



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL  
ENGINEERING

ECE 2211: ENGINEERING SURVEY I

**SPECIAL/SUPPLEMENTARY EXAMINATION**

**SERIES: JULY 2013**

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- Answer Booklet

This paper consists of **FIVE** questions.

Answer any **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

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**Question One**

- a) With an aid of a sketch, show that when  $\alpha$  and  $\beta$  are angles of depression as shown below:

$$H = \frac{S}{\tan \beta - \tan \alpha}$$

**(6 marks)**

- b) Define the term triangulation. A field observation from a triangulation scheme established for a small construction site in figure 1 had the following data. Using equal shift method, adjust these angles.

**(16 marks)**

Angle	Observed Value
1	26° 10' 48"
2	27° 37' 16"
3	35° 46' 10"
4	32° 57' 52"

5	28° 23' 17"
6	29° 04' 37"
7	126° 11' 59"
8	111° 15' 52"
9	122° 32' 02"

F

The co-ordinates of F and B were given as:

Station	Co-ordinates	
F	+250.00N	+719.37E
B	+447.15N	+250.00E

- c) Explain the two basic methods that are employed in angle adjustments in a triangulation scheme. **(4 marks)**
- d) With an aid of sketch, explain the difference between face left (FL) and face right (FR) observations when using a theodolite. **(4 marks)**

### Question Two

- a) The following angles were adjusted for a triangle ABC. These angles were:

$$\phi_A = 75^\circ 04' 25''$$

$$\phi_B = 42^\circ 35' 47''$$

$$\phi_C = 62^\circ 19' 48''$$

Given the datum co-ordinates of A and B as follows:

N(M)	E(M)
A +643 649.19	+409 577.46
B + 641 668.40	+412 600.36

Using the first principle, derive the co-ordinates of point C

**(10 marks)**

- b) Explain the importance of the following parts of a theodolite:
- (i) Trivet stage
  - (ii) Tribrach
  - (iii) Optical plummet
  - (iv) Telescope clamp
- (8 marks)**

### Question Three

- a) Define triangulation. Why is it important in survey **(8 marks)**

- b) The co-ordinates of stations S, A and P are given as follows:

Northings (M)	Eastings (M)
S: 170.50	1309.12
A: 958.87	1525.43
L: 565.81	1231.08

Calculate the co-ordinates of point B which has been located by the intersection from station S, A and

$$\hat{B S A} = 85^{\circ} 38' 49'', \hat{S A B} = 55^{\circ} 50' 53'' \hat{B A C} = 41^{\circ} 41' 48''$$

C by observing the following angles and

$$\hat{A C B} = 68^{\circ} 69' 32''$$

**(12 marks)**

Compute the co-ordinates of point B which has been located by intersection method from points S, A and P through observation of angles  $\hat{B S A} = 8^{\circ} 38' 49''$ ;  $\hat{S A B} = 55^{\circ} 50' 53''$  and  $\hat{B A P} = 68^{\circ} 09' 32''$

**(14 marks)**

### Question Four

- a) Define tachometry **(3 marks)**

- b) A tachometer had a multiplying constant of 100m and an additional constant of zero (0) when set up for use, the trunion axis had a reduced level of 17.2m. When sighted on to a vertically held leveling staff, the horizontal centre line read 1.8m and the lower and upper stadia lines had readings 1.4 and 2.2m respectively. If the angle of elevation of the instrument was  $8^{\circ}$ , calculate the following:

(i) Horizontal distance of the staff from the instrument **(3 marks)**

(ii) Reduced level of the ground at the staff position **(3 marks)**

- c) Discuss **TWO** methods that are important for the adjustment of a traverse. **(6 marks)**

- d) Differentiate between true bearing magnetic declination methods of determining angles between two points. **(5 marks)**

### Question Five

- a) The field abstract of figure 2 shows the observed angles for a braced quadrilateral PQRS. Using the data given, adjust the angles.

Figure 3

The field abstraction of figure 3 below indicates the observed angles of a braced quadrilateral PQRS. Compute the adjusted values of the angles:

<b>Angle</b>	<b>Observed Value</b>
1	30° 20' 50"
2	54° 10' 45"
3	54° 44' 38"
4	39° 43' 39"
5	41° 53' 49'
6	42° 37' 47"
7	54° 54' 56"
8	40° 33' 30"

**(20 marks)**