



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE
AND TECHNOLOGY
UNIVERSITY EXAMINATION 2012/2013**

**1ST YEAR 1ST SEMESTER EXAMINATION FOR THE
DEGREE OF BED (SCIENCE) AND BSC. (ACTUARIAL
SCIENCE)
(REGULAR)**

COURSE CODE: SMA 101

TITLE: ANALYTICAL GEOMETRY

DATE: 22/4/2013

TIME: 14.00-16.00PM

DURATION: 2 HOURS

INSTRUCTIONS

- 1. This paper contains SIX (6) questions**
- 2. Answer question 1 (Compulsory) and ANY other 2 Questions**
- 3. Write all answers in the booklet provided**

QUESTION ONE-30 MARKS (COMPULSORY)

- a) Use the third order matrix determinant to determine the equation of a line passing through the points A(1, 1) and B(4, -5) giving your answer in double intercept form. (4 marks)
- b) Determine the equation of a plane that passes through the points A(1,2,0), B(-1,0,1) and C(-2,1,-1) (4 marks)
- c) Given two parallel lines $4y - 3x = -3$ and $4y = 3x - 28$, determine the distance between them and the equation of a line that passes midway between them. (4 marks)
- d) Identify the conics given below (4 marks)
- (i) $x^2 - 4xy + 4y^2 - 24x + 12y = 0$
- (ii) $x^2 - 2xy + 2y^2 - 25 = 0$
- e) Find the equation of a circle which passes through (6, -5), (2, -7) and (-6, -1) giving your answer in the form $Ax^2 + By^2 + Cx + Dy + E = 0$. Give the equations of four lines that intersect to form the square that circumscribes the circle. (10 marks)
- f) Give polar coordinates in two forms for each of the following points, one with positive polar coordinates and another with negative polar coordinates. (4 marks)
- i) (-4, 5) ii) (-2, -7)

QUESTION 2 (20 MARKS)

- a) The equation of an ellipse is given by $25x^2 + 36y^2 - 200x + 216y - 176 = 0$
Find on the xy plane
- i) The centre of the ellipse (4 marks)
- ii) The coordinates of the vertices (2 marks)
- iii) The foci (2 marks)
- iv) The eccentricity (1 mark)
- v) The directrices (2 marks)
- vi) The area of the ellipse (2 marks)
- b) Determine the cartesian equations given that $x = 2\sin q$ and $y = 3\cos q$ hence sketch the curve on an xy plane (3 marks)
- c) Sketch the curve $r = \frac{6}{2 + 6\cos q}$ stating and clearly indicating the vertex/vertices and the focus/foci (4 marks)

QUESTION 3(20 MARKS)

- a) The equation of a hyperbola is given as $9x^2 - 36x - 4y^2 + 24y - 36 = 0$. Find
- i) The coordinate of the centre. (4 marks)
- ii) The foci of the hyperbola on the xy plane. (2 marks)
- iii) The vertices on the xy plane. (2 marks)
- iv) The asymptotes on the $x'y'$ plane and on the xy plane. (2 marks)
- v) The eccentricity (1 mark)
- vi) The directrices on the $x'y'$ plane and on the xy plane. (2 marks)
- b) A second degree curve is represented by the equation $x^2 - 2xy + y^2 - 16x - 48y = 0$. By eliminating the cross product term identify the conic section hence give its

equation on the $x'y'$ plane and state the equation of the axis.
(7 marks)

QUESTION 4 (20 MARKS)

- a) Sketch the polar curve $r = 5 \cos^2 \theta$ of each of the following in the range $0^\circ \leq \theta \leq 360^\circ$ and give its name (7 marks)
- b) Given three points A(1,1), B(-2,4) and C(-3,-1), Determine the equation of the lines AB and BC hence determine the value of angle ACB (7 marks)
- c) Give any two pair of parametric equations which represent the equation $9x^2 - 4y^2 = 36$ (4 marks)
- d) Convert the following points into cartesian coordinates
- i) $(-5, 30^\circ)$ ii) $(4, \frac{\pi}{2})$ (2 marks)

QUESTION 5 (20 MARKS)

- a) A parabola has the equation $y^2 - x - 4y + 3 = 0$
Determine
- i) the coordinates of the vertex (2 marks)
- ii) The focus. (2 marks)
- iii) The equation of the axis of symmetry (2 marks)
- iv) The equation of the directrix (2 marks)
- a) The coordinates of two points A and B are given as A(-4, 1) and B(2, 2), Determine the equation of a line perpendicular to AB and divides AB in the ratio 4: -1 giving your answer in the form $Ax + By + C = 0$ where A and B are constants (4 marks)
- b) A hyperbola whose centre is (2, -3) has its foci $\sqrt{13}$ units away from the centre along an axis parallel to the y - axis. If the vertices are 2 units away from the centre, then determine;
- (i) The equation of the hyperbola in the form $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ (4 marks)
- (ii) State the equation of the asymptotes. (4 marks)