(110)

(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2015/2016 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE (MATHEMATICS) AND BACHELOR OF EDUCATION

COURSE CODE: **MAT 224**

COURSE TITLE: ANALYTIC GEOMETRY

DATE: 29/4/16 **TIME:** 8.00 AM -10.00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (COMPULSORY) (30 MARKS)

(a) Find the distance of the point (2, 4, -5) from the plane $5x - 3y + z - 10 = 0$. (2 mks)

(b) Calculate the length of the curve $y = \ln(\sec x)$ for $0 \leq x \leq \frac{\pi}{4}$ (round your answer to 2 decimal places) (5mks)

(c) Write the vector form of a line through the points P_1 = (-3, 1,-4) and P_2 = (4, 4,-6) in parametric form. (3mks)

(d) Find the center and the radius of the circle $x^2 + y^2 - 4x + 6y = 12$ (3mks)

(e) Determine the angle between the lines whose direction ratios are (1, 1, 2) and $(\sqrt{3}, -\sqrt{3}, 0)$ (3mks)

(f) Given, the point (-2,-2,1), in Cartesian coordinates, convert it to

(i) Cylindrical coordinates (3mks)

(ii) Spherical coordinates (3mks)

(g) Sketch and identify the curve defined by the parametric equations;

(i) $x = 4\cos t, y = 2\sin t\ 0 \leq t \leq 2\pi$ (4mks)

(ii) $x = 2 + \cos t, y = 4 + \sin t\ 0 \leq t \leq 2\pi$ (4mks)

QUESTION TWO (20 MARKS)

(a) Given the equation of a circle $x^2 + y^2 = r^2$.

(i) Write this equation in parametric form (4mks)

(ii) Show that the length of the curve from $t = 0$ to $t = 2\pi$ is $2\pi r$ (4mks)

(b) Eliminate the parameter t and identify the curve defined by the parametric equations $x = t\cos t$, $y = t\sin t$ for$0 \leq t \leq 3\pi$. (4mks)

(c) Find the equation of a planeP containing the point (-3,1,3) and perpendicular to the vector, $\boldsymbol{n} = < 2,4.8 >$ in normal form (4mks)

(d) Find the vector equation of a line through the points P_1 = (-3, 2,-4) and P_2 = (4, 4,-6) in symmetric form. (4mks)

QUESTION THREE (20 MARKS)

(a) Define the terms (6 mks)

(i) Parabola

(ii) Hyperbola

(iii) Ellipse

(b) Analyze the following the following curves, in each case sketch its graph (14 mks)

(i) $y^2 + 2y + 8x + 17 = 0$

(ii) $9x^2 - 4y^2 - 72x + 8y + 104 = 0$

(jj) $2x^2 + y^2 - 4x - 6y + 3 = 0$

QUESTION FOUR(20 MARKS)

(a) Given lines whose direction ratios are given by the relations $l + m + n = 0$and $l^2 + m^2 - n^2 = 0$, find the angle between the lines. (8mks)

(b) Find the ratio in which the line through the points (1, -3, 2) and (-5, 4, -3) is divided by the plane $2x - 3y + z + 6 = 0$. Also find the coordinates of the point of intersection. (7mks)

(c) Find the coordinates of the point where a line through (3, -4, -5) and (2, -3, 1) crosses the plane $2x + y + z = 7$ (5mks)

QUESTION FIVE(20 MARKS)

(a) Using a diagram, derive the relationship between the Cartesian and spherical coordinates, hence convert (-1, 1, -√2) from Cartesian to spherical coordinates. (10 mks)

(b) Given a Cartesian coordinate $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 5\right)$ convert the point to cylindrical coordinates(5 mks)

(c) Convert the equation $r = 3$ into Cartesian coordinates and identify the surface of the equation given that the equation is in three dimension. (5 mks)