



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4507 : HIGHWAY ENGINEERING II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 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 (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 Marks

- With the aid of a diagrammatic representation of the laboratory apparatus, outline how a Bitumen Penetration test is carried out (10 Marks)
- Explain the term 'stage construction' and highlight at least FIVE circumstances in which it is advantageous in Pavement design' (8 Marks)
- With the aid of a sketch, outline the FOUR layers of flexible pavements and briefly explain the function of each layer (12 Marks).

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a) With the aid of a diagrammatic representation of the laboratory apparatus, outline how a CBR test is done in the laboratory (13 Marks)
- b) A CBR test on a sample of subgrade yielded the data shown in Table Q2b. Determine the CBR of the subgrade. Refer to Table Q2a for Standard force-penetration relationship (CBR = 100%) (7 Marks)

Table Q2a. Standard force-penetration relationship (CBR = 100%)

Penetration (mm)	Load (kN)
2	11.5
4	17.6
6	22.2
8	26.3
10	30.3
12	33.5

Table Q2b Laboratory CBR results of sample

Penetration (millimetres)	Load (kN)
0.5	1.6
1.0	3.3
1.5	4.9
2.0	6.6
2.5	8.2
3.0	9.3
3.5	10.5
4.0	11.4
4.5	12.2
5.0	13.0

QUESTION THREE (20 Marks)

- a) Outline the three subgroups of flexible pavements (6 Marks)
- b) Discuss the two forms of maintenance of bituminous roads (14 marks)

QUESTION FOUR (20 Marks)

- a) Discuss the main purpose of road drainage systems and highlight at least SIX defects caused by Improper Road Drainage (10 Marks).
- b) State at least FIVE advantages and THREE disadvantages of a rigid pavement as compared to a flexible one (8 Marks)
- c) Differentiate between Mechanical and Chemical stabilization (2 Marks).

QUESTION FIVE (20 Marks)

- a) With the aid of a diagram, outline how a bitumen softening point test is done in the laboratory (12 Marks)
- b) A new road is proposed to have a design life of 20 years, average daily number of standard axles of 1,800 with an annual growth rate of 4%. Calculate the cumulative number of standard axles (8 Marks)