



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)**

ECE 2404: HIGHWAY ENGINEERING I

**END OF SEMESTER EXAMINATION**

SERIES: APRIL 2015

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Pocket Calculator*

This paper consists of **FOUR** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

Use neat, large and well labeled diagrams where required

This paper consists of **TWO** printed pages

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**Question One (Compulsory)**

- a) Differentiate “At-grade’ intersections from ‘Grade-separated’ intersections **(2 marks)**
- b) State the factors which control the geometric design elements of a road and list the benefits for proper geometric design **(3 marks)**

- c) Define “Design Speed” and explain how its choice affects the design of the geometric design elements **(5 marks)**
- d) Define the term “channelization and explain its purposes. **(10 marks)**

**Question Two**

- a) Explain the purposes of transition curves and state the THREE major factors governing their design **(5 marks)**
- b) Explain the THREE methods which may be used to achieve maximum safety and minimum delay to vehicles in at-grade intersections and with aid of sketches, show the following vehicle movements at intersections:
  - (i) Diverging
  - (ii) Merging
  - (iii) Compound crossing and merging **(7 marks)**
- c) Describe the FIVE factors related to the roads as a physical feature in the environment to be considered in the location and design of a road project **(8 marks)**

**Question Three**

- a) Outline how the following features affect the design of the principal geometric design elements:
  - (i) Topography
  - (ii) Traffic volume and capacity
  - (iii) Roads classification
  - (iv) Environmental effects
  - (v) Design speed **(10 marks)**
- b) With aid of sketches, explain how the superelevation is developed from a normal camber to a full superelevation at the centre of the circle curve **(10 marks)**

**Question Four**

- a) Outline the THREE situations which warrant the introduction of climbing lanes and state TWO factors considered when designing vertical curves **(5 marks)**
- b) Explain the purpose of intersection islands and differentiate kerbed islands from ghost islands **(5 marks)**
- c) State the advantages and disadvantages of roundabouts as compared to other types of at-grade intersections **(10 marks)**

**Question Five**

- a) Explain the primary reasons for widening horizontal curves **(2 marks)**
- b) Define “design speed” and explain how its choice affects the design of the geometric design elements **(5 marks)**
- c) Draw a typical single-way carriageway cross-section and indicate clearly the following features:
  - (i) Verge
  - (ii) Berm
  - (iii) Carriageway slopes (i.e. cutting and embankment) **(5 marks)**

b) Outline the term “channelization” and state its purposes

**(8 marks)**