



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
SECOND YEAR FIRST SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 206: SURVEYING II

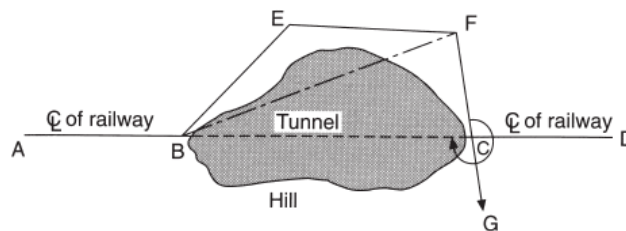
DATE:22/5/2019

TIME:11.00-1.00 PM

INSTRUCTIONS: Attempt questions **ONE** and any other **TWO** questions

QUESTION ONE (COMPULSORY) (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
	°	'	"		
<i>AB</i>	88	00	00	—	Centre line of railway
<i>BE</i>	46	30	00	495.8 m	
<i>EF</i>	90	00	00	350.0 m	
<i>FG</i>	174	12	00	—	Long sight past hill

Calculate:

(6 marks)

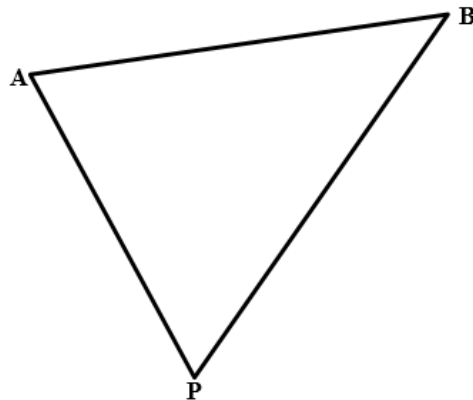
- i) The horizontal distance from F along FG to establish point C.
 - ii) The clockwise angle turned off from CF to give the line of the reverse tunnel drivage.
 - iii) The horizontal length of tunnel to be driven.
- b) In a traverse ABCDEFG, the line BA is taken as the reference meridian. The coordinates 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 tachometry (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) 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

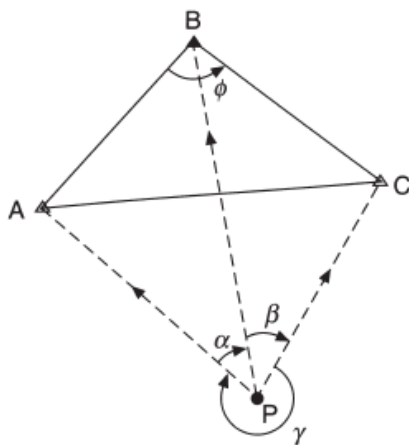
E_B 7994.42m N_B 24 343.45m

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)
<i>B</i>	$143^{\circ}54'47''$	<i>B- E₁</i>	651.16
<i>E₁</i>	$149^{\circ}08'11''$	<i>E₁- E₂</i>	870.92
<i>E₂</i>	$224^{\circ}07'32''$	<i>E₂- E₃</i>	522.08
<i>E₃</i>	$157^{\circ}21'53''$	<i>E₃- E₄</i>	1107.36
<i>E₄</i>	$167^{\circ}05'15''$	<i>E₄- C</i>	794.35
<i>C</i>	$74^{\circ}32'48''$		

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*.