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MATHEMATICS II AND
SURVEYING II
Oct./Nov. 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
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;
    Scientific calculator;
    Drawing instruments;
    Mathematical tables.
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 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.**

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Turn over

SECTION A: MATHEMATICS II

Answer at least TWO questions from this section.

1. (a) Determine the values of x and y in the equation:

$$x(1+j)^2 + y(2-j)^2 = 3 + 10j.$$

(6 marks)

 (b) Solve for x;

$$5\,Cosh\,x + 3\,Sinh\,x = 4.$$

(7 marks)

 (c) Evaluate $\int_0^{\frac{\pi}{6}} \sin^2 x\,dx$ using Maclaurin's series.

(7 marks)

2. (a) Differentiate from the first principle; $y = x^2 - 4x$.

(6 marks)

 (b) A curve has the equation $2x + 3y^2 + 3x^2y = 4x^2$. Determine the equation of the normal at the point $(-1, 1)$.

(8 marks)

 (c) Given $f(s, t) = s^2t + ln(t^2 - s)$. Determine the first and second partial derivatives.

(6 marks)

3. (a) Solve the differential equation;

$$(x+1)\frac{dy}{dx} = y + x + x^2$$

Given, $y = 2$ at $x = 1$

show that $y = 4(3 - 1n2)$ at $x = 3$.

(8 marks)

 (b) Solve the differential equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 36e^{5x}, \text{ when } x = 0, \ y = 9 \text{ and } \frac{dy}{dx} = 25.$$

(12 marks)

4. (a) Integrate the following:

 (i) $\int_0^\pi x^2 Cos4x\,dx$;

 (ii) $\int \frac{3x+11}{x^2 - x - 6}\,dx$.

(15 marks)

 (b) Determine the area of the region bounded by $y = 2x^2 + 10$ and $y = 4x + 16$.

(5 marks)

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

5. (a) Two straights connected by a 5° curve has its long chord 60 m. Calculate the intersection angle and tangent length. (8 marks)

(b) State **four** methods of setting out a curve by offset method. (4 marks)

Deflection distance method   Offset from long chord method
Offset from tangent method

(c) Arc length 200 m of 3° curve connects two straights. Calculate:

   (i) tangent length;
   (ii) long chord;
   (iii) mid-ordinate;
   (iv) external distance.

(8 marks)

6. (a) With the aid of sketch, describe:

   (i) open traverse;
   (ii) closed traverse.

(6 marks)

(b) The data in **table 1** was obtained during a traversing exercise.

Table 1

Leg	Distance (m)	Bearing	E	N	E(d)	N(d)	Corrected E	N
TEP - 1	180.623	130° 26' 15"						
1 - 2	221.611	145° 36' 00"						
2 - 3	315.366	10° 53' 05"						
3 - MEP	217.960	222° 15' 00"						

Given the following datum co-ordinates:

Station	N(m)	E(m)
TEP	1000.375	−1133.680
MEP	846.000	−959.980

$E = L\sin\theta$
$N = L\cos\theta$

Correction

$E = \Sigma E$ of first E
$\Sigma D \times 1^{st}$ distance
Σ of distance

$N = \Sigma L \times \dfrac{1^{st} \text{ distance}}{\text{Total distance}}$

Compute and adjust the traverse TEP to MEP by the Bowditch's method.

(14 marks)

7. (a) Differentiate between the **two** forms of curves in surveying.

(4 marks)

(b) Two straights intersecting at point I are to be connected by a circular curve of radius 500 m. The angle of deflection of the straights is 20° 30' and the chainage at intersection point is 2346.35 m. If the curve is to be set out by deflection angle method and standard chord of 20 on through chainage basis.
Calculate and tabulate the setting out data.

(16 marks)

8. (a) Distinguish between whole circle bearing and quadrantal bearing.

(3 marks)

(b) Table 2 shows the internal angles of a closed traverse ABCDEA. If the whole circle bearing of AB is 65° 23' 00", determine the whole circle bearing of BC, CD, DE and EA.

Table 2

Angle	Angular measurement
ABC	160° 33' 47"
BCD	125° 50' 13"
CDE	46° 44' 18"
DEA	86° 26' 05"
EAB	120° 25' 37"

(17 marks)

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