

Code No: 138FQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech IV Year II Semester Examinations, September - 2020****BASICS OF THERMODYNAMICS****(Electrical and Electronics Engineering)****Time: 2 hours****Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks

- 1.a) Explain Joules experiment and state the first law of thermodynamics applied to a closed system undergone by a cyclic process.
- b) A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1 m^3 to 0.4 MPa, 0.03 m^3 . Assuming that the pressures volume are related by $PV^n = \text{constant}$, find net work done by gas system. [7+8]
- 2.a) Explain about thermodynamic system and control volume.
- b) A gas in a piston cylinder assembly undergoes an expansion process for which the relationship between pressure and volume is given by $PV^n = \text{const}$. The initial pressure is 0.3 MPa, the initial volume is 0.1 m^3 and the final volume is 0.2 m^3 . Determine the work for the process in kJ if i) $n = 1.5$, ii) $n = 1.0$ and iii) $n = 0$. [7+8]
- 3.a) Why does free expansion have zero work transfer?
- b) A gas expands from an initial state where the pressure is 340 kPa and the volume is 0.0425 m^3 to a final pressure of 136 kPa. The relationship between the pressure and volume of the gas is $pv^2 = \text{constant}$. Determine the work for the process. [7+8]
- 4.a) Distinguish with between the terms 'change of state', path and process.
- b) A balloon is filled with air (200 kPa and 300K) such that it becomes as sphere of diameter 1m. It is then gradually heated till the pressure rises to 500 kPa. Determine the amount of work done during the process, assuming that the pressure inside the balloon is proportional to the diameter of the balloon. [7+8]
- 5.a) Show that the entropy change in a cyclic process is zero.
- b) Ten kg of water at 20°C is converted into ice at -10°C at constant atmosphere pressure. Assuming the specific heat of liquid water to remain constant at 4.2 kJ/kg K and that of ice to be half of this value and taking the latent heat of fusion of ice at 0°C to be 335 J/g . calculate the total entropy change of the system. [7+8]
6. In a gas turbine the gas enters at the rate of 5 kg/s with a velocity of 50 m/s and enthalpy of 900 kJ/kg and leaves the turbine with a velocity of 150 m/s and enthalpy of 400 kJ/kg . The loss of heat from the gases to the surroundings is 25 kJ/kg . Assume for gas $R = 0.285 \text{ kJ/kg K}$ and $c_p = 1.004 \text{ kJ/kgK}$ and the inlet conditions to be at 100 kPa and 27°C . Determine the power output of the turbine and the diameter of the inlet pipe. [15]

- 7.a) Explain the construction of psychometric chart at 1 bar pressure.
b) Explain the carrier equation and its applications and the concept of adiabatic saturation. [7+8]
- 8.a) Mention merits and demerits of diesel cycle and otto cycles.
b) In an air standard diesel cycle, the compression ratio is 15. Compression begins at 0.1 MPa, 40°C. The heat added is 1.675 MJ/kg. Find (i) the maximum temperature of the cycle, (ii) the work done per kg of air, (iii) the cycle efficiency, (iv) the temperature at the end of the isentropic expansion, (v) the cut-off ratio, (vi) the maximum pressure of the cycle and (vii) the m.e.p of the cycle. [5+10]

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