THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL, MECHANICAL, ELECTRICAL & ELECTRONIC ENG, BACHELOR OF ENG IN ELECTRICAL & ELECTRONIC ENG, BUILDING & CONSTRUCTION

SMA 2171: GEOMETRY

AMA 4102: GEOMETRY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions
Answer question **ONE (COMPUSLSORY)** and any **TWO** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1 (30 Marks)

a) Prove that $\tan\theta + \cot\theta = \sec\theta\csc\theta$ (4 marks)

b) If $\cos A = \dfrac{2}{5}$, $\tan B = \dfrac{5}{12}$ and B being acute, find the value of $\sin(A+B)$. (4 marks)

c) Given the lines, L_1 and L_2 such that L_1 passes through $P_1(0,5)$ and $P_2(-1,3)$ and L_2 passes through $P_2(-1,3)$ and $P_3(3,1)$, show that the lines L_1 and L_2 are perpendicular (3 marks)

d) Find the distance from the point (2,1) to the line $4x + 2y + 7 = 0$ (4 marks)

e) Find the equation of the curve that is the locus of all point equidistant from the line $x = -3$ and the point (3,0) (5 marks)

f) Find the centre of the circle and the radius of the circle given by the equation
$$x^2 + y^2 + \frac{1}{2}x - 3y - \frac{27}{16} = 0$$
(5 marks)

g) Give the length of a, the length of the focal chord and the equation of the parabola which is the locus of all points equidistant from the point (3, 0) and the line $x = -3$ (5 marks)

SECTION B (Answer any TWO questions)

Question 2 (20 Marks)

a) Find the foci, directices, eccentricity, length of focal chord and equation of the asymptotes of the hyperbola described by the equation
$$\frac{x^2}{9} - \frac{y^2}{16} = 1$$
(10 marks)

b) Express the equation of the following circle with its centre (a, 0) and with radius a in polar coordinates (5 marks)

c) Change the following equation to an equation in rectangular coordinates (5 marks)
$$r = \frac{3}{\sin \theta - 3\cos \theta}$$
(5 marks)

Question 3 (20 Marks)

a) Discuss and sketch the graph of the equation $16x^2 + 9y^2 + 64x - 18y - 71 = 0$ (7 marks)

b) Discuss and sketch the parabola $y = x^2 + 4x$ (8 marks)

c) Find the points of contact of the horizontal and vertical tangents to the curve represented by the parametric equation $x = 3 - 4\sin\theta$ and $y = 4 + 3\cos\theta$ (5 marks)

Question 4 (20 Marks)

a) Sketch the graph $r = 2 + 4\cos\theta$ (10 marks)

b) Find the equation of the tangent at the point (3,1) on the circle
$x^2 + y^2 - 4x + 10y - 8 = 0$
(5 marks)

c) In the triangle $\Delta PQR, r = 5.75cm, \ P = 42^o, \ Q = 65^o$. Calculate length PR (5 marks)

Question 5 (20 Marks)

a) Determine whether the lines $5y = 12x - 33$ and $3x + 4y = 9$ are tangents to the circle $x^2 + y^2 + 2x - 8y = 8$.

b) In triangle $\Delta XYZ, \ XY = 3.5cm, YZ = 4.5cm$ and $ZX = 6.5cm$. Calculate the size of angle Y
(5 marks)

c) Given that $\sin(x + \alpha) = \cos(x - \beta)$. Find *Tan x* in terms of α and β (7 marks)

d) Show that $\sin 3\theta - 3\sin 3\theta - 4\sin^3\theta$ (3 marks)