



TECHNICAL UNIVERSITY OF MOMBASA

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

ECV 4415: HIGHWAY ENGINEERING 1 **PAPER 2**

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)

- (a) (i) Draw a typical single carriageway cross section clearly indicating its features **(7 Marks)**
- (ii) State three main factors that determine the choice of a highway cross-section **(3 marks)**
- (b) Outline the main functions of the following features of a highway **(9 marks).**
- (i) Central reservation/Median strip
 - (ii) Shoulders
 - (iii) Drainage channels
- (c) With aid of a sketch, outline two ways of designating a curve. **(3 Marks)**
- (d) (i) Define a priority intersection giving its principal advantage over other types of intersections **(2 Marks)**



- (ii) With aid of sketches illustrate three forms of priority intersections (6 Marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION
QUESTION TWO (20 Marks)

a) Define the following terms as used in highway design and outline the three components of each term. (8 Marks):

- (i) Stopping sight distance
- (ii) Overtaking sight distance

b) Calculate the full overtaking sight distance (FOSD) for the 85th percentile driver on a section of highway with a design speed of 85km/hr (4 Marks)

c) With aid of a sketch, briefly explain *why a right-left stagger* is preferred to the left-right stagger for a staggered T- junctions. (5 Marks)

QUESTION THREE(20 Marks)

(a) Define a transition curve and explain its threefold purpose in horizontal curves. (8 Marks)

(b) Referring to table Q2(b), Calculate the *desired* and *absolute* minimum crest curve lengths for a vertical curve to be constructed between an ascending grade of 3% and a descending grade of 4% for a dual carriageway highway with a design speed of 100km/hr.(6Marks)

Table Q2(b): K values for vertical curvature

	Design speed (km/hr)					
	120	100	85	70	60	50
Desirable minimum K value – Crest curves (not recommended for single carriageways)	182	100	55	30	17	10
Absolute minimum K value – Crest curves	100	55	30	17	10	6.5
Absolute minimum K value – Sag curves	37	26	20	20	13	9
Full overtaking sight distance (FOSD) K value – Crest curve	—	400	285	200	142	100

- (c) Roads in Kenya are divided into classes according to their major function in the road network. Outline the highest three classes. **(6 Marks)**

QUESTION FOUR(20 Marks)

- (a) With aid of a clear sketch, outline the elements of a simple circular horizontal curve (8 Marks).
- (b) With the aid of diagrams, illustrate the following types of roundabouts (12 Marks)

QUESTION FIVE (20 Marks)

- (a) With aid of sketches, outline four types of horizontal curves (8 marks)
- (b) (i) Define degree of curvature and with aid of a sketch derive a formula relating the Degree of curvature and the Radius of the curve. (4 Marks)
- (ii) Using the relationship between the degree of curvature (D) and the radius of the curve (R), and given that the sight distance length (SD) lies within the curve length, with aid of a sketch, derive the formula for computing the Minimum offset clearance (Ms) required between the centreline of the highway and an obstruction restricting the sight distance (8 Marks).