2705/201 2709/201
2707/201 2710/201
MATHEMATICS II AND
SURVEYING II
June/July 2020
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING CONSTRUCTION
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE II

MATHEMATICS II AND SURVEYING II

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Mathematical table/Scientific calculator;
Drawing instruments.
*This paper consists of **EIGHT** questions in **TWO** sections **A** and **B**.*
*Answer **FIVE** questions choosing **TWO** questions from each section and **ONE** other question from either section.*
All questions carry equal marks.
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

SECTION A: MATHEMATICS II

*Answer at least **TWO** questions from this section.*

1. (a) Given $z_1 = p + 2i$ and $z_2 = 1-2i$ where p is a integer, determine:

(i) $\frac{z_1}{z_2}$ = in the form a = bi;

(ii) The possible values of P when

$$\left|\frac{z_1}{z_2}\right| = 13$$

(10 marks)

(b) Solve

$$z^4 + 8\sqrt{3} + 8i = 0$$

(10 marks)

2. (a) solve the differential equations.

(i) $\frac{dy}{dx} = 6y^2x$, when $x = 1$, $y = \frac{1}{25}$

(ii) $t\frac{dy}{dt} + 2y = t^2 - t + 1$, when $x = 1$, $y = \frac{1}{25}$

(10 marks)

(b) Use the method of undertermined coefficient to solve the differential equation.

$$\frac{d^2y}{dt^2} - 4\frac{dy}{dt} - 12y = 3e^{5t}$$

when $x = 0$, $y = \frac{18}{7}$ and x = 0, $\frac{dy}{dx} = -\frac{1}{4}$

(10 marks)

3. (a) Determined the derivatives of the following functions:

(i) $4x^2y^7 - 2x = x^5 + 4y^3$;

(ii) $x = t^5 - 4t^3; y = t^2$.

(7 marks)

(b) Show that $\frac{1}{y}\frac{\partial z}{\partial x} = \frac{1}{x}\frac{\partial z}{\partial y}$

Given that $z = \sin xy$.

(5 marks)

(c) Integrate the following functions:

(i) $\int xe^{-4x}dx$;

(ii) $\int \sin^5 x dx$

(8 marks)

4. (a) Solve for x given, $\sinh x = 10.17$. (5 marks)

(b) Solve the hyperbolic equation.

$$2\cosh 2\theta = 2\sin h\theta + 11$$ (7 marks)

(c) Expand $e^{\sin x}$ upto the term x^4 using Maclaurins series. Hence integrate

$$\int_0^1 e^{\sin x}\, dx$$ (8 marks)

SECTION B: SURVEYING II

*Answer at least **TWO** questions from this section.*

5. (a) State **four** permanent adjustments of a theodolite. (4 marks)

(b) Convert the following whole circle quadrantal bearing

(i) $151^\circ 20'$;
(ii) $332^\circ 40'$. (4 marks)

(c) Convert the following forward bearing to back bearings:

(i) 45° 20';
(ii) 197° 30'. (4 marks)

(d) With the aid of diagrams distinguish between:

(i) A lop and a closed oriented traverses;
(ii) Magnetic and true bearings. (8 marks)

loop - starts and ends at the same point from polygon
closed - enclose defined area and having common point for its bearing to the end.

True bearing - is a direction to an object from a point expressed as horizontal angle measured clockwise from true North.

6. (a) **Figure 1** shows reduced angular and linear measurements for a closed loop traverse. The bearing of the line AE is 51° 22' 30' while the coordinates of point A are 1000.00m, 1000.00 m.

(i) Determine the bearing of lines ED, DC, CB and BA;
(ii) Using the bowditch method, compute the final coordinates for points B, C, D and E. (20 marks)

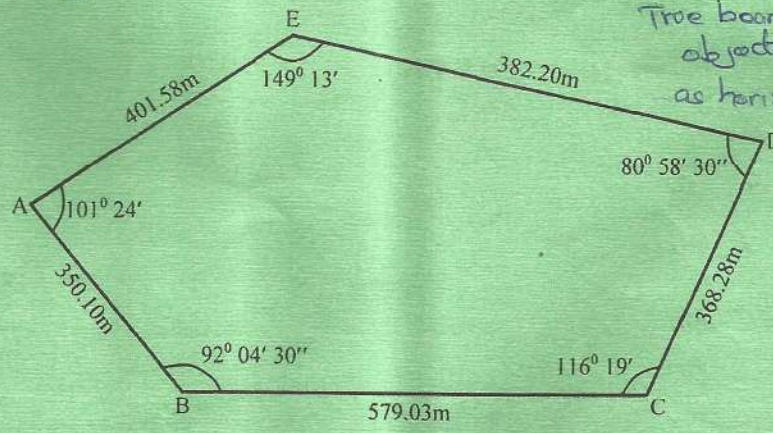

Fig. 1

7. (a) (i) ✓ Define transition curve. a curve of varying radii btw the curvature introduced btw straights and circular curve at both ends to smoother change of radii from infinity and radius to infinity.

(ii) ✓ State **four** functions of transition curve. (5 marks)

(b) A circular curve of radius 300 m, deflection angle 60° and standard length 30 m, calculate:

(i) angle by arc definition;
(ii) angle by chord definition;
(iii) length of curve;
(iv) tangent length;
(v) length of long chord;
(vi) mid - ordinate;
(vii) apex distance.

(15 marks)

✓ To provide medium for gradual introduction
✓ To accomplish gradual transition from the straight.
✓ To lead you gradually into the curvature
✓ Highways designed as it to design because its the proper way to layout the tangent to curve transition for the greatest.

Chord Arch = 30m = $R = \frac{1719}{D}$

$R = \frac{15}{\sin D/2}$

Chord Arch $R \times D \times \frac{\pi}{180} = 30$

8. (a) Explain with the aid of sketches the following types of curves:

(i) simple; ✓
(ii) compound; ✓
(iii) reverse; ✓
(iv) spiral. ✓

(12 marks)

(b) Draw a simple circular curve and show the following details:

(i) tangent point; ✓
(ii) tangent length; ✓
(iii) deflection angle; ✓
(iv) apex distance; ✓
(v) mid-ordinate. ✓

(8 marks)

(i) Bearings

$(n-2) \times 180$

$5-2 \times 180 = 540$

101 24 149 15 + 80 58 30 + 92 04 30 + 116 19 = 539 59 00

$540 - 539\ 59\ 00 = 0^\circ 1' 0'' = 0^\circ 0' 12''$ / 5

101 24 + 00 00 12 = 101 24 12

149 13 + 0 0 12 = 149 13 12

80 58 30 + 0 0 12 = 80 58 42

116 19 + 0 0 12 = 116 19 12

92 04 30 + 0 0 12 = 92 4 42

Find whole circle bearing
alternate angle add up to 180

51 22 30 + x = 180

$x = 180 - 51\ 22\ 30 = 128^\circ 37\ 30$

128 37 30 + 149 13 = 277 50 42

360 − 277 50 42 = 82 9 18

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