



# MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 517: DESIGN OF BRIDGES

DATE: 15/5/2019

TIME: 2.00-4.00 PM

---

## INSTRUCTIONS

- i. This paper consists of five questions.
- ii. Attempt QUESTION ONE and any other TWO questions

**Time: 2 Hours**

### QUESTION ONE (30 MARKS)

- a) Clearly discuss the five major basic types of inspections that can be performed on a bridge structure. (10 marks)
- b) With clear sketches, briefly discuss five major types of concrete bridges. (10 marks)
- c) Design a reinforced concrete slab deck which has 6m wide carriageway and the deck spans 34m centre to centre of bearings. The deck should be designed to carry 30 units of HB load in load combination 1. (10 marks)

### QUESTION TWO (20 MARKS)

A bridge super-structure is of reinforced concrete deck type supported on medium span pre-stressed girders. The bridge has three spans, the middle span being 280m, and two end spans at 145m each. The bridge deck total width is 15m in total inclusive of the footway and cycle way on either side. Design the bridge assuming that it is also to carry 30 units of HB loading.

**QUESTION THREE (20 MARKS)**

- a) Briefly discuss the HA and HB loading as applied to bridge engineering design. (10 marks)
- b) Briefly discuss the different steps involved when planning for construction of a new bridge. (10 marks)

**QUESTION FOUR (20 MARKS)**

Clearly discuss how preventive maintenance can be achieved in the following reinforced concrete bridge parts:

- a) Deck
- b) Wearing surface
- c) Railings
- d) Expansion joints

**QUESTION FIVE (20 MARKS)**

Determine the maximum bending moment that can be carried by a concrete slab deck under load combination 3 conditions. The deck carries a 100 mm depth of surfacing together with a normal HA live load uniformly distributed load of  $17.5 \text{ kN/m}^2$  and knife edge load of  $33 \text{ kN/m}$ . The deck should also be designed to carry 30 units of HB load. The span of the deck is 12.0 m center to center of bearings.