Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
200 Level 2nd Semester Examination – December 2018/ January 2019
SCT 242-2 Engineering Thermodynamics

Uva Wellassa University

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four (04)
Mark allocation: 100 Marks
Answer all questions

1.
A gas in a piston–cylinder assembly undergoes an expansion process for which the relationship between pressure and volume is given by,

$$pV^n = Constant$$

The initial pressure is 3 bar, 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

(a) n = 1.5
(b) n = 1.0
(c) n = 0.

(25 marks)

2.
A gas contained within a piston–cylinder assembly undergoes three processes in series:

Process 1–2: Constant volume from p_1 = 1 bar, V_1 = 4 m^3 to state 2, where p_2 = 2 bar.
Process 2–3: Compression to V_3 = 2 m^3, during which the pressure–volume relationship is pV = constant.
Process 3–4: Constant pressure to state 4, where V_4 = 1 m^3.
Sketch the processes in series on $p-V$ coordinates and evaluate the work for each process, in kJ.

(25 marks)

3.
Using the tables for water, determine the specified property data at the indicated states. In each case, locate each state as points on $p-v$ and $T-v$ diagrams.
(a) At p = 2 MPa, T = 300°C. Find u, in kJ/kg.
(b) At p = 2.5 MPa, T = 200°C. Find u, in kJ/kg.
(e) At p = 1.5 MPa, v = 0.2095 m^3/kg. Find h, in kJ/kg.

(25 marks)

4.
A system consisting of 1 kg of H_2O undergoes a power cycle composed of the following processes:
Process 1–2: Constant-pressure heating at 10 bar from saturated vapor.
Process 2–3: Constant-volume cooling to p_3 = 5 bar, T_3 = 160°C.
Process 3–4: Isothermal compression with Q_{34} = 2815.8 kJ.
Process 4–1: Constant-volume heating.
Sketch the cycle on $T-v$ and $p-v$ diagrams. Neglecting kinetic and potential energy effects, determine the thermal efficiency.

(25 marks)

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