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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITRY EXAMINATIONS 2023/2024 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 343

COURSE TITLE: ENGINEERING SURVEYING III

DATE: 7/12/2023 **TIME:** 8.00AM – 10.00AM

INSTRUCTIONS:

1. This paper contains **FOUR** questions
2. Answer any **THREE** questions
3. Marks for each question are indicated in the parenthesis.
4. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION 1 **(25 Marks)**

(a) Differentiate between the following terms as used in curve designation
- Back and forward tangents
- Point of intersection
- Through Chainage
- Compound circular curves

(5Marks)

(b) The tangent length of a simple curve is given as 202.12m and the deflection angle for a 30m chord is 2° 18′ Calculate:
(i) the radius
(ii) the total deflection angle
(iii) the length of curve
(iv) the final deflection angle

(8 Marks)

(c) Two straights AI and BI meet at I on the far side of a river. On the near side of the river, a point E was selected on the straight AI and a point F on the straight BI and the distance from E to F measured and found to be 85.00m. The angle AEF was found to be 165° 36′ and the angle BFE was 168° 44′. If the radius of a circular curve joining the straights is 500m.

(i) Determine the distance along the straights from E and F to the tangent points.
(8 Marks)

(ii) Explain clearly how to set out the curve if a theodolite and tape are available.
(4 Marks)

QUESTION 2 **(25 Marks)**

(a) What is a transition curve?
(2 Marks)

(b) Two types of curves (i.e. clothoid and cubic parabola) are often used to represent transition curves. Explain the differences between the two curves
(3 Marks)

(c) A parabolic vertical curve having equal tangent lengths is to connect a -3.5% gradient to a +2.3% gradient on a highway designed for a speed of 100kph. The absolute minimum sag K-value of 26 is to be used to obtain the length of the curve. The reduced level and the through chainage of the intersection point of the two gradients are 123.47m and 717.46, respectively. Calculate:
(i) The through chainages of the tangent points
(ii) reduced levels of the tangent points
(iii) The reduced levels along the curve at exact 20m multiples of through chainage.
(20 Marks)

QUESTION 3 (25 Marks)

a) State the principle of least squares method of adjustment. What assumptions are normally made in this method

(5 Marks)

b) The interior angles of a plane triangle are $\theta_1 = 41° 32'$, $\theta_2 = 78° 56'$ and $\theta_3 = 59° 26'$. Compute the adjusted angles using the observation equations method of least squares.

(6 Marks)

c) Levellings were carried out with the following results:

	Rise or Fall	Weight
P to Q	+ 4.32m	1
Q to R	+ 3.17m	1
R to S	+ 2.59m	1
S to P	- 10.04m	1
Q to S	+ 5.68m	2

The reduced level of P is known to be 134.31m above datum.

(i) Draw a sketch of the leveling network showing the direction of the leveling
(ii) Form Observation equations in the form $\mathbf{L_i + V_i = h_k - h_j}$
(iii) Generate the normal equations in matrix format
(iv) Solve the equations to obtain heights of Q, R, and S.

(14 Marks)

QUESTION 4 (25 Marks)

a) Briefly explain the following procedures of establishing survey controls.
- Trilateration
- Triangulation
- Resection

(6 Marks)

b) With the aid of sketches discuss the principles of Single, Double and Tripple differencing as relates to Precise Relative GPS surveying.

(9 Marks)

c) Explain what you understand by selective availability (3 Marks)

d) How are real-time GPS surveys carried out? What advantages do real-time surveys have over post-processed surveys? (7 Marks)