

DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATION 2020

INSTITUTE OF GEOMATICS, GIS AND REMOTE SENSING

**SECOND YEAR EXAMINATION FOR THE BACHELOR OF SCIENCE IN CIVIL
ENGINEERING, BACHELOR OF EDUCATION IN CIVIL ENGINEERING AND
BACHELOR OF SCIENCE IN BUILDING TECHNOLOGY**

GGE 2105: SURVEYING I

DATE: APRIL 2020

TIME: 2HOURS

Instructions: ATTEMPT QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION 1 [30 Marks]

- (a) Clearly elucidate the following terms as applied in surveying **[5 Marks]**
- (i) Benchmark
 - (ii) Datum
 - (iii) Azimuth
 - (iv) Height of collimation
 - (v) Coordinate system
- (b) Discuss three main methods for fixing positions in a horizontal plane. **[6 Marks]**
- (c) Determine the distance measured by an EDM and a reflector set at point A and B respectively given that the modulated frequency of light is 30MHz, the velocity of light in air is 3×10^8 m/s, the integral number of wavelengths is 75 and the partial distance between the lens and the centre of the instrument which is vertically above point A is 0.10m. **[4 Marks]**
- (d) A chain surveying method was used to demarcate the boundaries of a parcel of land where graduation pavilion will be constructed. The boundary corners of the parcel were defined by perpendicular offsets from the baseline AB as shown in the booking sheet in table 1. Determine the area of the parcel. **[5 Marks]**

Table 1

| Offsets (left-hand side) | B | Offsets (right-hand side) |
|--------------------------|------|---------------------------|
| | 200m | |
| 40m | 160m | |
| | 125m | 35m |
| 25m | 100m | |
| | 75m | 35m |
| | 50m | 25m |
| 22m | 25m | |
| 20m | 15m | 25m |
| 16m | 5m | |
| | 0m | |
| | A | |

- (e) Using height of collimation method, reduce the following set of Municipal cross section notes as shown in table 2 given that the known reduced level of BM98 is 1612.08m. Apply the arithmetic checks and distribute the misclosure. [10 Marks]

Table 2

| Station | BS (m) | IS (m) | FS (m) | Computed Reduced Level (m) | Remarks |
|---------|--------|--------|--------|----------------------------|--------------------------------|
| BM97 | 3.77 | | | | Benchmark BM97 |
| TP1 | 4.87 | | 3.01 | | |
| TP2 | | 5.23 | | | |
| TP3 | | 4.6 | | | |
| TP4 | | 5.97 | | | |
| TP5 | | 6.88 | | | |
| TP6 | | 4.87 | | | |
| TP7 | 6.70 | | 4.30 | | |
| TP8 | | 4.22 | | | |
| TP9 | 4.76 | | 6.39 | | |
| TP10 | 7.39 | | 3.76 | | |
| BM98 | | | 4.89 | 1611.98 | Benchmark BM98 R.L 1612.08m |

Where BS-Backsight; FS-Foresight; IS-Intermediate foresight

QUESTION 2 [20 Marks]

- (a) Briefly explain three methods that can be used in setting out a perpendicular line from chain line when setting out a building. [3 Marks]
- (b) Briefly discuss the following modern methods of surveying.
- (i) Global Navigation Satellite Systems [2.5 Marks]
- (ii) LiDAR [2.5 Marks]
- (c) A page of an old levelling book had been damaged by white ants and the readings marked X are missing as shown in table 3. Find the missing readings with the help of available readings and apply arithmetical check. [12 Marks]

Table 3

| Station (m) | Backsight (m) | Intermediate foresight(m) | Foresight (m) | Rise | Fall | R.L | Remarks |
|-------------|---------------|---------------------------|---------------|-------|-------|----------|-----------------|
| A | 3.244 | | | | | X | BM _A |
| 0+00 | | 2.791 | | X | | X | |
| 0+50 | | X | | 2.373 | | 1596.094 | |
| 0+75 | | X | | | X | 1592.954 | |
| 0+100 | X | | 2.432 | X | | 1594.533 | CP |
| 0+110 | | X | | 0.785 | | X | |
| 0+120 | | 2.334 | | | 0.552 | X | |
| 0+140 | | 1.324 | | X | | X | |
| 0+150 | X | | X | | 1.935 | X | CP |
| 0+200 | 4.013 | | 2.718 | 0.3 | | X | CP |
| 0+220 | | 3.336 | | X | | 1593.575 | |
| 0+250 | 3.227 | | X | | 0.758 | X | |
| 0+275 | | X | | 0.326 | | X | CP |
| 0+300 | | | X | 0.783 | | 1592.923 | BM |

QUESTION 3 [20 Marks]

- (a) Using interior angles shown in figure 1, calculate the bearings and azimuths of lines: A-B, B-C, C-D, D-E, E-A. **[5 Marks]**

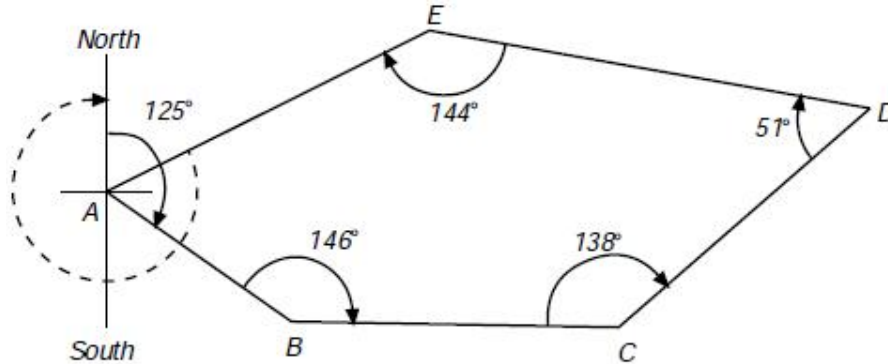


Figure 1

- (b) Surveying is based on simple fundamental principles which should be taken into consideration to enable one get good results. Discuss **[6 Marks]**
- (c) A field was surveyed with a 30m chain and its area was found to be 25.35Ha. If it was found that the chain was long by 75mm. Find the correct area of field. **[4 Marks]**
- (d) Discuss Electromagnetic Distance Measurement (EDM) instrument and the principle it employs in distance measurement **[5 Marks]**

QUESTION 4 [20 Marks]

- (a) Briefly differentiate between the following types of surveying technologies based on accuracy
- (i) Plane surveying **[2 Marks]**
- (ii) Geodetic surveying **[2 Marks]**
- (b) All survey operations are subjected to errors of observations and it is thus essential to know their characteristics, magnitudes and behaviour in order to be in a position to assess whether the observations conform to the required standards of accuracy for particular technique applied. Giving examples discuss the three kinds of errors that are encountered in surveying and mapping. **[6 Marks]**
- (c) Table 4 shows the observed lengths (in meters) and azimuth in a traverse. Determine the coordinates of point B, C, D, E and F given that the coordinate of point A(N,E) as 43280.214m and 12765.483m respectively. **[10 Marks]**

Table 4

| Traverse line | Azimuth | Distance (m) |
|---------------|-------------------------|--------------|
| A-B | 62 ⁰ 55'53" | 1045.500 |
| B-C | 139 ⁰ 13'09" | 1007.380 |

| | | |
|-----|-------------------------|---------|
| C-D | 57 ⁰ 25'43" | 897.810 |
| D-E | 340 ⁰ 56'15" | 960.660 |
| E-F | 272 ⁰ 55'53" | 943.890 |

QUESTION 5 [20 Marks]

- (a) A survey plan of a given parcel of land shows the dimension of the parcel of land as 24cm by 30cm at a scale of 1:1500. Determine the dimension of the plan of the same parcel of land at a scale of 1: 500 as well as the actual area on the ground. **[3 Marks]**
- (b) While levelling across a river, reciprocal levelling observations provided the following results for staves held vertically at A and B from levels station X and Y on each bank respectively.
- Staff reading at A from X= 2.497m
Staff reading at A from Y=3.294m
Staff reading at B from X= 3.213m
Staff reading at B from Y=4.013m
- Given the reduced level of A as 2756.346 m above mean sea level, determine the reduced level of point B. **[3 Marks]**
- (c) Using a suitable diagram, discuss the following uses of levelling and highlights its applications
- i. Longitudinal profiling **[2 Marks]**
 - ii. Contouring **[2 Marks]**
- (d) A tract of a land is defined by four corners i.e. A, B, C and D. A surveyor was given a task to plot this tract of land using a scale of 1:20000. The following measurements of distances and directions were specified. The distance and azimuth of a line AB were given as 1800m and 50⁰ respectively. The azimuths of C from B and A were given as 290⁰ and 350⁰ respectively. The position of point D was noted to be on the opposite side of point B and is 1600m and 1400m from C and A respectively. Determine the angle ADC, the azimuth DC, Azimuth DA and angle ABD. (*The diagram Must be plotted to scale*) **[10 Marks]**