CHAPTER FIVE – THE SECOND LAW OF THERMODYNAMICS

LECTURE NO. 1

HOME WORK

4.1 1 kg of steam at 20 bar, dryness fraction 0.9, is heated reversibly at constant pressure to a temperature of 300 °C. Calculate the heat supplied, and the change of entropy, and show the process on a T–s diagram, indicating the area which represents the heat flow.

(415 kJ/kg; 0.8173 kJ/kg K)

4.2 Steam at 0.05 bar, 100 °C is to be condensed completely by a reversible constant pressure process. Calculate the heat rejected per kilogram of steam, and the change of specific entropy. Sketch the process on a T–s diagram and shade in the area which represents the heat flow.

(2550 kJ/kg; 8.292 kJ/kg K)

4.3 0.05 kg of steam at 10 bar, dryness fraction 0.84, is heated reversibly in a rigid vessel until the pressure is 20 bar. Calculate the change of entropy and the heat supplied. Show the area which represents the heat supplied on a T–s diagram.

(0.0704 kJ/kg K; 36.85 kJ)

4.4 A rigid cylinder containing 0.006 m^3 of nitrogen (molar mass 28 kg/kmol) at 1.04 bar, 15 °C, is heated reversibly until the temperature is 90 °C. Calculate the change of entropy and the heat supplied. Sketch the process on a T–s diagram. Take the isentropic index, γ, for nitrogen as 1.4, and assume that nitrogen is a perfect gas.

(0.001 25 kJ/K; 0.407 kJ)

4.5 1 m^3 of air is heated reversibly at constant pressure from 15 to 300 °C, and is then cooled reversibly at constant volume back to the initial temperature. The initial pressure is 1.03 bar. Calculate the net heat flow and the overall change of entropy, and sketch the processes on a T–s diagram.

(101.5 kJ; 0.246 kJ/K)