**TECHNICAL UNIVERSITY OF MOMBASA**

*A Centre of Excellence*

*Faculty of Applied & Health Sciences*

**DEPARTMENT OF MATHEMATICS AND PHYSICS**

**APRIL 2016 SERIES EXAMINATION**

**UNIT CODE: AMA 4102  UNIT TITLE: GEOMETRY**

**MAIN EXAMINATION**

**TIME ALLOWED: 2HOURS**

<u>*INSTRUCTIONTO CANDIDATES:*</u>

You should have the following for this examination

- Mathematical tables
- Scientific Calculator

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

**QUESTION ONE  COMPULSORY (30 MARKS)**

a. Prove that $\dfrac{1+\cot\theta}{1+\tan\theta} = \cot\theta$ (4 marks)

b. Find the equation of the straight line whose unit normal is (5,2)  and passes through the point (2,1). Write the equation in the form Ax+By+Cz=0 (4 marks)

c. Determine the diameter and the circumference of a circle if an arc of length 4.75 subtends an angle of 0.91 rads (3 marks)

d. Express (4.5, 5.16 rad) in Cartesian coordinate and hence present it on the axis (4 marks)

e. A force of 4N is inclined at angle of $45^0$ to a second force acting at a point. Find the magnitude of the resultant of these two forces and direction of the resultant with respect to the 7N force by triangle method and by measurement. (4 marks)

f. Solve triangle DEF and find its area given that EF=35mm, DE= 25mm and angle at E is $64^0$ (6  marks)

g. The equation of a circle is given by $x^2 - 6x + y^2 + 4y - 3 = 0$ . determine the center and radius of the circle (5 marks)

**QUESTION TWO (20 MARKS)**

a. Find the points in which the lines $5y = 3x - 5$ cuts the hyperbola $4x^2 - 25y^2 = 15$ and the equations of the tangent to the hyperbola at these points. (5 marks)

b. Given the equation of the line in the form $\dfrac{x-2}{3} = \dfrac{y-4}{5} = \dfrac{z-7}{2}$ . Express it in the form $r = a + tu$ hence determine whether the point (8, 14, 11) lies on the line. (6 marks)

c. Determine the length of a tangent from the point (5,7) to the circle whose equation is $x^2 + y^2 - 4x - 6y + 9 = 0$ (5 marks)

d. Two cars P and Q are travelling towards the junction of two roads which are at right angles to one another. Car P has a velocity of 45km/h due East and car Q has a velocity of 55km/h due south. Calculate

    i.   The velocity of car P relative to car Q (2 marks)

    ii.  The velocity of car Q relative to car P (2 marks)

**QUESTION THREE (20 MARKS)**

a. Find the Cartesian equation of the polar equation $rcos\left(\theta - \frac{\pi}{3}\right) = 3$     (5 marks)

b. Find the distance from the point (2,1) t0 the line $4x + 2y + 7 = 0$     (4 marks)

c. Find the equation of the two tangent that can be drawn from the point (2,3) to the parabola $y^2 = 4x$     (5 marks)

d. Solve $3cos2\theta + sin\theta = 1$ for values of $\theta$ in the range $o \leq \theta \leq 360^0$     (6 marks)

**QUESTION FOUR (20 MARKS)**

a. Given that $p = 2i + j - k \ and \ q = i - 3j + 2k$. Determine

     i.      P.Q      (1 marks)

     ii.      P+Q      (1 marks)

     iii.      $|P + Q|$      (1 marks)

     iv.      $|P|+|Q|$      (1 marks)

b. Find the length of the tangent to the circle $x^2 + y^2 - 2x + 4y - 4 = 0$ from the center of the circle $x^2 + y^2 + 6x + 8y = 0$     (6 marks)

c. Plot a graph of the polar equation $r = 3cos3\theta$ in the range $0 \leq \theta \leq 360^0$ and hence state the rectangular coordinate from the polar equation     (6 marks)

d. Describe the circle represented by $x^2 + y^2 - 4x - 2y + 1 = 0$ and hence determine the equation of the tangent and the normal line at the point $(2 + \sqrt{3}, 2)$ (4 marks)

**QUESTION FIVE (20 MARKS)**

a. $If \ 4i + j - 2k, q = 3i - 2j + k \ and \ r = i - 2k. find$

     i.    $(p - 2q)xr$      (2 marks)

     ii.    $Px(2rx3q)$      (3 marks)

b. If $cos A = \frac{2}{5}, tan B = \frac{5}{12}$ and B being acute. Find the value of $sin(A + B)$ (3 marks)

c. Show that the distance between the line Ax+By+C=0 and a point (x, y) is given by

$r = \frac{Ax+By+c}{\sqrt{A^2+B^2}}$      (7 marks)

d. Find the equation for a hyperbola with asymptotes $y = \pm\frac{4}{3}x$ and a foci $(\pm10, 0 \ )$

     (5 marks)

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