Code No: 123AB

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, August/September - 2022
THERMODYNAMICS
(Mechanical Engineering)

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

Answer any five questions
All questions carry equal marks
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1. A cylinder Piston arrangement is containing fluid at a pressure of 3 bar and with specific volume of 0.18 m^3/kg allows the fluid to expand reversibility to a pressure of 0.6 bar according to the law $P=C/v^2$ where C is constant. Determine the work done by the fluid on the piston. [15]

2. A steam turbine operates under steady flow conditions. It receives 7200 kg per hour of team from the boiler. The steam enters the turbine at enthalpy of 2800 kJ per kg, a velocity of 4000 m per minute and elevation of 4 m. The steam leaves that turbine at enthalpy of 2000 kJ per kg, a velocity of 8000 m/ minute and elevation of 1 m. Due to radiation, heat loss from the turbine to this surroundings amount to 1580 kJ per hour, calculate the output of the turbine. [15]

3. The expansion of a perfect gas is so controlled that the pressure changes according to the P = AV + B where A and B are constant and V is the volume. The mass of gas is 1.4 kg and the initial and final pressures are 6 bar and 2 bar. The corresponding volumes are 0.2 and 0.6 m^3. Assume V =1.39, R = 0.28 kJ/kgK. Find the change in entropy per kg during expansion, the maximum value of internal energy per kg reckoned from zero degrees centigrade and the net heat removed or added during the cycle. [15]

4. Show that when a perfect gas is changes from state $P_1 V_1 T_1$ to another state $P_2 V_2 T_2$ the increase in entropy per unit mass is given by $(S_2 - S_1) = C_V \ln P_2/P_1 + C_p \ln V_2/V_1$. find the value of index **n** so that the gain of Entropy during the heating of gas at a constant volume between temperature T_1 and T_2 will be the same as that during and expansion according to the law PV^n=constant between the same temperatures. Show also that the heat supplied for unit mass of gas will be the same in each case. [15]

5. 3 kg of steam at 10 bar and 250 degree centigrade undergoes a constant pressure process, the resulting steam is wet having dryness fraction 0.6. Calculate work done, change in enthalpy and heat transferred assuming the non-flow process. [15]

6. Explain phase transformation at constant pressure. (Formation of steam) [15]

7. A perfect gas mixture consists of 3 kg of Nitrogen and 5 kg of carbon dioxide at a pressure of 3 bar and a temperature of 20 degrees centigrade. Calculate the mole fraction of each constant, the equivalent molecular weight of the mixture, the equivalent gas constant of the mixture, the partial pressure and partial volumes and the volume and density of the mixture. [15]

8. Compare the efficiency of the Otto, the Diesel and the dual cycle under the conditions of (a) equal compression ratio and heat input, (b) constant maximum pressure and heat Input (c) constant maximum pressure and output and (d) constant maximum pressure and temperature. [15]

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