TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2412: HIGHWAY ENGINEERING II

END OF SEMESTER EXAMINATION

SERIES: NOVEMBER 2016

TIME: 2 HOURS

DATE: **2016**

Instructions to Candidates

You should have the following for this examination: Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID.

This paper consists of five questions. Attempt question ONE (Compulsory) and any other TWO questions. All diagrams should be clearly drawn and labeled. Use of **Mobile Phones & programmable** calculators is not allowed. Each question should be on a fresh page of the answer booklet.

Question One (Compulsory)

a) Define the two types of road pavements and, explain their composition and characteristics. (10 marks)

b) While the tyre pressure designates the materials to be used in the pavements, it is the total applied wheel load which determines the depth of pavement required to ensure that the subgrade is not over-stressed. Illustrate the vertical stresses under dual-tyred wheel and explain the relationship of the two most important features. (4 marks)

c) A new road is to be designed using the following parameters

Annual Growth Rate	= 4%
Daily Number of standard axles	= 3000
Design Life	= 20 years

Calculate the cumulative number of standard axles (6 marks)

d) Draw neat sketches as illustrations to describe three ways in which water can penetrate into the subgrade soils. How can you prevent this entrance? (10 marks)

Question Two

a) Mention the three types of stresses in rigid pavements and explain the principle function of steel in rigid pavement. (3 marks)
b) What is Bitumen? Explain the three categories of bituminous materials and outline their classifications. (10 marks)
c) What are the main failures of bituminous surfacing and how do they occur? (7 marks))

Question Three

a) What do you understand by the term "soil stabilization" and, what is the purpose of additives on weak soils? (3 marks)
b) Outline the four methods used in soil stabilization for a highway project. (4 marks)
c) i. Explain in detail the "Empirical Method using a soil strength / California Bearing Ratio (CBR) Test Method. (10 marks)
   ii. Briefly explain the factors which may affect the CBR test results and why a sample is soaked for four days before testing. (3 marks)

Question Four

a) Explain the three aspects of surface drainage that the road engineer is particularly concerned about. (5 marks)
b) Define and briefly explain the three methods of draining water from the roads. (9 marks)
c) Give solutions for precipitation or rainfall whose water does not infiltrate the soil or is not stored temporarily in surface depressions within the drainage areas. (6 marks)

Question Five

a) Explain the advantages of labour intensive techniques as compared to equipment based techniques in road construction. (5 marks)
b) Explain the main failures of a pavement and what is the objective of surface drainage? (3 marks)
c) Outline what periodic maintenance is and, explain the activities under this type of maintenance. (5 marks)
d) What are the responsibilities of a Roads Maintenance Engineer and, explain the three points that should be observed in the maintenance and repair of pavements. (7 marks)