(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

EXAMINATIONS FOR THE DIPLOMA

IN

MECHANICAL AND INDUSTRIAL ENGINEERING

COURSE CODE: DME 079

COURSE TITLE: ENGINEERING THERMODYNAMICS II

DATE: 25/04/2022 **TIME: 8:00-10:00 AM**

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other **TWO** questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE **(30 MARKS)**

a) Describe the following terms as used in fuels.

i. Stoichiometric air-fuel ratio **(2mks)**

ii. Mixture strength **(2mks)**

iii. Proximate analysis **(2mks)**

b) Show that for a diesel cycle the thermal efficiency can be expressed as;

$$\eta = 1 - \frac{1}{\gamma r_v^{\gamma-1}}\left[\frac{\beta^{\gamma}-1}{\beta-1}\right]$$ **(10mks)**

c) With a aid of a T-S diagram give two reasons why a Carnot cycle cannot be used to analyze the process of a steam plant. **(6mks)**

d) Show that the specific humidity of an air mixture can be expressed as: $\omega = 0.622\frac{P_s}{P_a}$ **(8mks)**

QUESTION TWO **(20 MARKS)**

A sample of anthracite coal has the following composition by mass: 90% carbon, 3% hydrogen, 2.5% oxygen, 1% nitrogen, 0.5% sulphur and 3% ash. Determine the:

i. Stoichiometric air-fuel ratio for its combustion. **(9mks)**

ii. Actual air-fuel ratio if 25% excess air is supplied for combustion. **(2mks)**

iii. Dry and wet analysis of products of combustion by volume. **(9mks)**

QUESTION THREE **(20 MARKS)**

A steam power plant operates between a boiler pressure of 42bar and a condenser pressure of 0.035bar. Using a Carnot cycle with dry saturated steam at entry to the turbine, Calculate for these limits the;

i. Cycle efficiency **(7mks)**

ii. Work ratio **(10mks)**

iii. Specific steam consumption **(3mks)**

QUESTION FOUR **(20 MARKS)**

An oil engine takes in air at 1.0 bar and 20 ^{0}C. The maximum pressure is 69 bar and the compression ratio is 18. Calculate the air standard thermal efficiency based on dual combustion cycle. Assume heat added at constant volume is equal to heat added at constant pressure. **(20mks)**