APPLIED THERMODYNAMICS-II

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB18	Professional Core	3	1	-	4	30	70	100
Contact Classes:45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

Students will try to learn:

I. The usage of fundamental knowledge on thermodynamic cycles and fluid dynamics phenomena present in turbomachinery 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 designing approaches for developing governing equations and correlations related to intricate parts of turbomachinery and their components with due consideration of effect on the performance.
IV. A wealth of real world engineering problems and examples towards gaining the experience for designing and developing power generating systems in engineering practice.

COURSE OUTCOMES:

After successful completion of the coursestudents are able to:

CO1 Explain the thermodynamic processes, working and analyses of combustion, vapour and gas power cycles for producing electrical and mechanical power.
CO2 Apply the basic thermodynamic, stoichiometric and fluid dynamics laws for detailed analyses of vapor and gas power cycles related to thermal turbomachinery, combustion and rocket propulsion.
CO3 Illustrate the schematic and technical diagrams for the representation of vapour and gas power cycles related to thermal turbomachinery for electrical and mechanical power generation.
CO4 Analyse thermodynamically the thermal turbomachinery and nozzles for developing governing equations and correlations with due consideration of performance measures.
CO5 Categorize different configurations and modified methods of vapour and gas power cycles for enhancement of the performance during the production of electrical/mechanical power.
CO6 Describe the principles of operation, classification, working, accessories and mountings of various steam generators and condensers.
CO7 Illustrate the schematic diagrams of various steam generators and condensers for depicting and visualizing the flow of the working fluids.
CO8 Interpret various concepts, principles of operation, theories and phenomena related to the thermal turbomachinery and nozzles.
CO9 Illustrate the velocity diagrams for the representation of various blade configurations in the designing and solution process of practical turbomachinery problems.
CO10 Discuss the methodologies, variations in the configurations of thermal gas turbomachinery and rocket propulsion based on the availability of resources.
CO11 Determine several properties and parameters across various stages of the vapour and gas power cycles related to different practical scenarios of thermal turbomachinery and rocket propulsion.

1.

UNIT- I	BASIC CONCEPTS	Classes: 12

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, exhaust gas analysis.

UNIT - II	BOILERS AND STEAM NOZZLES	Classes: 12
Boilers: Classification, working principles with sketches, boilers mountings and accessories, working principles.; Basics of compressible flow, Isentropic flow of a perfect gas through nozzle, subsonic, supersonic and choked flow- normal shocks-ideal gas tables for isentropic and normal shock flow, flow of steam and refrigerant through nozzles, thermodynamic analysis of nozzle.		
UNIT - III	**STEAM TURBINES AND STEAM CONDENSERS**	**Classes: 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, velocity diagrams. Steam Condensers: Requirements of steam condensing plant, classification of condensers, working principle of different types.		
UNIT - IV	**GAS TURBINES**	**Classes: 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.		
UNIT - V	**JET PROPULSION AND ROCKETS**	**Classes: 12**
Jet propulsion: Principle of operation, classification of jet propulsive engines, working Principles withschematic 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.		

Text Books:

1. R. K. Rajput, “Thermal Engineering”, Lakshmi Publications, 8th Edition, 2015.
2. V. Ganeshan “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.
4. P.K Nag, “Engineering Thermodynamics”, Tata McGraw-Hill publishing Co. Ltd.