TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE)

ECE 2404: HIGHWAY ENGINEERING I

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One (COMPULSORY)

a) (i) Briefly describe THREE design objectives of highway geometric design. **(6 marks)**

(ii) An equal-tangent curve is to be constructed between grades of -2.0% and +1.0%. The PVI is at station 110 + 00 and at elevation 420m. Due to a street crossing the roadway, the elevation of the roadway at station 112+00 must be at 424.5m. Design the curve. **(8 marks)**

b) With the aid of neat diagrams, illustrate and show direction of flow:

i. Unchannelized four-leg intersection

ii. Channelized three-leg intersection **(6 marks)**

c) (i) A sound wall is to be constructed at the edge of shoulder, along the inside of an estate road. The inside lane 133.8m wide with shoulder of 1.20m. The radius of the curve measured up to the outer edge of the shoulder is 45m. Determine the sight distance of this section of the curve with t the should wall. **(6 marks)**

(ii) Outline the use of splitter islands on all roundabouts. **(4 marks)**

Question Two

a) With the aid of diagrams, illustrate the following interchanges: **(6 marks)**

(i) Full cloverleaf

(ii) Single point urban interchange

b) 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%.

(i) Calculate the vertical offset at the point of intersection of the two tangents at PI

(ii) Calculate the vertical and horizontal offsets for the highest point on the curve

Assume a design of 85km/h **(14 marks)**

Question Three

a) Define the following terms as used in highway design:

i. Sight distance

ii. Stopping sight distance

iii. Decision sight distance

iv. Passing sight distance **(8 marks)**

b) A vertical curve is to be constructed between a 3.5% grade and a -4% grade. The required sight distance is 300m. The dangerous object is considered to be on the pavement surface and the driver's eye level is at 1.05m above the pavement surface. Determine the length of the vertical curve that will satisfy the sight distance requirements. **(12 marks)**

Question Four

a) Briefly explain SIX factors to consider when combining horizontal and vertical curves in highway design. **(12 marks)**

b) Briefly explain EIGHT factors that warrant channelization of at-grade intersections. **(8 marks)**

Question Five

a) Outline SIX economic considerations that justify a climbing lane on a highway improvement project. **(9 marks)**

b) With the aid of a flow chart illustrate the design process for an interchange or junction. **(11 marks)**