Code No: 155DG

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2021
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) Explain the concept of "mean temperature of heat addition".
b) In a regenerative cycle the inlet conditions are 40 bar and 400 ^{0}C for the Rankine cycle steam is bled at 10 bar for regenerative heating. The exit pressure of the turbine is 0.8 bar. Neglecting pump work, determine the efficiency of the cycle. [6+9]

2. A convergent-divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 10 bar and 200 ^{0}C and the discharge takes place against a back pressure of 0.34 bar. Estimate the throat and exit areas. Assume isentropic flow and take the index n=1.3. Nozzle efficiency is assumed to be 85%. [15]

3.a) An impulse turbine is provided with single row wheel whose mean diameter is 100 cm and it is rotating at 50 rps. The nozzle in inclined at an angle of 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 118 N. Take blade friction factor=0.8. Assume the blades are equi-angular.
b) Explain the working of a single-stage impulse turbine. Sketch pressure and velocity variations along the axis of the turbine [8+7]

4.a) Describe the factors which influence of condenser and vacuum efficiencies of a condensing plant.
b) Discuss briefly the methods employed for improvement of thermal efficiency of an open cycle gas turbine plant. [7+8]

5.a) Why mountings are essential in boilers? Name different mountings and give functions of each.
b) A gas turbine is operated with a temperature limits of 300 K and 1200 K. Calculate the optimum pressure ratio for maximum network output and also calculate the thermal efficiency. [6+9]

6.a) What are the different methods of compounding of steam turbine stages? List the advantages and limitations of velocity compounding.
b) Differentiate between jet condensers over surface condensers. [7+8]

7.a) What are different savers of air leakage from the condenser plant? Explain the method of removing the air.
b) Explain different types of propellants used in solid propellant rockets. [8+7]

8.a) A turbojet engine indicates 45 kg of air per second and propels an aircraft with a uniform flight speed of 880 km/h. The isentropic enthalpy change for nozzle is 188.37 kJ/kg and its velocity coefficient is 0.96. The fuel-air ratio is 0.012, the combustion efficiency is 0.95 and the lower heating value of the fuel is 44,000kJ/kg. Calculate: i) the thermal efficiency of the engine, ii) the fuel flow rate in kg/h, iii) the propulsion power in kW, iv) the thrust power, v) the propulsive efficiency.
b) Describe with a sketch a solid propellant rocket. What is gain? What are the applications of solid propellant rockets? [6+9]

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