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 ELECTRICAL & ELECTRONIC/MECHANICAL/CIVIL ENGINEERING

SMA 2107/AMA 4102: GEOMETRY

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY/MARCH 2012
TIME: 2HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*

This paper consists of **FIVE** questions
Answer Question **ONE** (**Compulsory)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION A (Compulsory)

QUESTION ONE (30 MARKS)

a) Prove that $\dfrac{\sin 3A\sin 6A+\sin A\sin 2A}{\sin 3A\cos 6A+\sin A\cos 2A}=\tan 5A$ (4 marks)

b) Given that $\theta = 5/13$ and $\sin\alpha = 3/5$ such that α is obtuse, work out the possible values of $\tan\alpha - \theta$
(4 marks)

c) In triangle $PQR, QR = 3.5,\ RP = 4$ and $PQ = 5.$ Calculate the size of the angle P and hence find the area of the triangle. (3 marks)

d) Find the equations of the two straight line which pass through the point (3, -2) and make angles of 60^o with the line $\sqrt{3}x + y = 1$ (3 marks)

e) Verify that the point (3,2) lies on the circle $x^2 + y^2 - 8x + 2y + 7 = 0$ and find the equation of the tangent at this point. (4 marks)

f) Find the eccentricity, the coordinates of the foci and the equations of the asymptotes of the hyperbola $4x^2 - 9y^2 = 36$ (4 marks)

g) Find the general solution of the equation $2 \sin 3x \sin x = 1$ (3 marks)

h) Find the Cartesian equations of

(i) $r = a(1 + 2\cos\theta)$ (3 marks)

(ii) $r\cos(\theta - \alpha) = P$ (2 marks)

SECTION B (Attempt any TWO questions)

QUESTION TWO (20 MARKS)

a) A triangle ABC has sides a, b, c and semi-perimeter S (so that a + b +c =2s). Show that its real is $\Delta = \sqrt{\{s(s-a)(s-b)(s-c)}$ (6 marks)

b) Solve the equation: $\cos 6x + \cos 4x + \cos 2x = 0$ for values of x from 0^o to 180^o inclusive (5 marks)

c) If $\alpha = \frac{1}{5}$, $\tan\beta = \frac{4}{19}$ and $\gamma = \frac{2}{5}$, show that $\tan(\alpha + \beta + \gamma) = 1$ (4 marks)

d) The elevations of the top Q of a flagstaff PQ from three distant points, A, B, C which are in a horizontal line with P are θ, 2θ and 3θ respectively. Prove that AB = 3BC approximately. (5 marks)

QUESTION THREE (20 MARKS)

$$\left(\frac{x^2}{a^2}\right)+\left(\frac{y^2}{b^2}\right)=1$$

a) Show that the tangents to the ellipse at points whose eccentric angles differ by 90^o meet on the ellipse $\left(\frac{x^2}{a^2}\right)+\left(\frac{y^2}{b^2}\right)=2$ (5 marks)

b) The line joining the points (-1, 7) and (23, 17) is taken as the diameter of a circle. Find the equation of this circle, the length of its radius and the coordinates of its centre. (5 marks)

c) Find:

(i) The rectangular coordinates of the point whose polar coordinates are $6,\frac{\pi}{3}$ and;

(ii) The polar coordinates of the point whose Cartesian coordinates are (-5, 12) (5 marks)

$$2\sin^{-1}x+\sin^{-1}\left(x^2\right)=\frac{1}{2}\pi$$

d) Find x from the equation (5 marks)

QUESTION FOUR (20 MARKS)

$y^2=4a(a-x)$ $r=\frac{2a}{1+\cos\theta}$

a) Show that has a polar equation (8 marks)

$r=\frac{1}{\pi}\theta$ $0\le\theta\le\pi$

b) Sketch the graph for where (3 marks)

$A(2,-2),\ B(3,4)$ $x+y=2.$

c) A circle passes through the point and its centre is on the line Find its equation (5 marks)

d) Show that the point of intersection of two perpendicular tangents to a parabola lies on its directrix (4 marks)

QUESTION FIVE (20 MARKS)

$F(\cos\alpha+\mu\sin\alpha)=\mu W$ $\mu=\tan\lambda$ $F=\frac{W\sin\lambda}{\cos(\alpha-\lambda)}$

a) If where , prove that (5 marks)

$$\theta\sin 3\theta+\sin 2\theta\sin 6\theta+\sin 3\theta\sin 9\theta=2\sin 3\theta\sin 7\theta\cos 2\theta$$

b) Show that sin (6 marks)

c) A triangle has sides of lengths $m - n$, m and $m+n$ where $m>n>0$. Use the cosine formula to show that if the triangle is obtuse angled, then $\frac{1}{4}m < n < \frac{1}{2}m$. (5 marks)

d) Solve the triangle in which $B = 60^\circ,\ b = 14cm$ and c = 16cm. (4 marks)