THERMAL ENGINEERING

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC20	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Prerequisite: Thermodynamics

I. COURSE OVERVIEW:

Thermal Engineering is science intended to introduce concepts and working principles of boilers, turbines, condensers and nozzles which are widely used in different industrial applications such as automobile, agriculture, industry for transport, water pumping, electricity generation, earth moving and for supply mechanical power. This course also deals with working principles of aircraft systems such as propulsion systems and rockets in various fields of engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The usage of knowledge on thermodynamic cycles and fluid dynamics phenomena presents in turbo-machinery and combustion for producing electric and mechanical energy/power.

II. The operational concepts, principles, features, procedures and detailed thermodynamic analyses related to components of power cycles, rocket propulsion as well as steam and power generators.

III. The real-world engineering problems and examples towards gaining the experience for designing and developing power generating systems in engineering practice.

III. COURSE OUTCOMES:

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

CO 1	**Recall** the thermodynamic processes, working and analyses of combustion, vapor power cycles for electrical and mechanical power.	Remember
CO 2	**Interpret** various concepts, principles of operation, theories and phenomena related to the boilers and nozzles.	Understand
CO 3	**Develop** the performance parameters of the steam turbine and reaction turbine for maximum efficiency, thermodynamic analysis ofa stage, degree of reaction, velocity diagram.	Apply
CO 4	**Demonstrate** the principles of operation, classification, working, accessories and mountings of various steam generators and condensers.	Understand
CO 5	**Identify** the working principles and analyses of combustion, gaspower cycles for producing electrical and mechanical power.	Apply
CO 6	**Demonstrate** the principles, methodologies and variations in the configurations of thermal gas turbo-machinery and rocket propulsionbased on the availability of resources.	Understand

IV. COURSE SYLLABUS:

MODULE-I: BASIC CONCEPTS (12)

Rankine cycle schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance, regeneration and reheating.

MODULE –II: BOILERS AND STEAM NOZZLES (12)

Boilers: Classification, working principles with sketches, boilers mountings and accessories.

Basics of compressible flow, Isentropic flow of a perfect gas through nozzle, subsonic, supersonic and choked flow- normal shocks, flow of steam through nozzles, thermodynamic analysis of nozzle.

MODULE –III: STEAM TURBINES AND STEAM CONDENSERS (12)

Steam Turbines: Classification, Impulse turbine-velocity diagrams, pressure and velocity compounding.

Reaction turbine-principle of operation, thermodynamic analysis of a stage, degree of reaction, velocitydiagrams.

Steam Condensers: Requirements of steam condensing plant, classification of condensers, working principle ofdifferent types.

MODULE –IV: GAS TURBINES (12)

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 combustion chambers of gas turbine plant.

MODULE –V: JET PROPULSION AND ROCKETS (12)

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; Rockets: Application, working Principle, classification, propellant type, thrust, propulsive efficiency, specific impulse, solid and liquid propellant rocket engines.

V.TEXT BOOKS:

1. P.K Nag, "Engineering Thermodynamics", Tata McGraw-Hill, 6th Edition, 2017.
2. R. K. Rajput, "Thermal Engineering", Lakshmi Publications, 8th Edition, 2015.

VI. 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

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/112/106/112106133
2. https://nptel.ac.in/courses/112/103/112103281/