Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	THERMODYNAMICS
COURSE CODE	:	BWC 20303
PROGRAMME CODE	:	BWC
EXAMINATION DATE	:	JANUARY/FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS
		2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPENED BOOK**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) A gas undergoes a cycle in a piston-cylinder assembly consisting of the following two Processes, A and B, between the same end states, 1 and 2, where;
$P_1 = 1 \times 10^5$ N/m^2, $V_1 = 1$ m^3, $U_1 = 300$ kJ,
$P_2 = 10 \times 10^5$ N/m^2, $V_2 = 0.1$ m^3, $U_2 = 400$ kJ.

Process A: from state 1 to a pressure of 10×10^5 N/m^2 with constant-volume process, then followed by process to state 2 with constant-pressure.

Process B: process from state 1 to state 2 with pressure-volume relationship is PV = constant

Kinetic and potential effects are not significant. For each process, **A** and **B**:

(i) sketch the process on P – V coordinates.

(4 marks)

(ii) calculate work (kJ).

(6 marks)

(iii) calculate heat transfer (kJ).

(4 marks)

(b) A piston cylinder assembly contains a gas; undergoes three processes in series:

Process A - B; constant volume: State A from $P_A = 1 \times 10^4$ kg/m^2, $V_A = 4$m^3 to state B; $P_B = 2 \times 10^4$ kg/m^2

Process B - C; pressure-volume relationship is $p\forall$ = constant: compression to $V_C = 2$ m^3.

Process C - D: constant pressure to state D where $V = 1$m^3.

(i) Sketch the processes on P – V coordinates.

(5 marks)

(ii) Evaluate the work of each process in kJ.

(6 marks)

Q2 (a) There is one-inlet, and one-exit that the air enters; with control volume at 3×10^5 N/m^2, temperature at 227 °C , and with velocity 15 m/s through a flow area of 14 cm^2. At the exit; the pressure, temperature and velocity are 1.5×10^5 N/m^2, 183.5 °C, and 150 m/s, respectively. By assuming this is steady-state operation, determine:

(i) the mass flow rate, in kg/s.

(6 marks)

(ii) the exit flow area, in cm^2.

(4 marks)

(b) Liquid water flows isothermally at 20 °C through a one-inlet, one-exit duct operating at steady state. The duct's inlet and exit diameters are 0.2 m and 0.01 m, respectively. At the inlet, the velocity is 40 m/s and the pressure is 1×10^5 N/m^2. At the exit, determine:

(i) velocity, in m/s.

(6 marks)

(ii) the mass flow rate, in kg/s.

(4 marks)

(c) A closed rigid tank; V= 2 m^3 contains Refrigerant 134a, initially a two phase liquid-vapor mixture at 10 °C. The refrigerant is heated to a final state where is 52 °C and quality is 100%. Determine the mass of vapor present at initial states.

(5 marks)

Q3 (a) Describe **ONE (1)** example of practical thermodynamic application in the modern world we live in today. Include the thermodynamic processes that are involved in the application.

(8 marks)

(b) (i) Define reversible and irreversible thermodynamic processes.

(2 marks)

(ii) Give an example for each reversible and irreversible process.

(2 marks)

(c) A Carnot engine operates between reservoirs at 450 °C and 25 °C .

(i) Determine the efficiency of the engine.

(3 marks)

(ii) If the engine does 5.0 J of work per cycle, calculate the heat per cycle it absorb from the high-temperature reservoir.

(3 marks)

(c) Calculate the heat per cycle it exhaust to the cold-temperature reservoir.

(3 marks)

(d) Sketch a Carnot cycle on a temperature-volume diagram for the system.

(4 marks)

Q4 (a) Explain the working principle of a domestic refrigerator.

(8 marks)

(b) Name the thermodynamic process and list out the parameters that is changing and constant involved in the following event:

(i) boiling water in an open container.
(ii) cooking in a pressure cooker.
(iii) freezing water into ice.

(9 marks)

(c) Thermodynamic cycle refers to any closed system that undergoes various changes due to temperature, pressure, and volume, however, its final and initial state are equal.

(i) Describe **TWO (2)** types of thermodynamic cycle.

(6 marks)

(ii) Name an example of application for each of the cycle mentioned in **Q4 (c) (i)**.

(2 marks)

– **END OF QUESTIONS** –