(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2018/2019 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DIPLOMA

IN

CIVIL ENGINEERING

COURSE CODE: DCE 083

COURSE TITLE: HIGHWAY ENGINEERING II

DATE: WEDNESDAY 30TH JANUARY 2019 TIME:9.00AM -11.00AM

INSTRUCTIONS:

1. Answer Question ONE and any other THREE Questions
2. Marks for each question are indicated in the parenthesis.
3. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

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

SECTION A – COMPULSORY (25 MARKS)

Question One

a) Explain the following terms as used in Highway Engineering

i. Single Axle (2 Marks)

ii. Tandem Axle (2 Marks)

iii. Tridum Axle (2 Marks)

iv. Quadrum Axle (2 Marks)

v. Pavement Structure (2 Marks)

b) With the aid of a diagram, explain the **three** types of pavement layers (9 Marks)

c) Discuss with clear examples the difference between Flexible and Rigid pavement (3 Marks)

d) Name explain t**hree** highway engineering materials (3 Marks)

SECTION B (45 MARKS)

Question Two (15 Marks)

a) One of the primary functions of a pavement is load distribution. Loads, the vehicle forces exerted on the pavement (e.g., by trucks, heavy machinery, airplanes), can be characterized by the parameters. State any **five** of these parameters : (10 Marks)

b) Pavement structural design requires a quantification of all expected loads a pavement will encounter over its design life. Explain the **two** ways of quantification. (5 Marks)

Question Three (15 Marks)

a) State the **two** chief means with which, water as a result of a high water table or exceptionally wet weather, accumulates under the pavement structure. (2 Marks)

b) Rigid pavements respond to loading in a variety of ways that affect performance (both initial and long-term). State the **three** principal responses (3 Marks)

c) Calculate the load factors for the following vehicles

i) State the expression for determining the load factor (2 Marks)

ii) Trailer 36 tonnes (2 Marks)

iii) Bus 24 tonnes (2 Marks)

iv) Lorry 10 tonnes (2 Marks)

v) Car 1.8 tonnes (2 Marks)

Take the standard axle load (L_S)= 8.16 tonnes

Question Four (15 Marks)

a) Explain the meaning of the term Resilient Modulus (M_R) (2 Marks)

b) Resilient modulus is determined using which test? (2 Marks)

c) Calculate the number of initial annual commercial vehicles per direction (Vo) for a two-lane road with the following traffic conditions: AADT= 3,000 veh/day, 20% are commercial vehicles Directional distribution = 70% north, 30% south (5 Marks)

b) Calculate the number of initial annual commercial vehicles per direction (Vo) for a multi-lane highway with following traffic conditions: AADT = 20,000 veh/day, Directional split = 80:20 55% traffic uses outer lane, 15% trucks and buses (6 marks)

Question Five (15 Marks)

a) Explain **two** interrelated characteristics that subgrade's performance generally depends on. (3 Marks)

b) Poor subgrade should be avoided if possible, but when it is necessary to build over weak soils there are several methods used to improved subgrade performance: explain **three** of them. (6 Marks)

c) Environmental variations can have a significant impact on pavement materials and the underlying subgrade, which in turn can drastically affect pavement performance. Discuss **three** key environmental parameters of concern. (6 Marks)