JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA 533003, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

III Year-I Semester		L	T	P	C
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THERMAL ENGINEERING – II
(Use of steam tables and Mollier chart is allowed)

Course objectives:
1) To understand the basic concepts of thermal engineering and boilers.
2) To gain knowledge about the concepts of steam nozzles and steam turbines.
3) To gain knowledge about the concepts of reaction turbine and steam condensers.
4) To understand the concepts of reciprocating and rotary type of compressors.
5) To acquire knowledge about the centrifugal and axial flow compressors.

UNIT– I:
BASIC CONCEPTS: 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.
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– II:
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– III:
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.

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UNIT– IV:
COMPRESSORS: Classification – fan, blower and compressor – positive displacement and non-positive displacement type – reciprocating and rotary types.
RECIPROCATING: 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: Roots Blower, vane sealed compressor, Lysholm compressor –mechanical details and principle of working   efficiency considerations.

UNIT– V:
CENTRIFUGAL COMPRESSORS: Mechanical details and principle of operation –velocity and pressure variation. Energy transfer-impeller blade shape-losses,slip factor, power input factor, pressure coefficient and adiabatic coefficient– velocity diagrams – power.
AXIAL FLOW COMPRESSORS: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor – isentropic efficiency- pressure rise calculations – Poly tropic efficiency.

TEXT BOOKS:
1) Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central Publishing House
2)   Heat Engineering /V.P Vasandani and D.S Kumar/Metropolitan Book Company, New Delhi.

REFERENCES:
1) Thermal Engineering-M.L.Mathur & Mehta/Jain bros. Publishers
2) Thermal Engineering-P.L.Ballaney/ Khanna publishers.
3) Thermal Engineering / RK Rajput/ Lakshmi Publications
4) Thermal Engineering-R.S Khurmi, &J S Gupta/S.Chand.

Course Outcomes: At the end of the course, student will be able to
CO1: Explain the basic concepts of thermal engineering and boilers.
CO2: Discuss the concepts of steam nozzles and steam turbines.
CO3: Gain knowledge about the concepts of reaction turbine and steam condensers.
CO4: Discuss the concepts of reciprocating and rotary type of compressors.
CO5: Acquire knowledge about the centrifugal and axial flow compressors.