(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER MAIN EXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE (MATHEMATICS)

COURSE CODE: MAT 102

COURSE TITLE: ANALYTIC GEOMETRY

DATE: 25th April, 2023 **TIME:** 12.00noon - 2.00pm

INSTRUCTIONS TO CANDIDATES

- Answer question ONE (COMPULSORY) and any other TWO questions

Time: 2 hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MKS)

a) Find the direction cosines of the normal to the plane $3x+4y+12z=52$. Also find the length of the perpendicular from the origin to the plane. (4mks)

b) Find the area enclosed by one loop of the four-leaved rose $r=\cos 2\theta$. (4mks)

c) Sketch the graph of the quadric surface given by $\frac{x^2}{4}+\frac{y^2}{5}+\frac{z^2}{9}=1$ (4mks)

d) Find the spherical coordinates equation for the sphere $x^2+y^2+(z-1)=1$. (3mks)

e) Parameterize the curve $y=9x^2$, (2mks)

f) Determine the centre and radius of the circle whose equation is $2x^2+2y^2+6x-8y+12=0$. (3mks)

g) Find the equation of the tangent to the parabola $y=4x-x^2$ at the point (1, 3). (3mks)

h) Find the Equation of the hyperbola with vertices a$(0, \mp 1)$ and asymptotes $y=2x$. (4mks)

i) Write the equation of the plane through the points A(1,1,0), B(1,0,1) and C(0,1,1). (3mks)

QUESTION TWO (20 MKS)

a) Find the center, vertices, foci and asymptotes of the conic $9x^2-16y^2-72x-32y=16$ and sketch its graph. (8mks)

b) Find the equation of the tangent to cycloid $x=r(\theta-\sin\theta)$, $y=r(1-\cos\theta)$, $\theta=\frac{\pi}{3}$. (6mks)

c) A conic is given by the polar equation r= $\frac{10}{3-2\cos\theta}$, find the eccentricity, identify the conic, locate the directrix and sketch the conic. (4mks)

QUESTION THREE (20 MKS)

a) Describe the surfaces $\begin{matrix} 7x^2+4y^2-28z^2=0 \\ 3x^2+5y^2-15z=0 \end{matrix}$ (4mks)

b) The planes $x+2y-3z=2$ & $2x+3y+2z=4$ intersect on line L. Find the parametric equation of L and state its direction vectors. (6mks)

c) Find the equation of the ellipse with foci (2,-2), (4,-2) and vertices (1,-2), (5,-2) (5mks)

d) Sketch and identify the curve $r=1-2\cos\theta, 0\le\theta\le 2\pi$ (5mks)

QUESTION FOUR (20MKS)

a) Find the vertices and foci of the ellipse $9x^2 - 18x + 4y^2 = 27$ (7mks)

b) Calculate the perimeter of the hypocycloid with four cusps $x^{2/3} + y^{2/3} = a^{2/3}$.
(7mks)

c) write the equation of the circle through the following points
$A(4,3), B(0,1)$ *and* $C(1,0)$ (6mks)

QUESTION FIVE (20 MKS)

a) a curve C is defined by the parametric equations $x = t^2, y = t^3 - 3t$;

i) Show that C has two tangents at the point (3, 0) and find their equations. (5mks)

ii) Find the point on C where the tangent is horizontal or vertical. (6mks)

iii) Determine where the curve is concave upward or downward. (2mks)

iv) Sketch the curve. (2mks)

b) Find the vertex, focus and directrix of the curve $X + 2^2 = 8(y - 3)$ (5mks)