Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 2nd Semester Examination – Dec. /Jan. 2017/18
SCT 371-2 Applied Thermodynamic

Uva Wellassa University

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four (04) Essays
Mark allocation: 100
Answer all questions
Thermodynamic property tables will be provided

1. The condition at the beggnning of the compression in an air standard Diesel cycle are fixed by P_1=200KPa, and T_1=380K. The compression ratio is 20 and the heat addition per unit mass is 900 kJ/kg. Determine

   i. The maximum temperature in K.

   (10 marks)

   ii. The cutoff ratio.

   (3 marks)

   iii. The net work per unit mass of air, in kJ/kg.

   (8 marks)

   iv. The thermal efficiency.

   (4 marks)

2.

   a. State the Kelvin – Planck Statement related to the second law of thermodynamics by giving one practical example (Maximum 100 words) (8 marks)

   b. Water is the working fluid in a Carnot vapor power cycle. Saturated liquid enters the boiler at a pressure of 8 MPa, and saturated vapor enters the turbine. The condenser pressure is 8 KPa. Determine

      i. The thermal efficiency.

      (6 marks)

      ii. The back work ratio.

      (5 marks)

12

iii. The heat transfer to the working fluid per unit mass in the boiler.

(3 marks)

iv. The heat transfer from the working fluid per unit mass in the condenser.

(3 marks)

3. Steam at 10 MPa, 600° C enters the first-stage turbine of an ideal Rankine cycle with reheat. Steam at the first stage expands to 0.7 MPa and then reheated to 480° C before entering the second-stage turbine, where it expands to the condenser pressure of 0.008 MPa. The net power output is 100 MW. Determine

i. The rate of heat transfer to the working fluid passing through the stream generator, in MW.

(10 marks)

ii. The thermal efficiency.

(10 marks)

iii. The rate of heat transfer to cooling water passing through the condenser, in MW.

(5 marks)

4. Refrigerant 134a is the working fluid in an ideal vapor-compression refrigeration cycle that communicates thermally with a cold region at 0° C and a warm region at 22° C. Saturated vapor enters the compressor at 0° C and saturated liquid leaves the condenser at 22° C. The mass flow rate of the refrigerant is 0.08 kg/s. Determine

i. The compressor power, in kW.

(10 marks)

ii. The refrigeration capacity, in kW.

(10 marks)

iii. The coefficient of performance.

(5 marks)