JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

<table>
<tr><td rowspan="2">II Year - II Semester</td><td rowspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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<tr><td colspan="6" align="center">APPLIED THERMODYNAMICS</td></tr>
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Course objectives:
This course is intended to study the thermodynamic analysis of major components of Rankine cycle, refrigeration cycles and compressible fluids and to analyze the energy transfers and transformations in these components including individual performance evaluation.

UNIT – I
VAPOUR POWER CYCLES: Carnot, Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.
COMBUSTION: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

UNIT II
BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.
UNIT – III
STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow - its effects, degree of super saturation and degree of under cooling, Wilson line.
STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency
UNIT IV
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 – calculation of blade height.
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 – V
COMPRESSORS – Classification –Reciprocating type, Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, saving of work, minimum work condition for two stage compression.

Rotary (Positive displacement type)
Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.
Rotary (non positive displacement type)
Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, velocity diagrams.
Axial Flow Compressors: Mechanical details and principle of operation, velocity diagrams.

TEXT BOOKS:

1. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGraw Hill
2. Applied Thermodynamics - R Yadhav

REFERENCES:

1. Thermal Engineering- Mahesh Rathore - TataMcGrawHill
2. Heat Engineering (MKS and SI units) - VP Vasandani& DS Kumar - Metropolitan books
3. Thermal Engineering - Sadhu Singh- Pearson Publishers
4. Applied Thermodynamics - Eastop & McConkey- Pearson 5th Edn
5. Fluid Mechanics Fundementals and Applications - Y.A.Cengel, J.M.Cimbala- McGrawHill
6. Thermal Engineering-M.L.Marthur & Mehta- Jain bros. Publishers
7. Thermal Engineering - RK Rajput- Lakshmi Publications

Course outcomes:
CO1**:** Expected to learn the working of steam power cycles and also should be able to analyze and evaluate the performance of individual components
CO2: Student is able to learn the principles of combustion , stochiometry and flue gas analysis
CO3: Students will be able to design the components and calculate the losses and efficiency of the boilers, nozzles and impulse turbines**.**
CO4: Students will be able to design the components and calculate the losses and efficiency of reactions turbines and condensers.
CO5: Student is able to learn various types of compressors, principles of working and their performance evaluation.