R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, March - 2017
THERMODYNAMICS
(Common to AE, AME, ME)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks
- - -

1.a) What are the major reasons for the generation of irreversibilities? Explain the importance of studying about the irreversibility.

b) A gas undergoes two processes that are in series. The first process is an expansion that is carried out according to the law PV = constant, and the second process is a Constant pressure process that returns the gas to the initial volume of the first process. The start of the first process is at 400 kPa and 0.025 m^3 with the expansion to 200 kPa. Sketch the process on a P-V diagram, and determine the work of the combined process. [7+8]

2.a) Explain the corollaries of first law of thermodynamics along with the suitable examples.

b) The air speed of a turbo jet engine in flight is 270 m/s. The ambient air temperature is 15°C. Gas temperature at outlet of nozzle is 600°C. Corresponding enthalpy values for air and gas are respectively 26 and 912 kJ/kg. Fuel air ratio is 0.0190. Chemical energy of the fuel is 44.5 MJ/kg. Owing to incomplete combustion 5% of the chemical energy is not released in the reaction. Heat loss from the engine is 21 kJ/kg of air. Calculate the velocity of the exhaust jet. [7+8]

3.a) What do you understand by the term Claussius Inequality? Explain its significance.

b) An adiabatic turbine receives gas at 700 kPa and 1000 °C and discharges it at 150 kPa and 665 °C. The surrounding temperature is 25 °C. Determine the decrease in availability function, available energy and irreversibility. [8+7]

4.a) What is Mollier chart? How to understand the saturation properties from the chart? Explain.

b) Throttling colorimeter has steam entering to it at 10 MPa and coming out of it at 0.05 MPa and 100°C. Determine dryness fraction of steam. [8+7]

5.a) Differentiate between throttling process and free expansion process along with their importance.

b) 0.3 m^3 of air at pressure 8 bar expands to 1.5 m^3 and a final pressure is 1.3 bar. Assuming the expansion to be polytropic, calculate the polytropic index, heat supplied and change of internal energy and entropy. [8+7]

6.a) A gaseous mixture in an engine cylinder has 14% CO_2; 13:5% O_2 and 72:5% N_2 by volume. The mixture at 1050^0C expands reversibly and according to the law $PV^{1.2}$ = constant to 7 times of its initial volume. Determine the work done and heat transfer per unit mass of the mixture. The average C_p values for CO_2, O_2, and N_2 are 1.27 kJ/kg K, 1.11 kJ/kg K and 1.196 kJ/kgK respectively.

b) Differentiate between specific humidity and relative humidity of moist air. [8+7]

7.a) Stirling cycle uses air at the beginning of the isothermal expansion the air is at 1000 K and 10 bar. The minimum pressure in cycle is 2 bar and at the end of the isothermal compression the volume is 60% of the maximum volume. Calculate the thermal efficiency of the cycle and the mean effective pressure.

b) Derive the equation for thermal efficiency and mean effective pressure for a diesel cycle from the p-v and T-s diagrams. [8+7]

8.a) Define Coefficient of Performance and derive the same for vapour compression refrigeration system.

b) How does the combined cycle work for the power generation? Which cycle is better suited for the topping part of the combined cycle? Why? [8+7]

--ooOoo--