**Code No: 155DG** **R18**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech III Year I Semester Examinations, February - 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) With the help of neat sketch explain the working of Rankine Cycle and write the methods to improve the cycle efficiency.

b) A boiler generates 13000 kg of steam at 7 bar during a period of 24 hrs and consume 1250 kg of coal whose CV =30000kj/kg. Taking the enthalpy of steam coming out of boiler=2507.7kj/kg and water is supplied to the boiler at $40^0$C. Find (i) the efficiency of the boiler (ii) equivalent evaporation per kg of coal. [9+6]

2. What are the functions of boiler mountings and accessories? Explain any one mountings and accessories with neat line sketch. [15]

3.a) Derive the expression for critical pressure ratio in terms of index of expansion.

b) Steam having a pressure of 10.5 bar 0.95 dryness is expanded through a convergent - divergent nozzle and the pressure of steam leaving the nozzle is 0.85 bar. Find the velocity at throat for maximum discharge conditions. Index of expansion may be assumed as 1.135. Calculate the mass flow rate of steam through the nozzle? [8+7]

4.a) What is mean by over expansion and under expansion?

b) In a steam nozzle, the steam expands from 4 bar to 1 bar. The initial velocity is 60 m/s and the initial temperature is $200^0$C. Determine the exit velocity if the nozzle efficiency is 92%? [7+8]

5. Steam enters the blade row of an impulse turbine with a velocity of 600 m/s at an angle of $25^0$ t the plane of rotation of blades. The mean blade speed is 250 m/s. the blade angle on the exit side is $30^0$. The blade friction coefficient is 10%. Determine the (a) Blade angle at inlet (b) work done per kg of steam (c) Diagram efficiency (d) axial thrust per kg of steam per second? [15]

6.a) 250 kg/min of steam (3 bar, 0.97 dry) flows through a given stage of reaction turbine. The exit angle of fixed blades as well as moving blades is 200 and 3. 76 kW of power is developed. If the rotor speed is 380 rpm and the tip leakage is 5 percent, calculate the mean drum diameter and the blade height. The axial flow velocity is 0.8 times the blade velocity.

b) Define the term Degree of Reaction used in Reaction Turbines. Prove that moving and fixed blades should have the same shape for 50% reaction. [9+6]

7.a) Discuss the merits and demerits of surface condensers over jet condensers.

b) In gas turbine plant, the compressor takes air at $15^0$C and compresses with pressure ratio of 4 with isentropic efficiency 82%. Then the air is heated in the heat exchanger using 75% of the available heat with exhaust gases and then heated in combustion chamber to $600^0$C. Isentropic efficiency of turbine is 70%. Taking the properties of air and gases same, find work developed per kg of air flow and thermal efficiency of the cycle; Take effectiveness of heat exchanger as 0.75? [6+9]

8.a) Discuss in detail the needs and demands met by Turbo jet.

b) How are rockets classified explain in detail? [8+7]

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