KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SPECIAL EXAMINATION

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE IN BACHELOR OF EDUCATION SCIENCE

SECOND SEMESTER 2021/2022

(JULY, 2022)

MATH 114: GEOMETRY AND LINEAR ALGEBRA

STREAM: Y1 S2 **TIME: 2 HOURS**

DAY: WEDNESDAY, 11.30 AM – 1.30 PM **DATE: 20/07/2022**

INSTRUCTIONS:

1. Do not write anything on this question paper.
2. Answer ALL Questions in section A (Compulsory) and any other TWO Questions in section B.

SECTION A (30 MARKS)

1.

a. Show that lines $4x + 6y = 2$ and $6x = 4y + 1$ are perpendicular (4marks)

b. Find the scalar of $\vec{A} = 14i + 12j - 8k$ and $\vec{B} = 6i + 4j - 8k$and the angle θ between them. (6 marks)

c. Simplify $(4 + 3i)^3$ (3 marks)

d. Differentiate between standard and general forms of a circle (4 marks)

e. Express $r = 1 - 3cos\theta$ in rectangular coordinates (3 marks)

f. Find the polar equation of the circle whose Cartesian equation is $2x^2 + 2y^2 = 8x$ (6 marks)

g. Find the equation of hyperbola having foci $at\ F1(-5,0)\ and\ F2(5,0)$ and the difference of the total radii 6. (4 marks)

SECTION B (20 MARKS)

2.

a. A line passes through points $A(2,-1,5)$ and $B(3,6,-4)$.

i. Write a vector equation of the line. (5marks)

ii. Write parametric equations for the line. (5marks)

iii. Determine if the point $C(0,-15,9)$ lies on the line. (5marks)

b. Find the foci, vertices and asymptotes of a hyperbola with equation $\frac{(x+2)^2}{9} = 1 + \frac{(y-1)^2}{4}$ (5marks)

3.

a. Find the axis, vertex,focus and directrix of the parabola $2y^2 + 16x - 12y + 2 = 0$ (6 mark)

b. Let $z_1 = 2 + 2\sqrt{3i}$ and $z_2 = -1 - \sqrt{3i}$, Evaluate $3(z_1 z_2)$ (4 marks)

c. Given that $\vec{A} = i - 3j + 2k$ and $\vec{B} = 2i + 6j$ find

i. $\vec{A}X3\vec{B}$ (5 marks)

ii. $\vec{B}X\vec{A}$ (5 marks)

4.

a. Check if the two line $3x - 5 = 2y$ and $4x + 5y = 1$ are parallel (4 marks)

b. Find the foci, vertices and asymptotes of a hyperbola with equation $\frac{(x+2)^2}{9} - 1 = -\frac{(y-1)^2}{4}$ (6 marks)

c. Find a unit vector that is perpendicular to both $\vec{A} = 2i - 2j - k$ and $\vec{B} = i + j + k$. What is the area of the parallelogram with $\vec{A}$ and $\vec{B}$ as its sides? (5 marks)

d. Find the axis, vertex,focus and directrix of the parabola $y^2 + 8x - 6y + 1 = 0$ (5 marks)

5.

a. Write the equation of the circle $6x^2 + 6y^2 - 24x + 36y + 30 = 0$ in standard form (4 marks)

b. Derive the equation of an ellipse and use it to find the foci and vertices of the ellipse $\frac{x^2}{16} = 1 - \frac{y^2}{25}$ (10 marks)

c. Given $\vec{A} = 3i - 2j - 5k$ and$\vec{B} = 2i + j + k$. Find;

i. $\overrightarrow{||-7A||}$ (2 marks)

ii. $\overrightarrow{||2A} - \overrightarrow{3B||}$ (2 marks)

iii. $\vec{A}.\vec{B}$ (2 marks)