



MACHAKOS UNIVERSITY

University Examination 2019/2020

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 304 SURVEYING III

DATE: 11/12/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

- a) Define the following terms as used in surveying (8 marks)
- i. Residual
 - ii. Mass haul diagram
 - iii. Borrow
 - iv. Limit of economical haul
- b) While observing angles at a station, the horizon was closed. The observations in Table I and their standard deviations were obtained:

Table 1

No.	Angle	S (")
a ₁	134°38'56"	±6.7
a ₂	83°17'35"	±9.9
a ₃	142°03'17"	±4.3

- What are the most probable values for these observations? (4 marks)
- c) Outline the principle behind the rate of approach stating its application in route location (4 marks)

- d) Part of a motorway scheme involves the design and setting out of a simple curve with cubic spiral transitions at each end. The transitions are to be designed such that the centrifugal ratio is 0.197, whilst the rate of change of centripetal acceleration is 0.45m/s^3 at a design speed of 100 km/h. If the chainage of the intersection to the straights is 2154.22m and the angle of deflection 50° , calculate: (8 marks)
- The length of transition to the nearest 10 m.
 - The chainage at the beginning and the end of the total composite curve.
 - The setting-out angles for the first three 10-m chords on a through chainage basis.
- e) The Volumes in cubic meters of excavation (+) and fill (–) between successive sections 100 m apart on a 1300-m length of a proposed railway are given.

Section	0	1	2	3	4	5	6	7
Volume (m^3)	–1000	–2200	–1600	–500	+200	+1300	+2100	
Section	7	8	9	10	11	12	13	
Volume (m^3)	+1800	+1100	+300	–400	–1200	–1900		

- Draw a mass haul diagram for this length.
- If earth may be borrowed at either end, which alternative would give the least haul? (6 marks)

QUESTION TWO (20 MARKS)

- With the aid of a clearly labelled diagram, derive the formula for the Apex distance in curves. (4 marks)
- Describe the approximations used in vertical curve computations (5 marks)
- Two straights, with a deflection angle of 36° , are to be joined with a circular curve of 500m radius. The forward chainage of the Intersection Point is 6051.35m. Compute the setting-out data required for chords of 20m length. (11 marks)

QUESTION THREE (20 MARKS)

An existing length of road consists of a rising gradient of 1 in 20, followed by a vertical parabolic crest curve 100 m long, and then a falling gradient of 1 in 40. The curve joins both gradients tangentially and the reduced level of the highest point on the curve is 173.07 m above datum. Visibility is to be improved over this stretch of road by replacing this curve with another parabolic curve 200 m long.

- Find the depth of excavation required at the mid-point of the curve.

