



(Knowledge for Development)

KIBABII UNIVERSITY COLLEGE

**A CONSTITUENT COLLEGE OF MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY**

UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

AND BACHELOR OF EDUCATION

COURSE CODE: MAT 224

COURSE TITLE: ANALYTIC GEOMETRY

DATE: 27/4/15

TIME: 11.30AM -12.30PM

INSTRUCTIONS TO CANDIDATES

Answer Question One in and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 4 Printed Pages. Please Turn Over.

Question one (30 Marks)

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

[4 marks]

- b) What are the direction cosines of a line normal to the lines whose equations are;

$$\frac{x-2}{-1} = \frac{y+1}{2} = \frac{z-4}{-3} \quad \text{and} \quad \frac{x+2}{-2} = \frac{y+3}{1} = \frac{z-2}{3}$$

[3 marks]

- c) Find the angle between the lines whose direction ratios are given by the relations

$$l + m + n = 0 \quad \text{and} \quad l^2 + m^2 - n^2 = 0$$

[3 marks]

- d) Find the distance between the parallel planes whose equations are;

$$2x - 2y + z + 3 = 0 \quad \text{and} \quad 4x - 4y + 2z + 5 = 0$$

[2 marks]

- e) Find the equation of the perpendicular from the point $P(1, 6, 3)$ to the line

$$\frac{x-2}{1} = \frac{y+1}{-1} = \frac{z+1}{-3}$$

. Also obtain the foot of the perpendicular and its length. [4 marks]

- f) Find the centre and the radius of the sphere whose equation is

$$2x^2 + 2y^2 + 2z^2 - 2x + 4y - 6z - 1 = 0.$$

[3 marks]

- g) Find the focus and the directrix of the parabola $7x^2 = 4y$. Sketch. [4 marks]

- h) Discuss and sketch the graph of the equation $4x^2 + 18y^2 = 36$. [4 marks]

- i) Write the equation $x^2 - y^2 = 5z^2$ in cylindrical coordinates. [3 marks]

Question Two (20 Marks)

- a) Find the equation of a sphere through the origin, which passes through the points $(0,1,-1), (-1,2,0)$ and $(1,2,3)$ [6 marks]
- b) Find the equation of a right circular cone which passes through the point $(2,1,3)$ with the vertex at $(1,1,2)$, and whose axis is parallel to the line $\frac{x-2}{2} = \frac{y-1}{-4} = \frac{z+2}{3}$ [7 marks]
- d) Find the length and the equation of the line of the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ [7 marks]

Question three (20 Marks)

- a) Analyze the equation $3x^2 - 8y - 12z = 4$ and sketch its graph. [8 marks]
- b) Analyze the equation $x^2 - 4y^2 + 2x + 8y - 7 = 0$ and sketch its graph. [6 marks]
- c) Find the locus of the point whose distance from the point $(1,-1,1)$ is five times its distance from the plane $2x + 3y - 6z = 2$. [6 marks]

Question four (20 Marks)

- a) Describe the set of points $P(r, \theta, z)$ whose cylindrical coordinates satisfy the simultaneous equations $r = 2, \theta = \frac{\pi}{4}$. [10 marks]
- b) Evaluate the repeated integral by changing to cylindrical coordinates;

$$\int_{x=0}^3 \int_{y=0}^{\sqrt{9-x^2}} \int_{z=0}^2 \frac{1}{\sqrt{x^2 + y^2}} \partial z \partial y \partial x$$

[10 marks]

Question five (20 Marks)

- a) Find the equations of the planes bisecting the angles between the planes $2x - y + 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$, and specify the one that bisect the acute angle.

[10marks]

- b) Find the equation of the sphere having its centre on the plane $4x - 5y - z = 3$ and passing through the circle $x^2 + y^2 + z^2 - 2x - 3y + 4z + 8 = 0, x - 2y + z = 8$. [10 marks]