



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 206: SURVEYING II

DATE: 26/3/2021

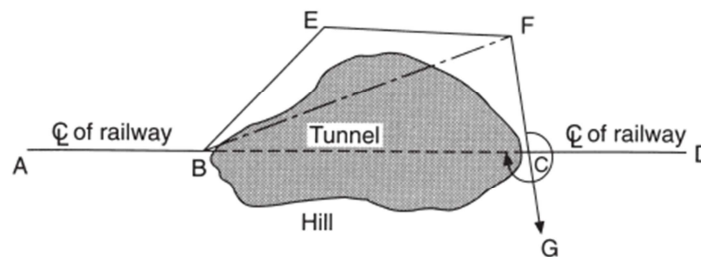
TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer question one and any other two questions

QUESTION ONE (30 MARKS)

- a) A level railway is to be constructed from A to D in a straight line, passing through a large hill situated between A and D. In order to speed the work, the tunnel is to be driven from both sides of the hill (see the figure below).



The centre-line has been established from A to the foot of the hill at B where the tunnel will commence, and it is now required to establish the centre-line on the other side of the hill at C, from which the tunnel will be driven back towards B. To provide this data the following traverse was carried out around the hill:

Side	Bearing			Horizontal distance (m)	Remarks
	°	'	"		
AB	88	00	00	—	Centre line of railway
BE	46	30	00	495.8 m	
EF	90	00	00	350.0 m	
FG	174	12	00	—	Long sight past hill

Calculate:

(6 marks)

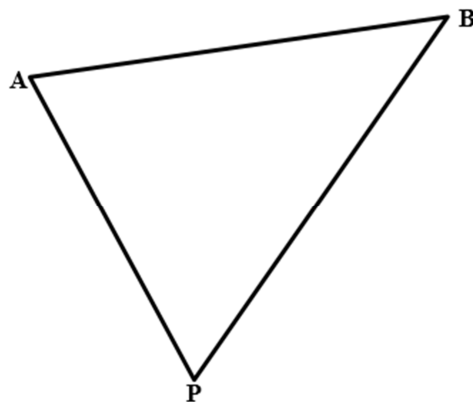
- The horizontal distance from F along FG to establish point C.
 - The clockwise angle turned off from CF to give the line of the reverse tunnel drivage.
 - The horizontal length of tunnel to be driven.
- b) In a traverse ABCDEFG, the line BA is taken as the reference meridian. The coordinates of the sides AB, BC, CD, DE and EF are:

Line	AB	BC	CD	DE	EF
ΔN	-1190.0	-565.3	590.5	606.9	1017.2
ΔE	0	736.4	796.8	-468.0	370.4

If the bearing of FG is $284^\circ 13'$ and its length is 896.0 m, find the length and bearing of GA.

(2 marks)

- c) Describe the three types of traverses used to establish survey controls (3 marks)
- d) In the figure below, A and B have coordinates 1870.74mE, 953.56mN and 2013.53mE, 1020.23mN respectively. Determine the coordinates of P if, distance AP and BP have been measured by EDM as 143.94m and 178.08m respectively. (6 marks)



- e) With the aid of well labelled diagrams, describe the principle behind the stadia method in tacheometry (9 marks)
- f) Describe the basic principle of satellite position fixing. (4 marks)

QUESTION TWO (20 MARKS)

- a) Outline the methods used in the establishment of the survey controls (4 marks)
- b) Outline the computation steps in a traverse (8 marks)
- c) Explain how the coordinates of a point can be determined by observations to known points. (8 marks)

QUESTION THREE (20 MARKS)

- a) Describe how a control point could be obtained using the intersection method (7 marks)
- b) Explain the basic features of a typical theodolite (13 marks)

QUESTION FOUR (20 MARKS)

- a) Describe the steps involved in setting up a theodolite (7 marks)
- b) Outline the sources of error in traversing (3 marks)
- c) The coordinates of A, B and C in the figure below are:

E_A 1234.96m N_A 17 594.48m

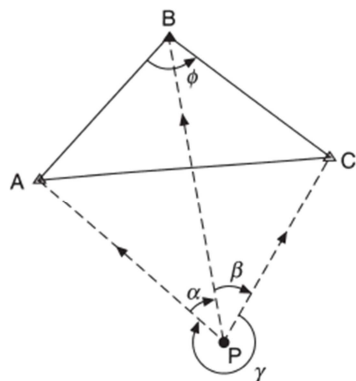
E_B 7994.42m N_B 24 343.45m

E_C 17 913.83m N_C 21 364.73m

And the observed angles are:

$APB = \alpha = 61^\circ 41' 46.6''$

$BPC = \beta = 74^\circ 14' 58.1''$



Find the coordinates of P. (10 marks)

QUESTION FIVE (20 MARKS)

A link traverse below commences from known stations, A and B, and connects to known stations C and D. The bearing of the link AB is $151^{\circ}27'38''$ and that of CD is $347^{\circ}37'41''$. The observed angles and distances are as in the table below.

Station	Observed angle	Line	Distance (m)
B	$143^{\circ}54'47''$	B- E ₁	651.16
E ₁	$149^{\circ}08'11''$	E ₁ - E ₂	870.92
E ₂	$224^{\circ}07'32''$	E ₂ - E ₃	522.08
E ₃	$157^{\circ}21'53''$	E ₃ - E ₄	1107.36
E ₄	$167^{\circ}05'15''$	E ₄ - C	794.35
C	$74^{\circ}32'48''$		

Given that the coordinates of point B & C are (3854.28, 9372.98) & (7575.56, 8503.21) respectively, compute the adjusted coordinates of points E₁, E₂, E₃, E₄.