2705/201
2707/201
2709/201
2710/201
MATHEMATICS II AND
SURVEYING II
June/July 2021
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;
Drawing instruments;
Scientific calculator;
Mathematical table.

*This paper consists of **EIGHT** questions in **TWO** sections; A and B.*
*Answer **FIVE** questions choosing at least **TWO** questions from section A and B 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 5 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) (i) Determine the modulus and argument of the complex number

$$W = \frac{-9+3i}{1-2i}.$$

(ii) The conjugate of complex number z is denoted as $\overline{z}$. Solve the equation:

$z - 12 = i(9 - 2z)$

giving the answer in the form $x + iy$. (10 marks)

(b) (i) Show that $\cosh^2 x - \sinh^2 x = 1$.

(ii) Express $5\cosh^2 x + 3\sinh^2 x$ in terms of $\cosh x$, hence solve the equation $5\cosh^2 x + 3\sinh^2 x = 9.5$.

(10 marks)

2. (a) Differentiate from first principle $y = \frac{1}{x}$. (6 marks)

(b) A curve is described by the equation:

$3x^2 - xy + y^2 + 2x - 4y = 1$

Determine the first derivative and hence show that the value of x at the stationery points satisfies the equation

$$x^2 = \frac{5}{33}.$$ (7 marks)

(c) A surface is defined by the Cartesian equation

$z = x^2 y + y^2 x$.

Determine the equation of the tangent plane at the point (1, 2, 6). (7 marks)

3. (a) Given the differential equation $\frac{dy}{dx}\sin x = \sin x \sin 2x + y\cos x$.

Determine the exact value of y at $x = \frac{\pi}{4}$ given that $y = \frac{3}{2}$ when $x = \frac{\pi}{6}$. (8 marks)

(b) Use the method of undetermined co-efficient to solve the differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = 34\cos 2x \text{ given } y = 18,\ \frac{dy}{dx} = 0 \text{ at } x = 0.$$

(12 marks)

4. (a) Integrate the following functions:

(i) $\int \frac{2x}{(4+3x^2)^2}\,dx$;

(ii) $\int_0^{\frac{\pi}{4}} 4x\cos 4x\,dx$.

(10 marks)

(b) Calculate the area between the parabolas $y = 1 + 10x - 2x^2$, and $y = 1 + 5x - x^2$.

(5 marks)

(c) Determine the Taylor series for the function $x^4 + x - 2$ centred at $a = 1$. (5 marks)

SECTION B: SURVEYING II

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

5. (a) Determine the degree for a circular curve of radius 300 m and standard length 30 m using:

(i) arc definition;

(ii) chord definition.

(6 marks)

(b) Two straights intersect at a chainage of 1250.620 m having deflection angle of 60°. If the radius of the curve 400 m is to be laid out, calculate:

(i) chainage at tangent point;

(ii) chainage at the end of the line;

(iii) length of long chord;

(iv) apex distance;

(v) mid-ordinate.

(14 marks)

6. (a) Explain the following terms as applied in compass traversing:

(i) magnetic meridian;

(ii) local attraction;

(iii) magnetic bearing.

(6 marks)

(b) The following bearings were recorded during an open compass traverse.

Line	W.C.B. Forward	W.C.B. Back
AB	69° 00′	249° 00′
BC	82° 00′	260° 00′
CD	75° 00′	258° 30′
DE	172° 30′	354° 00′
EF	153° 30′	331° 00′
FG	354° 30′	172° 00′

Correct the bearing for local attraction. (14 marks)

7. (a) State the **two** forms of curves giving **two** examples in each. (3 marks)

(b) A circular curve of radius 500 m is to connect two straights. The intersection point; I is in accessible and therefore deflection angle is indeterminable. Using the information in **figure 1**, determine:

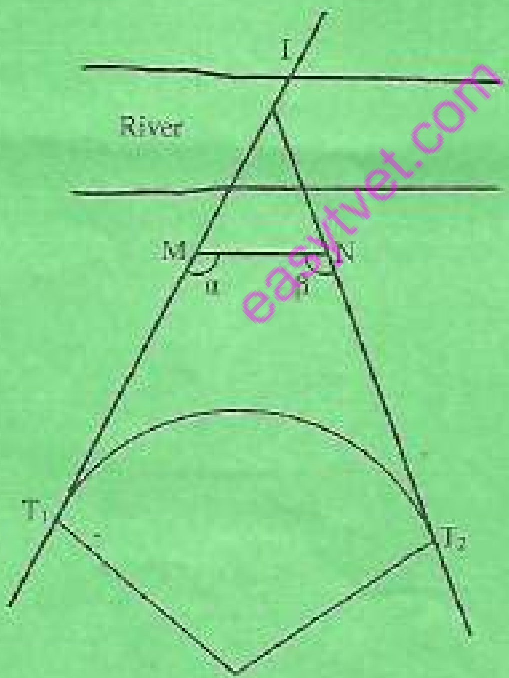

Fig. 1

(i) tangent length;

(ii) deflection angle of the first subchord, standard chord and last subchord if the curve is set at 25 m intervals.

(17 marks)

8. The following data refer to a theodolite transverse ABCDEA, starting and closing at A;

(i) Find the closing errors.

(ii) Find the accuracy of the transverse.

(iii) Adjust the traverse using Bowditch's rule and determine the co-ordinates of the points.

Line	Length (cm)	Bearing
AB	351.5	0° 10′
BC	282.0	40° 34′
CD	467.0	119° 05′
DE	512.6	208° 36′
EA	363.5	288° 12′

Datum co-ordinates of A are:

N + 900.00 E + 700.00

(20 marks)

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