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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, August - 2022
THERMAL ENGINEERING - II
(Mechanical Engineering)

Time: 3 Hours   **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a)   A Simple Rankine Cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam is dry and saturated. Calculate the cycle efficiency, work ratio and specific steam consumption.

  b)   Explain the concept of mean temperature of heat addition.   [7+8]

2.   Describe with a neat line sketch of a Benson Boiler mentioning its distinguishing features. State the advantages and disadvantages for this type of boilers.   [15]

3.a)   Explain the metastable expansion of steam in a nozzle with the help of h-s diagram.

  b)   Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2 bar. If the dryness fraction of the discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam. If 10% of heat drop is lost in friction, find the percentage reduction in the final velocity.   [8+7]

4.a)   Derive an expression for maximum discharge through convergent divergent nozzle for steam.

  b)   Dry saturated steam at a pressure of 8 bars absolute enters a convergent-divergent nozzle and leaves at 1.5 bars absolute. If the flow is isentropic and corresponding expansion index is 1.135, find the ratio of cross-sectional area at exit and throat for maximum discharge.   [9+6]

5.a)   What are the different methods of compounding of steam turbine stages? List the advantages and limitations of velocity compounding.

  b)   A stage of impulse-reaction turbine is provided with single row wheel whose mean diameter is 100cm and it is rotating at 50 rps. The nozzle angle=20 ^{0} and the velocity of steam coming out of the turbine is 350 m/sec. Determine the power developed if the axial thrust on the end bearings is limited to 118N. Take blade friction factor=0.8. Assume the blades are equi-angular.   [7+8]

6.   In a reaction turbine, the blade tips are inclined at 35 ^{0} and 20^0 in the direction of motion. The guide blades are of same shape as that of the moving blades, but reversed in direction. At a certain place in the turbine, the drum diameter is 1m and the blades are 10 cm high. At this place, the steam has a pressure of 1.75 bar and dryness fraction of 0.935. If the speed of this turbine is 250 rpm and the steam passes through the blades without shock, find the mass of steam flow and power developed in the ring of moving blades?   [15]

7.a) Briefly state the effects of air leakage on the performance of a condenser.
  b) In a simple gas turbine plant, air enters at 1 bar and $20\,^0C$ and compressed with isentropic efficiency of 80% to 4bar. Then it is heated in combustion chamber with A:F ratio=90:1. The Calorific value of a fuel used is 41.8 MJ/kg. If air flow is 3kg/sec, find the power developed and thermal efficiency by the plant. Take Cp= 1kJ/kg^{0}C and Υ=1.4 for air as well as gas? [7+8]

8.a) Discuss in detail Solid and Liquid propellant Rocket Engines.
  b) Draw the schematic diagram of Turbo jet and explain its working. [8+7]

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