



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4415: HIGHWAY ENGINEERING 1
&
BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
TCV4323: HIGHWAY GEOMETRIC DESIGN

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2024
TIME: 2HOURS

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 and any other TWO questions.

DO NOT WRITE ON THE QUESTION PAPER.

QUESTION ONE (COMPULSORY) (30 marks)

- a) Geometric roadway design can be broken into three main parts. Mention and briefly explain each of these parts.
(6 marks)
- b) Define an intersection and mention the factors which are taken into consideration in the design and construction of roads.
(3 marks)
- c) What is the primary aim of vertical alignment and, why are vertical curves required?
(4 marks)

- d) Briefly, explain the two types of sight distances. (4 marks)
- e) Explain the four (4) physical features which may reduce traffic capacity: (7 marks)
- f) A 2-lane 7.3m wide single carriageway road has a curve radius of 600m. The minimum sight stopping distance required is 160m. Calculate the required distance to be kept clear of obstructions in metres. (3 marks)
- g) Define an acceleration lane and explain two factors that determine how acceleration lanes are introduced. (3 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a) Explain the purpose of intersection islands and the uses of directional and divisional islands. (5marks)
- b) Explain the following terms
- Highway Capacity
 - Interrupted Flow
 - Un-Interrupted flow
- (5 marks)
- c) A vertical alignment for a single carriageway road consists of a parabolic crest curve connecting a straight-line uphill gradient of +4% with a straight line downhill gradient of -3%.
- 1) Calculate the vertical offset at the point of intersection of the two tangents at PI
 - 2) Calculate the vertical and horizontal offsets for the highest point on the curve.
- Assume design speed of 85km/hr and use the absolute minimum K value for crest curves. (10 marks)

QUESTION THREE (20 Marks)

- a) Define an intersection and mention the factors which are taken into consideration in the design and construction of roads. (3 marks)
- b) Sketch and discuss a Normal Roundabout and, state FIVE advantages and disadvantages of roundabouts as compared to other types of intersections. (8 marks).

- c) Intersections are classified either as “At-grade” or “Grade Separated”. Explain these two types of intersections giving details of the classifications and examples.
(9 marks)

QUESTION FOUR (20 Marks)

- a) Explain the THREE basic ways of resolving crossing conflict at intersections. (3 marks)
- b) Discuss briefly THREE methods for draining water from a highway (6 marks)
- c) i. Define a transition curve and explain its purpose in horizontal curves. State THREE major factors that govern the design of a transition curve. (4 marks)
- d) Given: a curve radius of 400m, design speed of 110kph and friction 0.4, estimate the minimum length of spiral necessary for a smooth transition from tangent (straight) to the circular curve. (7 marks)

QUESTION FIVE (20 Marks)

- a) i. What is curve widening in horizontal alignment? (2 marks)
- ii. Illustrate curve widening diagrammatically and show how the extra width is calculated. (5 marks)
- iii. Highlight four points to be noted when widening horizontal curves. (4 marks)
- b) With the aid of sketches, explain the following types of interchanges:
- i. Trumpet Interchange
- ii. Diamond Interchange
- iii. Cloverleaf Interchange (9 marks)