2705/201
2707/201
2709/201
2710/201
MATHEMATICS II AND
SURVEYING II
June/July 2022
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 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.

SECTION A: MATHEMATICS II

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

1\. (a) Given that:

$$In = \int_0^{\frac{\pi}{2}} \cos^n \theta \, d\theta$$

Derive the reduction formula

$$In = \frac{n-1}{n} In - 2$$

Have evaluate:

$$\int_0^{\frac{\pi}{2}} Cos^5 \theta \, d\theta .$$

(8 marks)

(b) Equation of a parabola is given by $y^2 = 121x$.

(i) Sketch the area bounded by the parabola, the x-axis and the ordinate $x = 11$.

(ii) Determine by integration the area in (i).

(iii) Determine the co-ordinates of the centroid of the area. (12 marks)

2\. (a) Given the function:

$$y = ASin\frac{r\pi}{e} \times Sin\frac{r\pi ct}{e}$$, show

that $\frac{d^2y}{dx^2} = \frac{1}{C^2}\frac{\partial^2 y}{\partial t^2}$

(5 marks)

(b) The radius of a right circular cone increase at 1 cm s^{-1}. and the height increases at 2 cms^{-1}. Determine the rate at which the volume is increasing when the radius 1 m and height is 3 metres. (6 marks)

(c) A curve is given by the parametric equations:

$$x = 2(\theta + \cos\theta),\ y = 2(1 - \sin\theta)$$

Determine the radius of curvature of the curve when $\theta = \frac{\pi}{6}$. (9 marks)

3\. (a) Solve the differential equation:

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

given that when $x = 1$ $y = -3$ (9 marks)

(b) A mass of weight 2.5 Newtons stretches a spring by 0.625 metres. When released from equilibrium position, the resistive force twice the instantaneous velocity acts on the system. The mass is released from equilibrium with a upward velocity of $3ms^{-1}$. Determine its displacement X in terms of time.

(11 marks)

4. (a) Given that

$$m + 3j + \frac{4 - nj}{2 + 3j} = 4 - j2$$

determine the values of m and n. (7 marks)

(b) Solve the equation:

$$Z^2 - 3 + 5j = 0$$

(13 marks)

SECTION B: SURVEYING II

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

5. (a) Define the following terms as used in curve ranging:

(i) external distance (E);
(ii) point of intersection (P1)
(iii) middle Ordinate (M)
(iv) degree of curve(D).

(8 marks)

(b) The straights lines ABI and CDI are tangents to a proposed circular curve of radius 1600M. The lengths AB and CD are each 1200 m. The intersection point is inaccessible. Given the length of BD as 1485 m, and the angles at B and D as; a $A\hat{B}D = 123° 48'$ and $B\hat{D}C = 126° 12'$ respectively:
Calculate:

(i) distances from tangent points for points A and C respectively;
(ii) the deflection angles for the first sub-chord, standard chord and last sub-chord. Standard chord 30 m.
(iii) the setting out angles for the first five points from the first tangent point.

(12 marks)

6. The straights AB and BC intersect at poin B and are to be connected by a simple circular curve of 600 m radius. Given the deflection angle at B as 50°; calculate:

(i) tangent length;

(ii) length of curve;

(iii) chord length;

iv) chainage of A and C if the chainage of point B is 1122.59 m;

(v) all setting-out data assuming 30 m chord on a through chainage basis.

(20 marks)

7. (a) Outline the functions of the following components of a theodolite:

(i) footscrews

(ii) optical plummet;

(iii) tribrach. (6 marks)

(b) List **three** errors that may occur while taking readings with a theodolite. (3 marks)

(c) Outline the procedure of setting up a theodolite. (7 marks)

(d) Using the illustrations, distinguish between the following terms:

(i) interior and exterior angles;

(ii) forward and back bearings. (4 marks)

8. **Table 1** shows data from a loop traverse from datum point P and back to the same point. Using the data from **table 1** compute adjusted coordinates of stations A, B and C by Bowditch method given the following Datum Coordinates:

P:1000.00 mE, 1000.00 mN

Table 1

Line	**Corrected Bearing**	**Distance (m)**
PA	25° 33' 51"	1035.92
AB	72° 55' 15"	1415.50
BC	145° 43' 30"	1645.55
CP	270° 15' 36"	2732.11

(20 marks)

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