



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

..... YEAR **SECOND** SEMESTER EXAMINATION FOR, BACHELOR OF
SCIENCE IN

EMT 206– ENGINEERING THERMODYNAMICS 1

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a) Explain the following terms
- Open system
 - Closed system
 - Isolated system
 - Adiabatic system (8marks)
- b) A mass of 1.5kg of air is compressed in a quassi-static process from 0.1MPa to 0.7kmpa for which $Pv = \text{constant}$. The initial density of air is 1.16kg/m^3 . Find the work done by the piston to compress the air. (6marks)
- c) If a gas of volume 6000cm^3 and at pressure of 100kpa is compressed quass-static according to
- $$PV^2 = \text{constant}$$
- Until the volume becomes 2000cm^3 .
Determine the find pressure and the work transfer (6marks)
- d) What is the difference between ideal and perfect gas (2marks)
- e) What is the mass of air contained in a room $6\text{m} \times 9\text{m} \times 4\text{m}$ if the pressure is 101.325kpa and the temperatures is 25°C (for air $2 = 0.287\text{kJ/k and k}$) (4marks)
- f) State the assumptions made in the analysis of steady flow energy equation (4marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- a) State the first law of thermodynamics (2marks)
- b) In a cyclic process, heat transfer are $+14.7\text{kJ}$, -25.2kJ , -3.56kJ and 31.5kJ . what is the net work for this cyclic process? (2marks)
- c) A mass of 8kg gas expands within a flexible container so that the P-V relationship is of the form $PV^{1.2} = \text{constant}$. The initial pressure is 1000kpa and the initial volume is 1m^3 . The final pressure is 5kpa. If the specific internal energy of the gas decreases by 40kJ/kf . Find the heat transfer in magnitude and direction (8marks)
- d) A nozzle is a device for increasing the velocity of a steady flowing steam.at inlet to a certain nozzle the enthalpy of the fluid passing is 3000kJ/kf and the velocity is 60m/s . at the discharge and the enthalpy is 2762kJ/kf . The nozzle is horizontal and there is negligible heat loss from it.
- Find the velocity at the exist from the nozzle
 - If the inlet is 0.1m^2 and specific volume at inlet is $0.187\text{m}^3/\text{kJ}$. Find the mass flow rate

- iii) If the specific volume at the nozzle exit is $0.498\text{m}^3/\text{kg}$. Find the exit area of the nozzle

(8marks)

QUESTION THREE (20 MARKS)

- a) Describe the process of formation of steam and give its graph representation also (6marks)
- b) Explain the following terms relating to steam formation
- i) Specific heat of water
 - ii) Dryness fraction of steam
 - iii) Superheated steam
 - iv) Latent heat of steam (6marks)
- c) State Boyle's and Charles's laws and derive an equation of state for a perfect gas (4marks)
- d) A certain gas has $C_p = 0.913$ and $C_v = 0.653\text{kJ/kgK}$. Find the molecular weight and the gas constant of the gas (4marks)

QUESTION FOUR (20 MARKS)

- a) Define a chemical fuel (1mark)
- b) Describe primary and list some important primary fuels (3marks)
- c) What are secondary fuels. list some important secondary fuels (3marks)
- d) Explain stoichiometric air-fuel (MF) Ratio (3marks)
- e) Define heating value of fuel (2marks)
- f) Define the air-fuel ratio on both a molar and mass basis for a complete combustion of octane C_8H_{18} WITH
- i) The theoretical amount of air
 - ii) 150% theoretical air (50% excess air)

(8marks)