50

[Type text]

(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATION 2021/2022 ACADEMIC YEAR

SEMESTER ONE MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION IN TECHNOLOGY (MECHANICAL ENGINEERING) (FOURTH YEAR)

COURSE CODE: TEM 471

COURSE TITLE: THERMODYNAMICS II

DATE: 27-04-2022 **TIME: 08:00-10:00**

INSTRUCTIONS:

1. **This paper contains FOUR questions**
2. **QUESTION ONE IS COMPULSORY**
3. **Attempt any TWO questions from the remaining.**
4. **Question ONE carries 30 marks and the REST 20 marks each.**
5. **Examination duration is 2 (TWO) HOURS**

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE (30Marks)

a) In an ideal Otto cycle engine, the temperature and pressure at the beginning of compression are 43°C and 100 kPa respectively and the temperature at the end of adiabatic compression is 323°C. If the temperature at the end of constant volume heat addition is 1,500°C, calculate: **(20Marks)**

(i) The compression ratio

(ii) The air-standard efficiency

(iii) The temperature and pressure at the end of adiabatic expansion. Assume ratio of specific heat for air, γ as 1.4.

b) Discuss the differences between internal combustion engines and external combustion engines. **(10Marks).**

QUESTION TWO (20Marks)

a) Outline at least four assumptions made for describing the working of an air standard Carnot engine. **(8Marks).**

b) Discuss the reasons why liquid fuels are more advantageous in comparison to sold fuels **(8Marks).**

c) Define the terms Molecules and Atoms in relation to thermodynamics **(4Marks).**

QUESTION THREE (20Marks)

A Carnot cycle works on steam between the pressure limits of 7 MPa and 7 kPa. Draw the T-S representation for this Carnot cycle operation. Determine:

i) Thermal efficiency

ii) Turbine work

iii) Compression work per kg of steam.

QUESTION FOUR (20Marks)

a) The chemical formula for alcohol is C_2H_6O. Calculate the stoichiometric air/fuel ratio by mass and the percentage composition of the products of combustion per kg of C_2H_6O **(15 Marks)**.

b) List the basic measurements to be undertaken to evaluate the performance of a SI or CI engine **(5 Marks).**

APPENDICES

Table 11.1. Symbols and Molecular weights

Elements / Compounds / Gases	*Molecule*		*Atom*	
	Symbol	*Molecular weight*	*Symbol*	*Molecular weight*
Hydrogen	H_2	2	H	1
Oxygen	O_2	32	O	16
Nitrogen	N_2	28	N	14
Carbon	C	12	C	12
Sulphur	S	32	S	32
Water	H_2O	18	—	—
Carbon monoxide	CO	28	—	—
Carbon dioxide	CO_2	44	—	—
Sulphur dioxide	SO_2	64	—	—
Marsh gas (Methane)	CH_4	16	—	—
Ethylene	C_2H_4	28	—	—
Ethane	C_2H_6	30	—	—