DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING AND BACHELOR OF BUILDING TECHNOLOGY

GGE 2204: SURVEYING II

DATE: 06/04/2022 **TIME: 8.30-10.30 A.M.**

Instructions: ATTEMPT QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE [30 Marks]

(a) Clearly elucidate the following terms as applied in surveying [5 Marks]
   (i) Zenith angle
   (ii) Control network
   (iii) Traverse
   (iv) Global Navigation Satellite Systems (GNSS)
   (v) Tacheometry

(b) With the aid of diagram(s), discuss the following methods of traversing

   (i) Open traverse [2 Marks]
   (ii) Closed link traverse [2 Marks]
   (iii) Closed loop traverse [2 Marks]

(c) With aid of the diagrams, discuss the application of trilateration in GPS positioning [5 Marks]

(d) Table 1 shows the stadia readings of the graduated staff held at point B as was obtained during tacheometric surveying from the theodolite set at station A. Determine the horizontal distance (H) and reduced level of point B given that the reduced level of point A was 1500.231m and the instrument height was 1.233m above point A. [5 Marks]
Table 1

Instrument at	Height of instrument(m)	To	Vertical angle	Stadia readings at point B (m)	Remarks

A	1.233	B	+10º 30'00"	1.225 1.422 1.620	R.L of A = 1500.231 m

(e) Determine the coordinate of point P using resection method given that the observed horizontal angles APB(α) is 56˚ 31'11″ and BPC(β) is 64˚ 59'28″ and were observed at station P as shown in figure 1 between three known control points A, B and C whose coordinates are tabulated in table 2. [9 Marks]

Table 2

Station	**Northing (m)**	**Easting (m)**
A	9847.341	12041.112
B	10013.762	12546.888
C	9333.219	12644.191

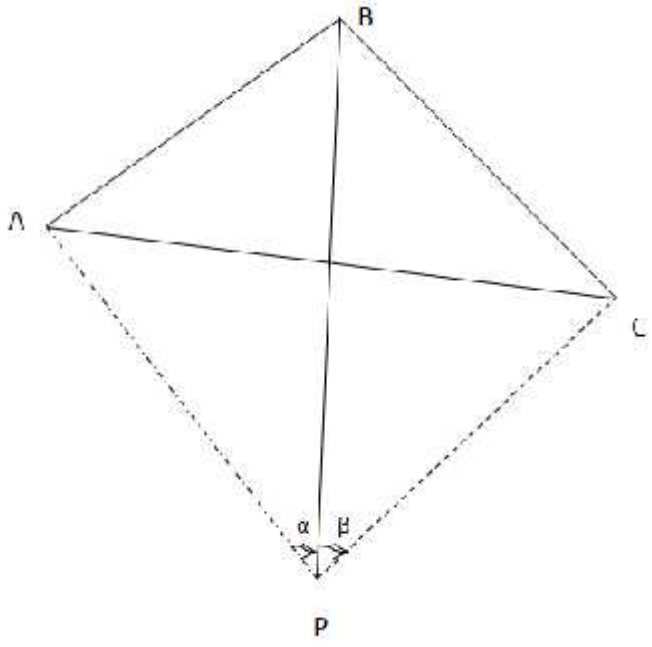

Figure 1

QUESTION TWO [20 Marks]

(a) With the aid of mathematical illustrations, discuss how trigonometric heighting method is used in vertical distance measurement. [3 Marks]

(b) With the aid of diagrams, discuss the four kinds of plane table survey [8 Marks]

(c) Table 3 shows the observed lengths (in meters) and azimuth for the traverse. Adjust this traverse for northings and easting by making corrections to preliminary coordinates using Bowditch method given the coordinates of stations A and F. [9 Marks]

Table 3

Traverse line	Azimuth	Distance (m)	Final Northings(m)	Final Easting (m)	Remarks
			43280.214	12765.483	A
A-B	$62^0$55'53"	1045.500			B
B-C	$139^0$13'09"	1007.380			C
C-D	$57^0$25'43"	897.810			D
D-E	$340^0$56'15"	960.660			E
E-F	$272^0$55'53"	943.890	44432.811	13854.547	F

QUESTION THREE [20 Marks]

(a) With aid of the diagrams, discuss the following methods used in the establishment of controls networks

(i) Triangulation [2 Marks]

(ii) Intersection [2 Marks]

(iii) Resection [2 Marks]

(b) A closed link traverse was run from benchmark BMA and closed to benchmark BMY and the observation were recorded in the field notebook in table 4. Reduce the bearings and reduce the traverse using Bowditch method given that BM.A (N_A.E_A) is 202313.741m, 167489.316m, BM.B (N_B,E_B) is 202745.858m, 167740.954m, BM.X (N_X,E_X) is 202197.600m, 167561.051m and BM.Y (N_Y,E_Y) is 202040.809m, 167735.384.

[14 Marks]

Table 4

T3 L $121^0$10'10" R $301^0$10'15"	@BM.X 258.013m @ T3	BM. Y L $131^0$57'57" R $311^0$58'00"
T2 L $54^0$47'15" R $234^0$47'00"	250.712m @ T2	BM. X L $301^0$10'20" R $121^0$10'15"

T1 L $294^0$32'40" R $114^0$32'46" BM. A L $269^0$17'38" R $89^0$17'40" BM. B L $30^0$12'30" R $210^0$12'40"	260.241m @ T1 261.241m @ BM. A	T3 L $234^0$47'02" R $54^0$47'10" T2 L $114^0$32'41" R $294^0$32'45" T1 L $89^0$17'50" R $269^0$17'40"

Where L and R are left face and right face respectively

QUESTION FOUR [20 Marks]

(a) Briefly discuss the following types of stadia systems tacheometric measurements methods as employed in surveying

(i) Fixed hair method [2 Marks]

(ii) Movable hair method [2 Marks]

(iii) Tangential system method [2 Marks]

(b) Using intersection method, determine the coordinate of point P (N_P, E_P) coordinated from two existing control points A and B as shown in figure 2, given that the clockwise horizontal angles at A and B were observed as PAB=281˚ 46' 01″ and ABP= 298˚ 21' 16″ respectively, the coordinates of control points A and B were 48917.324mE, 73321.441mN, and 55389.712mE, 68847.321mN respectively. [6 Marks]

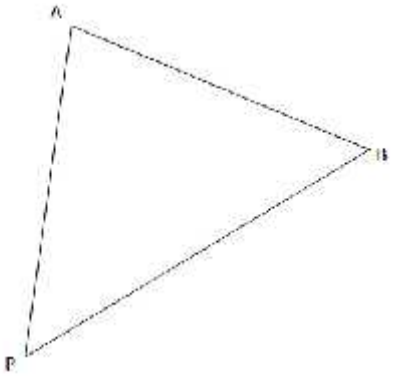

Figure 2

(c) Discuss the procedure of carrying out traversing using a total station machine [8 Marks]

QUESTION FIVE [20 Marks]

(a) Determine the reduced level of station B using the trigonometric heighting method, given that: the theodolite was set at station A which had a reduced level of 1200.345m, the height of instrument at point A was 1.567m, the vertical height of the measuring centre of the target at B was 1.235m, the slope distance between the theodolite and the target measured using the EDM machine was 67.882m, and the zenith angle measured using the vertical circle of the theodolite to the target was $95^0$20'24". [3 Marks]

(b) With the aid of a diagram, discuss the basic principle used by the Global Positioning Systems (GPS) in positioning [4 Marks]

(c) With the aid of a diagram, describe how the ray trace is carried out using a total station. [6 Marks]

(d) Adjust the following whole circle bearings measured using a theodolite machine as shown in the table 5. *(Show the workings)* [7 Marks]

Table 5

Station	Observed azimuth	Final azimuth
At BM.K		
BM.Q	$237^0$01'07"	$237^0$01'12"
TR1	$251^0$43'54"	
BM.T	$338^0$58'15"	$338^0$58'20"
At TR1		
BM.K	$71^0$43'34"	
TR2	$354^0$02'54"	
At TR2		
TR1	$174^0$02'52"	
TR3	$43^0$07'38"	
At TR3		
TR2	$223^0$07'39"	
TR4	$05^0$20'21"	
At TR4		
TR3	$185^0$20'24"	
TR5	$326^0$19'27"	
At TR5		
TR4	$146^0$19'31"	
BM.X	$338^0$06'22"	
At BM.X		
TR5	$158^0$06'37"	
BM.Y	$298^0$32'26"	$298^0$32'29"