



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**

**END OF SEMESTER EXAMINATION
SERIES: APRIL – MAY 2025
TIME: 2 HOURS**

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)

- Differentiate a flexible pavement from a rigid pavement and, using a neatly labeled sketch, clearly explain the functions and parameters of the principle layers of a flexible pavement. (10 marks)
- A new road is to be designed with the following factors: Growth Rate = 2.5%, Number of standard axles = 2200, Design Life = 15 years. Calculate the cumulative number of standard axles. (5 marks)
- What is the primary aim of pavement design and, what leads to the instability of the subgrade? (5 marks)
- 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)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a) 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 overstressed. Illustrate the vertical stresses under dual-tyred wheel and explain the relationship of the two most important features. (4 marks)
- b) Explain the three assumptions made when calculating stress, strain and deflection in flexible pavement. (3 marks)
- c) Mention and state the functions of the four joints in rigid pavements. (6 marks)
- d) Outline seven advantages of rigid pavements. (7 marks)

QUESTION THREE (20 Marks)

- 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 of soil stabilization (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 (20 Marks)

- a) What is “stage construction” and why is it mostly applicable in developing countries? (4 marks)
- b) What do you understand by the term “labour based construction techniques”? Outline the benefits accrued from the use of labour based construction techniques as compared to equipment based techniques. (6 marks)
- c) Briefly explain the four basic earthworks operations, mentioning suitable plants used in each operation. (10 marks)

QUESTION FIVE (20 Marks)

- a) What is road maintenance and what does it entail? (4 marks)
- b) Describe the four common types of road maintenance. (8 marks)

c) What are the main failures of bituminous surfacing and how do they occur? (8 marks)