



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

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

ECE 2306: SURVEYING III

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer booklet
- Scientific Calculator

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 **THREE** printed pages

Question One (COMPULSORY)

- a) The planimeter is a device used to measure area and may be broadly classified into mechanical and digital planimeters. State the components of a mechanical planimeter and describe how it measures area, while distinguishing between the two major types. **(6 marks)**

- b) State the THREE main variables influencing circular curve design citing which one(s) is (are) at the discretion of the engineer. **(4 marks)**
- c)
- Y

The figure above illustrates a traverse with points A, B, C, D and E where A is the most westerly point and D, the most southerly station. All coordinates are positive. Compute the traverse area by the coordinate method. **(6 marks)**

- d) What would be the radius of a circular curve with a chord defined degree of curve of 4° and the deflection angle of 20° ? **(4 marks)**
- e) The interior angles of a closed traverse of six sides are given as:
- 118° 15' 58"
 - 93° 59' 01"
 - 23° 44' 10"
 - 269° 21' 00"
 - 98° 00' 39"
 - 116° 38' 12"

Each angle has been measured with equal precision. Compute the correct adjusted angles for the six-sided figure. **(6 marks)**

- f) Citing its functions, explain what you understand by the term 'spiral curve' as used in surveying. **(2 marks)**

- g) Define the following terms as used in surveying:

- (i) Swell **(1/2 marks)**
- (ii) Cut **(1/2 marks)**
- (iii) Precision **(1/2 marks)**
- (iv) Deflection Angle **(1/2 marks)**

Question Two

- a) A cross-sectional area was measured using a fixed-arm planimeter which gave the readings directly in mm². The initial planimeter reading was set to zero (0) and the final reading was 7362. If the

horizontal scale of the cross-section was 1 in 200 the vertical scale was 1 in 100, calculate the true area represented by the cross-section. **(4 marks)**

- b) (i) Outline the TWO main purposes for the design and construction of vertical curves. **(4 marks)**
- (ii) The parabola is considered to be a desirable geometric curve in vertical alignment design. State TWO characteristics of the parabola that make it suitable for this purpose. **(2 marks)**
- (iii) Outline the procedure for computing a vertical curve. **(10 marks)**

Question Three

- a) Outline the various types of errors in surveying measurements. **(15 marks)**
- b) Given that a section has a formation width of 16, and the ground slopes transversely at 1 in 10 and that the side slopes are 1 in 3 and the height at the centre-line is 0.5m, compute the cross-sectional area, w_1 and w_2 for out fill. **(5 marks)**

Question Four

- a) It is required to connect two straight whose deflection angle is $130^{\circ} 16' 00''$ by a circular curve of radius 600m. Compute the data necessary for setting out the curve by tangential angles method if the through chainage of the intersection point is 2745.72m and the pegs are at intervals of 25m. State also any assumptions made and show all necessary checks. **(14 marks)**
- b) A distance is measured four times ($n = 4$) with the following results. $L_1 = 32.51\text{m}$, $L_2 = 32.48$, $L_3 = 32.52\text{m}$ and $L_4 = 32.53\text{m}$. Compute the least squares estimate of the distance. **(6 marks)**

Question Five

- a) The figure below represents two circular concentric curves. The outermost curve has a radius of 39.73m and both curves have a deflection angle of $53^{\circ} 29'$. Given that the two curves are 16.50m apart, what constitutes the area between the arcs? **(4 marks)**

16.5m

- b) Two level cross-sections 100m apart have center heights of 3.6m and 4.8m respectively. Both excavations have a formation width of 44m. The side slopes are 1 in 1.5. Compute the volume between the sections. **(6 marks)**
- c) Define the following terms as used in surveying expressing them mathematically and graphically while possible:
- (i) Haul **(1/2 marks)**
- (ii) Waste **(1/2 marks)**

(iii) Balancing line

(1/2 marks)

(iv) Free Haul

(1/2 marks)

$$\alpha_1 = 41^\circ 33', \quad \alpha_2 = 78^\circ 57' \quad \alpha_3 = 59^\circ 27'$$

- d) The interior angles of a plane triangle are adjusted angles using the method of least squares and compute the (8 marks)