INTI International University & Colleges

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Diploma in Mechanical Engineering (DMEN)
Course	:	**EGM2172: Engineering Thermodynamics 1**
Date of Examination	:	27 July 2021 (Tuesday)
Time	:	4.00pm – 6.15pm Reading Time : Nil
Duration	:	2 Hours 15 Minutes

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Thermodynamics Tables

Examiner(s)	:	**Nur Hafizah Habideen**
Chief Moderator	:	Soo Swee Yoong

*This paper consists of **4** printed pages, including the cover page*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM2172: ENGINEERING THERMODYNAMICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Question 1

Figure Q1 shows the water heater system in a house. A 60 L electric water heater whose heaters rated at 1.6 kW is needed for a hot water in a household. The hot water tank is initially full with hot water at 80°C. A person takes a shower by mixing a constant flow of hot water from the tank with cold water at 20°C at a rate of 0.06 kg/s. After a shower period of 8 min, the water temperature in the tank is measured to drop to 60°C. The heater remained on during the shower and hot water withdrawn from the tank is replaced by cold water at the same flow rate. Determine:

(a) the mass flow rate of hot water withdrawn from the tank during the shower,

(15 marks)

(b) the average temperature of mixed water used for the shower.

(10 marks)

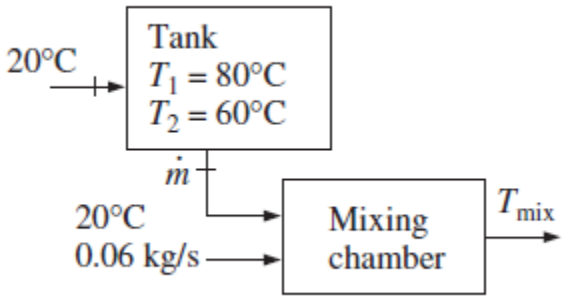

Figure Q1

Question 2

(a) An adiabatic steam turbine is used to drive a generator. Steam enters a turbine steadily at 10 MPa and 550°C with a velocity of 60 m/s and leaves at 25 kPa with a quality of 95 percent. A heat loss of 30 kJ/kg occurs during the process. The inlet area of the turbine is 150 cm^2, and the exit area is 1400 cm^2. Determine:

(i) the mass flow rate of the steam,

(9 marks)

(ii) the exit velocity,

(3 marks)

(iii) the power output.

(5 marks)

(b) Radiators are heat exchangers used to transfer thermal energy from one medium to another for the purpose of cooling and heating.

(i) Explain whether the radiator should be analysed as a closed system or as an open system.

(3 marks)

(ii) Are radiators steady flow devices? Explain.

(2 marks)

(iii) Explain the thermal energy transfers in terms of energy balance.

(3 marks)

Question 3

(a) A closed system of Carnot heat-engine cycle use 0.0103 kg of steam as the working fluid. The maximum absolute temperature in the cycle is twice the minimum absolute temperature and the net work output of the cycle is 25 kJ. Determine the temperature of the steam during the heat rejection process, if the steam changes from saturated vapor to saturated liquid during heat rejection.

(10 marks)

(b) A Carnot heat engine receives heat at 750 K and rejects the waste heat to the environment at 300 K. The rate of heat removes from the cooled space at -15°C is 400 kJ/min and rejects it to the same environment at 300 K. Determine:

(i) the rate of heat supplied to the heat engine,

(9 marks)

(ii) the total rate of heat rejection to the environment.

(6 marks)

Question 4

(a) A household refrigerator has a power input of 450 W and a COP of 2.5. It is used to cool five large watermelons, 10 kg each, to 8°C. Determine how long it will take the refrigerator to cool them, if the watermelons are initially at 20°C.

Take $c_{watermelon}$ = 4.2 kJ/kg·°C

(6 marks)

(b) An adiabatic compressor compresses refrigerant-134a at 140 kPa and -10°C and exit at 700 kPa and 50°C. The compressor needs 0.7 kW to operate. Neglecting the changes In kinetic and potential energies, determine:

(i) the isentropic efficiency of the compressor,

(7 marks)

(ii) the volume flow rate of the refrigerant at the compressor inlet, in L/min,

(8 marks)

(iii) the maximum volume flow rate at the inlet conditions.

(4 marks)

~THE END~