



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)  
*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2205: THEORY OF STRUCTURES I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012

TIME: 3 HOURS

## Instructions to Candidates:

You should have the following for this examination

- Answer Booklet

This paper consists of **FIVE** questions

Answer any **THREE** questions

Maximum marks for each part of a question are clearly shown

This paper consists of **FOUR** printed pages

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## Question 1

- a) With an aid of a diagram, differentiate between FACE LEFT and FACE RIGHT (4 marks)
- b) What is a ray trace? A traverse was run from Donga to Twiga whose datum coordinates were given below:

Station	Northings (M)	Easting (M)
Twiga	+28 162.86	+68 5828.56
Donga	+26 594.36	+68 6431.52
Nyoka	+23 857.59	+68 2214.04

Station	Observed Brg	Correction	Oriented Brg	Adjustment	Final Brg
At Donga	FN Pg 1				
Nyoka	237° 01' 07''				237°01'12''
K6	251° 43' 54''				
Twiga	338° 58' 15''				
At K6					
Donga	71°43'34''				
K7	354° 02' 54''				

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**At K7 FN Pg 2**  
 K6 174° 02' 52''  
 K8 43° 07' 38''

**At K8**  
 K7 223° 07' 39''  
 K9 05° 20' 21''

**At K9**  
 K8 185° 20' 24''  
 K10 326° 19' 27''

**At K10 FN Pg 3**  
 K9 146° 19' 31''  
 K11 338° 06' 22''

**At K11**  
 K10 168° 06' 37''  
 Twiga 298° 32' 26''

**At Twiga FN Pg 4**  
 K11 118° 32' 31'  
 Donga 158° 58' 09'' 158°58'20''  
 JKU 220° 00' 47'' 220°00'55''

Prepare a final bearing sheet for the new points, K6, K7, K8, K9, K10 and K11 (16 marks)

c) The areas within the underwater contours are as follows:

Contour:	190	188	186	184	182
Area (M2):	3350	2860	1730	840	310

Calculate the volume of water in the lake between 182m and 190m using End Area and Prismoidal methods (6 marks)

d) Compute the side widths and cross-sectional area of an embankment to road with formation width of 12.50m and side slopes 1 vertical 2 horizontal when the centre height is 3.10m. The existing ground has cross-fall of 1 in 12 at right angles to the embankment (8 marks)

**Question 2**

a) A circular curve of radius 500m is connecting two straights at an angle of 80°. Given that the chainage at the intersection point I is 2642.64m, compute the setting out data for the four chords (10 marks)

b) The figure below shows the existing ground levels on a 15m square grid forming part of a site which is to be excavated to a uniform formation level of 10.00 m above the datum. Calculate the volume of the earth to be excavated assuming the vertical sides (10 marks)

Fig 2: Not to Scale

**Question 3**

- a) Differentiate between simple and reverse curves (2 marks)
- b) Determine the area in hectares enclosed by the line of a closed traverse ABCDE whose coordinates are given as follows:

Station	Northings (m)	Eastings (m)
A	300.00	200.00
B	385.65	306.98
C	282.02	368.55
D	248.80	392.93
E	185.70	291.74

If the chain, nominally 20m long used on the survey was later found to be 0.1m too long, calculate the correct value of the area (12 marks)

- c) State Simpon’s rule. In a chain survey, the following offsets were taken to a fence from a chain line:

<b>Change (m)</b>	0	20	40	60	80	100	120	140	160	180
<b>Offsets (m)</b>	0	6.45	10.46	9.38	11.94	14.86	10.12	5.01	2.79	1.09

Compute for the area between the fence and the chain (6 marks)

**Question 4**

- a) Define tachometry and state its applications (3 marks)

- $\beta$        $\alpha$
- b) Derive the horizontal distance when angles  $\beta$  and  $\alpha$  are angles of depression (6 marks)
- c) With an aid of a diagram, indicate the elements of a simple curve (7 marks)
- d) Define the following terms as used in Mass Haul Diagrams
- (i) Mass Haul Diagram (1 mark)
  - (ii) Shrinkage (1 mark)
  - (iii) Free Haul Distance (1 mark)
  - (iv) Average Haul Distance (1 mark)

### Question 5

- a) What are the uses of Mass Haul Diagrams (6 marks)
- b) A theodolite whose height of the instrument level is 1.85 has a multiplying constant of 100 and an additive constant of 1.0. If the angle of elevation is  $09^{\circ}$ , and the upper, middle and lower stadia readings are 4.8, 3.6 and 2.2 respectively, what is the distance of the staff from the station and what is the reduced level at the staff (6 marks)
- c) A roadway kerb has a radius of curvature of 40m. The length of the long cord is 60m. Calculate the offsets from the cord at 10m intervals (2 marks)
- d) A traverse was run between A and E as shown below. Give the necessary data of the bearing and the distance and compute the partial coordinates for the traverse (6 marks)

W.C.B