



## 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

### **ECE 2412: HIGHWAY ENGINEERING II**

SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES: SEPTEMBER 2018**

**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**

- State at least Five advantages of a rigid pavement as compared to a flexible one.(5 Marks)
- State three functions of a subbase in a pavement, ( 3 marks)
- 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**)
- Outline the three subgroups of flexible pavements (6 Marks)
- Write short notes on minor maintenance of bituminous roads by **patching** ( 7 marks)

#### **ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

#### **QUESTION TWO (20 Marks).**

- With the aid of a sketch, outline the FOUR layers of flexible pavements and briefly explain the function of each layer (16 Marks).

- State four reasons for resurfacing flexible pavements (4Marks)



**QUESTION THREE (20 Marks)**

- (a) 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 (12 Marks)
- (b) With the aid of a diagrammatic representation of the laboratory apparatus, outline how a Bitumen Penetration test is carried out (8 Marks)

**QUESTION FOUR(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 the 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 FIVE(20 Marks)**

- (a) Outline four basic phases of structural deterioration for a flexible pavement ( 8 Marks)
- (b) Briefly explain the following terms as used in Highway Engineering (4 marks)
  - (i) Cement stabilized soil
  - (ii) Cement- modified soil
- (c) State at least FOUR differences between flexible and rigid pavements (8 Marks)