



# TECHNICAL UNIVERSITY OF MOMBASA

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

### ECV 4507: HIGHWAY ENGINEERING II PAPER 1

#### END OF SEMESTER EXAMINATION

**SERIES:** JANUARY 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 aid of sketches discuss the use of side gutters and catch water drain in road surface drainage systems (10 Marks)
- State the four assumptions of the Boyd and Foster semi-rational method of finding the Equivalent single wheel load (ESWL) (4 Marks)
- With aid of clear sketches, outline the procedure for finding the Equivalent single wheel load (ESWL) for equal stress criteria by Boyd and Foster semi-rational method (10 Marks)
- A set of dual tyres has a total load of 4090 KN, a contact radius  $a$  of 114 mm and a centre to centre tyre spacing of 343 mm. Find the ESWL by Boyd & Foster method for a depth of 343 mm (6 Marks)



## ANSWER ANY TWO QUESTIONS FROM THIS SECTION

### QUESTION TWO (20 Marks)

- a) A new road is proposed to have a design life of 20 years, average daily number of standard axles of 1,500 with an annual growth rate of 4%. Calculate the cumulative number of standard axles (9 marks)
- b) Outline four basic phases of structural deterioration for a flexible pavement ( 8 Marks)
- c) State three functions of a subbase in a pavement, ( 3 marks)

### QUESTION THREE (20 Marks)

- (a) State the THREE inherent deficiencies of Road Note 29 that led to its revision by LR1132. (6 Marks):
- (b) Outline the FOUR point design criteria adopted by LR1132 in revising RN29 by redefining pavement failure, thereby delivering a thicker but longer lasting highway likely to be in a less deteriorated state after 20 years. (8 Marks)
- (c) Calculate the cumulative number of standard axles for designing a new pavement with annual average daily traffic for commercial vehicles on the opening day as 2000, Growth rate 4%, Design life 20 years and Damage factor 3.5 (6 Marks)

### QUESTION FOUR (20 Marks)

With the aid of neat sketches, illustrate the stress and temperature distribution for a flexible pavement under the application of a wheel load. (20 Marks)

### QUESTION FIVE(20 Marks)

With the aid of diagrams illustrate the use of the following rigid pavement joints (20 Marks)

- (i) Contraction joint
- (ii) Expansion joint
- (iii) Warping joint
- (iv) Construction joint