TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4507: HIGHWAY ENGINEERING II
&
BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
TCV4427: HIGHWAY PAVEMENT DESIGN & CONSTRUCTION

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2024
TIME: 2HOURS

Instructions to Candidates

You should have the following for this examination:
-ANSWER BOOKLET, EXAMINATION PASS AND STUDENT ID
This paper consists of five questions.
Attempt question ONE and any other TWO questions.

DO NOT WRITE ON THE QUESTION PAPER.

QUESTION ONE (COMPULSORY) (30 marks)

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

b) Explain the fundamental information required when designing a road pavement. (5 marks)

c) Explain the three assumptions made when calculating stress, strain and deflection in flexible pavement. (3 marks)

d) 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)

e) What is Bitumen? Explain the three categories of bituminous materials and outline their classifications. (8 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

a) Define and briefly explain the three methods of draining water from the roads. (7 marks)

b) i. California Bearing Ratio (CBR) Test Method is amongst three Empirical Methods using a soil strength test method that has been universally accepted. Explain this method in detail. (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 THREE (20 Marks)

a) Define "Bituminous Concrete" and State the main functions of the following components of Dense Bituminous mix:

i. Fine aggregates
ii. Coarse Aggregates
iii. Filler
iv. Binder (9 marks)

b) What are the main failures of bituminous surfacing and how do they occur? (7 marks)

c) Outline the four methods used in soil stabilization for a highway project. (4 marks)

QUESTION FOUR (20 Marks)

a) What is the importance of the following factors which are considered in pavement design?

i. Traffic loading
ii. Climate
iii. Materials characteristics (6 marks)

b) Draw a diagram to show the layers of a Flexible Pavement and, explain the functions of each layer (8 marks)

c) Calculate the cumulative number of standard axles for a new road to be designed given that the Annual Growth Rate is 4%, Daily Number of Standard Axles is 3000 and the Design Life is 20 years
(6 marks)

QUESTION FIVE (20 Marks)

a) What is roads maintenance? State the objectives of roads maintenance and the responsibilities of the maintenance engineer. (7 marks)

b) Outline what periodic maintenance is and, explain the activities under this type of maintenance. (4 marks)

c) Explain each of the following basic construction operations and mention the plant used to carry out each of these operations.

i. Clearing operation
ii. Excavation operation

iii. Finishing operation (9 marks)