TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

BACHELOR OF SCIENCE IN STATISTICS & COMPUTER SCIENCE
BACHELOR OF CHEMICAL ENGINEERING
BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

AMA 4102/SMA 2171: GEOMETRY

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME ALLOWED: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One (Compulsory)

a) Show that

$$\frac{\tan^2 \theta + 2}{1 + \tan^2 \theta} = 1 + \cos^2 \theta$$

(3 marks)

b) Three circles with radii 4, 5, 6 cm respectively are tangent to each other externally. Find the smallest angle of the triangle whose vertices are the centre of the circle **(4 marks)**

c) Express in polar form the Cartesian equation of the circle:

$$x^2 + y^2 = 4x$$

and hence graph the polar equation **(5 marks)**

d) Solve for x: $\sin 3x + \sin x = 0$ for $-180 \le x \le 180$ **(5 marks)**

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

f) Two banks of a rive are parallel and the distance between two points A and B along the same bank is 20 metres. For a point C on the opposite bank $\angle$ BAC=56º and $\angle$ ABC = 41º. Determine the width of the river. **(4 marks)**

g) Convert
  (i) 3.47 radians to degrees. **(2 marks)**
  (ii) 837º into radians **(2 marks)**

Question Two

a) Determine the equation of the circle that passes through the points (2, 8), (5, 7) and (6, 6) and state its centre and radius. **(10 marks)**

b) Solve for x within $0 \leq x \leq 360$ $7\cos x + 2\sin x = 4$ **(10 marks)**

Question Three

a) Prove the identity:
$$\frac{\sin 3\theta}{\sin \theta} - \frac{\cos 3\theta}{\cos \theta} = 2$$
(6 marks)

b) Solve the equation $12\cos^2 \theta + \sin \theta = 11$ if $0 \leq \theta \leq 360$ **(7 marks)**

c) Determine the equation of the tangent to the curve:
$x^2 + y^2 - 4x - 2y - 8 = 0$ and parallel to the line $3x + 2y = 0$ **(7 mark)**

Question Four

a) Show that for any triangle ABC
$$\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2 + b^2 + c^2}{2abc}$$
(6 marks)

b) Express in rectangular form:
$r = \sin \theta \cot \theta$
(4 marks)

c) Find the equation and length of the tangent line of $y^2 = \frac{4}{3}x$ at (3, 2) **(7 marks)**

d) Given that: $\sin(x - 2) = \cos(x + \alpha)$ show that $\tan \alpha = 1$ **(3 marks)**

Question Five

a) Find the points of contact of the horizontal and vertical tangent to the curve:

$$y = 3 - 4\sin\theta$$
$$y = 4 + 3\cos\theta$$

(9 marks)

b) The angle of elevation of the peak of a mountain from a point A is 35°. The angle of elevation from point B which is 500m directly behind A is 25°. Determine the height of the mountain. **(8 marks)**

c) If $\tan\theta = -\dfrac{4}{3}$ where θ is obtuse. Determine $\dfrac{\sec^2\theta + 1}{17}$ **(3 marks)**