



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED PHYSICS

BSc HONOURS IN EARTH SCIENCES

SURVEYING II

SES 2204

Second Semester Examination Paper

March 2025

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Scientific Calculator, Ruler

Examiner's Name: C. Makura

### INSTRUCTIONS

ANSWER ALL PARTS OF QUESTION 1 IN SECTION A AND ANY THREE QUESTIONS FROM SECTION B.

### MARK ALLOCATION

QUESTION	MARKS
1.	40
2.	20
3.	20
4.	20
5.	20
6.	20
Maximum possible mark	100

## SECTION A

- a. What is the distinction between horizontal and vertical control in surveying? 2
- b. List any two methods used for horizontal control. 2
- c. Describe the selection criteria of Triangulation and Trilateration stations. What are the field applications of Triangulation? 4
- d. Explain the classification of the triangulation system. 6
- e. (i) What checks can be applied to closed and open traverses? 2  
(ii) What do you understand by closing error? 2  
(ii) Explain how it is adjusted. 2
- f. From the following traverse observations and supplied coordinates, calculate and derive the final coordinates for the unknown traverse stations. Use the "Bowditch method" in this process and assume that all distances have been reduced to grid equivalents. 20
- |                   |             |
|-------------------|-------------|
| FAB = 154°35'55". | AB = 81.590 |
| ABC = 80°52'48".  | BC = 90.164 |
| BCD = 108°50'49". | CD = 84.243 |
| CDE = 160°17'16". | DE = 69.050 |
| DEF = 83°30'19".  | EF = 62.533 |
| EFA = 131°52'23". | FA = 73.060 |
- A = 451 539.465m E, 318 705.596m N  
F = 451 611.585m E, 318 717.282m N

## SECTION B

### QUESTION 2

- a. State the two aims of setting out and briefly describe the three basic principles on which setting out operations should be based in order that these aims can be achieved. 5
- b. With the aid of illustrations, discuss the use of sight rails, slope rails, profile boards and travellers as means of providing vertical control during setting out operations. 5
- c. Two design points E and F are to be set out by intersection from the ends of a baseline XY using two 1" reading theodolites. The coordinates of the points which are based on the same coordinate system are as follows:  
E = 1192.41mE; 1336.78mN F = 1207.66mE; 1108.25mN  
X = 1063.17mE; 1214.89mN Y = 1241.11mE; 1235.46mN  
Calculate the horizontal angles that must be set out at X relative to the line XY and at Y relative to the line YX to establish the positions of E and F. 10

### QUESTION 3

- a. Write short notes on types of circular curves. 6
- b. Define degree of a curve. Derive a relation between the radius and degree of a curve. 4
- c. Two tangents AB and BC intersect at a point B at chainage 150.5m. Calculate all the necessary data for setting out a circular curve of radius 100m, deflected angle  $30^\circ$  by the method of offsets from the long chord. 10

### QUESTION 4

- a. (i) What is resection? 2  
(ii) What is intersection? 2
- b. The coordinates of known stations are A (7492m N, 3932m E) and B (7487m N, 2960m E). Calculate the coordinate of unknown point P, where the observed horizontal angles taken to P from A is  $44^\circ 52' 36''$  and to P from B is  $75^\circ 33' 22''$  respectively. 6
- c. From the following given GPS coordinates of five sided closed traverse, determine the area of the plot.  
A = 5000m E, 1000m N  
B = 4682.287m E, 1627.656m N  
C = 5375.511m E, 1475.458m N  
D = 6100.866m E, 1631.480m N  
E = 5851.827m E, 772.537m N 10

### QUESTION 5

- a. Explain two important reasons why surveyors would like to relate their surveys to a coordinate system. 2
- b. Some classes of projections preserve some spatial characteristic (at the expense of others). Name three classes of projections and what they preserve. 6
- c. Can you explain the concept of projected coordinate systems and how they differ from geographic coordinate systems? 3
- d. What is the difference between a geoid and an ellipsoid? 3
- e. Explain plan and a map. Note the differences between them. 4
- f. Explain the term Representative Factor. 2

### QUESTION 6

- a. Despite the best equipment's and methods used, it is still impossible to

take observations that are completely free of small variations caused by errors which must be guided against or their effects corrected. Briefly describe the three sources of error. 6

b. State the laws of weights. 3

c. An angle A was measured by different persons and the following are the values -:

Angle	No of Measurements
65°30''10''	2
65°29''50''	3
65°30'00''	3
65°30'20''	4
65°30'10''	3

Find the most probable value of the angle.

d. Define the terms accuracy and precision with the help of an example 4  
3

e. Surveying is one of the world's oldest and most important arts because from the earliest times it has been necessary to mark boundaries and divide land. Surveying has now become indispensable to our modern day way of life. Discuss the importance of surveying in this modern day. 4

**END OF PAPER**