Code: 9D17101

M.Tech I Semester Supplementary Examinations February/March 2018

ADVANCED THERMODYNAMICS

(Refrigeration & Air Conditioning)

(For students admitted in 2012, 2013, 2014, 2015 & 2016 only)

Time: 3 hours Max. Marks: 60

Answer any FIVE questions

All questions carry equal marks

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1 (a) What is the condition for exact differential?

(b) Why does the Gibbs function remain constant during phase transformation?

2 Write down the first and second TdS equations, derive the expression for difference of heat capacities, Cp and Cv. What does the expression signify?

3 (a) State Daltons law of partial pressures. How the partial pressure in a gas mixture related to the mole fraction?

(b) Find the increase in entropy when 2 kg of oxygen at 60℃ are mixed with 6 kg of nitrogen at the same temperature. The initial pressure of each constituent is 103 kPa and is the same as that of the mixture.

4 Give azeotropic mixing refrigerants for the following refrigerants. Mention the chemical formula also. (a) R-500 (b) R-502 (c) R-503 (d) R-504.

5 (a) Deduce the expression for the available energy from the finite energy source at the temperature T when the environmental temperature is T_0.

(b) What is the availability referred to a cycle?

6 Consider an air compressor that receives ambient air at 100 kPa, 25℃. It compresses the air to a pressure of 1 MPa, where it exits at a temperature of 540 K. Since the air and compressor housing are hotter than the ambient, it loses 50 KJ per kg air flowing through the compressor. Find the reversible work, reversible heat transfer, and irreversibility of the process.

Control volume: The air compressor

Inlet state : P_i, T_i known; Stat fixed

Exit state : P_e, T_e known; Stat fixed

Process : Non-adiabatic compression with no change in kinetic or potential energy

Model : Ideal gas

7 In a gas turbine plant, working on the Brayton cycle with a regenerator of 75% effectiveness, the air at the inlet to the compressor is at 0.1 Mpa, 30℃, the pressure ratio is 6, and the maximum cycle temperature is 900℃. If the turbine and the compressor have each of an efficiency of 80%, find the percentage increase in the cycle efficiency due to regeneration.

8 Write short notes on:

(a) Thermo-electric power generators with neat sketch.

(b) Solar photo voltaic cell power plant with necessary diagram.

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