas turbine plant, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating, closed and Semi-closed cycles, merits and demerits, brief concepts of compressors combustion chambers and turbines of gas turbine plant.	
UNIT-V	**JET PROPULSION AND ROCKETS**
Jet propulsion: Principle of operation, classification of jet propulsive engines, working Principles with schematic diagrams and representation on T-S diagram, thrust, thrust power and propulsion efficiency, turbo jet engines, needs and demands met by turbo jet, schematic diagram, thermodynamic cycle, performance evaluation thrust augmentation methods; Rockets: Application, working Principle, classification, propellant type, thrust, propulsive efficiency, specific impulse, solid and liquid propellant rocket engines.	

Text Books:

1. R. K. Rajput, "Thermal Engineering", Lakshmi Publications, 8th Edition, 2015 V.
2. Ganesan, "Gas turbines", Tata McGraw-Hill, 3rd Edition, 2010

Reference Books:

1. P. Khajuria, S. P Dubey, "Gas Turbines and Propulsive systems", Dhanpat Rai Publishers., 1st Edition, 2012.
2. Ballaney, "Thermal Engineering", Khanna Publishers, 1st Edition, 2012.
3. R. Yadav, "Thermodynamics and Heat Engines", Central Book Depot, 1st Edition, 2002