MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOY (MMUST)

UNIVERSITY EXAMINATIONS
2013/2014 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS

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

COURSE CODE: CES 343
COURSE TITLE: ENGINEERING SURVEYING III

DATE: April 2014 **TIME: 3HOURS**

INSTRUCTIONS TO CANDIDATES

- This paper contains Five Questions
- ANSWER any **FOUR** Questions

QUESTION 1 (25 Marks)

(a) Differentiate between the following terms as used in curve designation
- Back Tangent and Forward Tangent
- Through Chainage and Degree of Curvature

(4 Marks)

(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:
- the radius
- the total deflection angle
- the length of curve
- 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. (Use appropriate diagram) (7 Marks)

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

(6 Marks)

QUESTION 2 (25 Marks)

(a) What is a transition curve? State two of the major roles of a transition curve.

(3 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 (4 Marks)

(c) A road curve of 180 m radius it to be set up to connect two tangents. The maximum speed on this part of the road will be 13.2m/s. Transition curves are to be introduced at each end of the curve. The chainage of the intersection point is 1092.18m while the angle of intersection is 62° 30'. Given that the rate of change of radial acceleration is 0.3m/sec^3, calculate:
(i) The suitable length of the transition curve
(ii) The necessary shift of the circular curve
(iii) The chainage at the beginning and at the end of the combined curve
(iv) The value of the first two deflection angles of the transition curve assuming a peg interval of 10m.

(14 Marks)

(d) Show how the computed values in (C) above change when more accurate formulae are used.

(4 marks)

QUESTION 3 (25 Marks)

(a) Using suitable illustrations where possible differentiate between the following terms as used in the design of vertical curves

(i) A summit curve and a rising curve
(ii) A sag curve and a falling curve
(iii) Sight Stopping Distance and Full Overtaking Sight Distance

(6 marks)

(b) A falling gradient of 2.5% meets a rising gradient of 3.2% at a reduced level of 235.60m and a through chainage of 1172.45m. A parabolic vertical curve having equal tangent lengths is to be used to connect the gradients and the K value for the curve is 26. Calculate:

(i) The through chainages of the tangent points (5 marks)

(ii) The reduced levels of the tangent points (4 marks)

(iii) Tabulate the reduced levels along the curve at exact 30m multiples of through chainage. (6 marks)

(iv) The through chainage and the reduced level of the lowest point on the curve. (4 Marks)

QUESTION 4 (25 Marks)

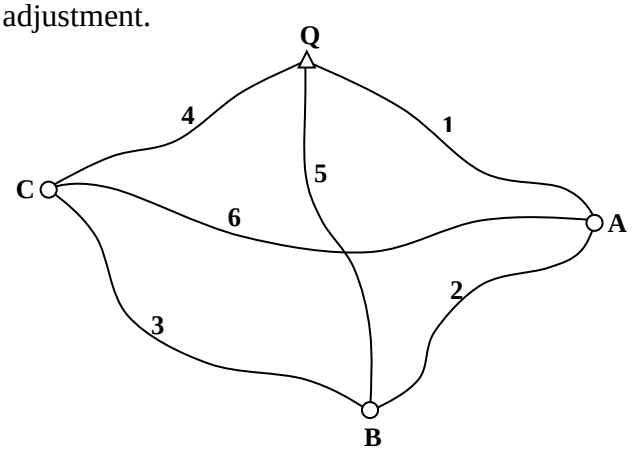
(a) What is the least squares criterion and why is it needed. (2 Marks)

(b) The three measured angles of a plane triangle are $l_1 = 45° 25' 01"$, $l_2 = 65° 20' 00"$ and $l_3 = 69° 15' 02"$. Compute the least-squares estimates for the three angles assuming that the measurements are uncorrelated and of equal precision

(8 Marks)

(c) The leveling network above shows four points Q, A, B and C with all possible pairwise height differences measured. All measurements are carried out twice. The mean of the two height distances and the distance between them is given. Q has a known height of 34.294m which is considered fixed. Determine the heights of points A, B and C by means of weighted least squares adjustment.

(15 Marks)



Q to A =	0.905m (0.30km)
A to B =	1.675m (0.45km)
C to B =	8.445m (0.35km)
C to Q =	5.864m (0.30km)
Q to B =	2.578m (0.50km)
C to A =	6.765m (0.45km)

QUESTION 5 (20 Marks)

a) In Triangulation surveys, the choice of stations must be carefully reconnoitered to select the most suitable positions for control stations. Briefly state the considerations that must be observed. (4 Mark)

b) With regard to GPS surveying briefly describe the following methods
(i) Static (ii) Rapid static (ii) Kinematic (iv) Real Time kinematic (12 marks)

c) For most GPS surveys, it is recommended that no satellites with an elevation of less than $10\text{-}15^0$ above the horizon be used. Explain why? (2 marks)

d) The accuracy of GPS measurements is improved a significant amount by using differential and relative methods. Explain? (4 Marks)

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

END