THERMAL ENGINEERING- II

V Semester: MECHANICAL ENGINEERING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A4ME17	CORE	3	-	-	3	30	70	100

COURSE OVERVIEW :

The primary focus of this course is on application of laws of Thermodynamics to analyse steam and gas turbine cycles. It also emphasize on analysis of the major components of steam and gas turbine plants and their applications.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Demonstrate rankine cycle, and Apply thermodynamic concepts on boilers.
2. Figure out different types and applications of steam nozzles, and condensers.
3. Classify and explain steam turbines.
4. Explain working of gas turbines.
5. Demonstrate the basic principles of operation of refrigeration and Air- conditioning systems.

UNIT-I BASIC CONCEPTS AND BOILERS

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating-Cycles.

Boilers:Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance.

UNIT-II STEAM NOZZLES & STEAM CONDENSORS

Steam Nozzles: Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles, Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape.

STEAM CONDENSERS: Requirements of steam condensing plant, Classification of condensers, working principle of different types, vacuum efficiency and condenser efficiency, air leakage, sources and its affects, air pump, cooling water requirement.

UNIT-III STEAM TURBINES

Impulse turbine: Mechanical details, Velocity diagram, effect of friction, power developed, axial thrust, blade or diagram efficiency, condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow.

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.

UNIT-IV	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, Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT-V	REFRIGERATION AND AIR CONDITONING

REFRIGERATION: Reversed Carnot cycle – Performance Evaluation – Vapour Compression Cycle, Vapour absorption cycle – mechanical details, working principles, use of P-H charts for calculations.
AIR- CONDITIONING:Introduction, classification and working principles of air-conditioning systems, requirements, schematic layout of a typical plant.

Text Books:

1. R. K. Rajput, Thermal Engineering, 18th edition, Lakshmi Publications, New Delhi, India.
2. V. Ganesan, Gas Turbines, 3rd edition, Tata McGraw-Hill education (P) Ltd, New Delhi, India.
3. CP Arora ,Refrigeration and Air Conditioning , TMH.

Reference Books:

1. P.L. Ballaney, 1966, Thermal Engineering, 25 edition, Khanna Publishers, New Delhi, India
2. Cohen, Rogers, SaravanaMuttoo (2011), Gas Turbines, 9th edition, Addison Wesley Longman, New Delhi, India.
3. R. Yadav (2011), Thermodynamics and Heat Engines, 7th Edition, Central Book Depot, Allahabad, India.
4. P. Khajuria, S. P. Dubey (2009), Gas Turbines and Propulsive Systems, 5th edition, Dhanpatrai Publications, New Delhi, India.
5. Basic Refrigeration and Air-Conditioning by Ananthanarayanan, TMH

Web References:

1. http://nptel.ac.in/downloads/112101004/
2. https://www.accessengineeringlibrary.com/browse.
3. https://www.researchgate.net/publication/233903699

E-Text Books:

1. https://engineeringstudymaterial.net/ebook/introduction-to-thermal-systems-engineering
2. http://webserver.dmt.upm.es/~isidoro/tc3/Thermal engineering.pdf

MOOC Course:

1. https://www.edx.org/learn/mechanical-engineering
2. https://www.coursera.org/browse/physical-science-and-engineering/mechanical- engineering
3. https://www.mooc-list.com/categories/engineering