



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE
UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE
ACTUARIAL
SPECIAL RESIT 2015/2016 ACADEMIC YEAR
MAIN REGULAR RESIT

COURSE CODE: SMA101

COURSE TITLE: ANALYTICAL GEOMETRY

EXAM VENUE: LAB 1

STREAM: (BSc. Actuarial)

DATE: 04/05/2016

EXAM SESSION: 11.30 – 1.30 PM

TIME: 2.00 HOURS

Instructions:

- 1. Answer question 1 (Compulsory) and ANY other 2 questions**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (COMPULSORY)

- a) Define the Conic sections below
- i) Hyperbola
 - ii) Ellipse (2 marks)
- b) Determine the distance between two parallel lines $y = 4x + 10$ and the line passing through the points $(0,0)$ and $(-1,-4)$ (4 marks)
- c) A line L_1 has an equation $y = -2x + 6$. Calculate the acute angle between L_1 and L_2 whose equation is $3y + 2x + 6 = 0$ (4 marks)
- d) Calculate the area of a circle which passes through $(4, 7)$, $(-13, 0)$ and $(11,0)$. (Give your area in terms of π) (7 marks)
- e) Convert the following polar coordinates in to Cartesian coordinates
- (i) $(-4, 200^\circ)$
 - (ii) $(6, -\frac{\pi}{4})$ (4 marks)
- f) Use the third order matrix determinant to determine the equation of a line passing through the points $(-5, -2)$ and $(15, 3)$ giving your answer in double intercept form, hence declaring the intercepts. (4 marks)
- g) Determine the centre and area of an Ellipse bounded by the lines $y = 8$, $y = -2$, $x = 3$ and $x = -3$. (5 marks)

QUESTION 2(20 MARKS)

- a) The equation of an ellipse is given by $72x^2 + 50y^2 - 432x + 400y - 352 = 0$
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)
 - (vii) The area of the ellipse (3 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. (6 marks)

QUESTION 3(20 MARKS)

- a) The equation of a hyperbola is given as $3x^2 - 12x - \frac{4}{3}y^2 - 8y - 12 = 0$. 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. (4 marks)
 - (vi) The eccentricity (1 mark)
 - (vii) The directrices on the $x'y'$ plane and on the xy plane. (3 marks)

b) Give the cartesian equation of the following pairs of parametric equations

(i) $x = t - t^2$, $y = t^2 + t^3$ (2 marks)

(ii) $x = \frac{2t}{1+t^3}$, $y = \frac{2t^2}{1+t^3}$ (2 marks)

QUESTION 4(20 MARKS)

a) Find the parametric equation of the following Cartesian equations

(i) $x^3 + y^3 = 3xy$ (2 marks)

(ii) $xy = x - y$ (2 marks)

(iii) $\frac{x^2}{9} + \frac{y^2}{4} = 1$ (2 marks)

b) (i) A conic section has the equation $3x^2 + 4\sqrt{3}xy - y^2 = 7$. Rotate the axes of the conic section by eliminating the cross product term. (8 marks)

(ii) Identify the conic section on the new $x'y'$ plane (2 marks)

(iii) Give the coordinates of the focus/foci of the conic on the $x'y'$ plane. (2 marks)

(iv) Find the eccentricity of the conic section (2 marks)

QUESTION 5(20 MARKS)

a) Sketch and give the name of the polar curves $r = 1 + 4\cos\theta$ (6 marks)

b) Identify the conic sections given below

i) $4x^2 - 4xy + y^2 - 5\sqrt{5}x + 5 = 0$ iii) $r = \frac{4}{2 - 2\cos\theta}$ (6 marks)

ii) $3x^2 - 4\sqrt{3}xy - y^2 = 24$ iv) $r(8 + 6\sin\theta) = 0$

c) A parabola has the y - intercepts -1 and 2 while the x -intercept is 4
Find (8 marks)

- (i) The equation of the parabola
- (ii) The equation of the axis of the parabola
- (iii) The vertex and focus of the parabola
- (iv) The equation of the directrix of the parabola