THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN ARCHITECTURE

DIPLOMA IN BUILDING & CIVIL ENGINEERING

AMA 2106: GEOMETRY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Mathematical tables*
- *Scientific calculator*

This paper consists of **FIVE** questions
Answer any **THREE** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

Question 1 (20 marks)

$$2 \sin\left(\frac{A+B}{2}\right) \cos\left(\frac{A+B}{2}\right) = \sin A + \sin B$$

a) Prove   (6 marks)

b) Solve the equation;   (8 marks)

$$\cos 2\theta - \cos \theta = 0$$

(8 marks)

c) A tower 10m high is constructed on a hill. The angle of depression to a beacon in the field is found to be 24º. The angle of depression from the foot of the tower to the same beacon is 10º. Determine;
   (i)   The height of the hill
   (ii)   The distance between the beacon and the hill   (6 marks)

Question 2 (20 marks)

a) Three forces acting at a point are 30N at 30º, 100N at 150º and 150N at 300º from the horizontal axis in anticlockwise direction. Determine:
   (i)   The resultant force
   (ii)   The direction in which the resultant force acts.   (10 marks)

b) Three forces act at a point. They are given as follows:

$$p = 4\underset{\sim}{i} + 3\underset{\sim}{j} - 2\underset{\sim}{k} \quad q = 2\underset{\sim}{i} - \underset{\sim}{j} + 3\underset{\sim}{k}$$

$$r = 2\underset{\sim}{i} + 2\underset{\sim}{j}$$

$$\left| \underset{\sim}{p} - \underset{\sim}{q} - \underset{\sim}{r} \right|$$

Find (i)

$$p \, and \, q$$

    (ii) The angle between   (10 marks)

Question 3 (20 marks)

$$a = 2\underset{\sim}{i} - 4\underset{\sim}{j} + \underset{\sim}{k} \qquad a - 3\underset{\sim}{i} + 2\underset{\sim}{k}$$

a)

$$\left| \underset{\sim}{a} - \underset{\sim}{b} \right|$$

Determine (i)

$$a \times b$$

(ii)   (9 marks)

b) A piece of wood is sliced off a circular pole 5m long along its entire length. The maximum thickness of the piece is 0.07m. Find the volume of the offcut   (5 marks)

c) An object is displaced from point A of coordinates (2,4,3) to point Q of co-ordiantes (5,2,-1). The

$$F = 3i + 2j - k$$

force causing the displacement is given as   . Find work done by the force

(6 marks)

Question 4 (20 marks)

a) Express $2\cos\theta - 4\sin\theta$ in the form $R\cos(\theta + \alpha)$ and hence solve the equation;
$3\sin\theta + 4\cos\theta = 5\sin\theta + 1$ $O^{o} \leq \theta \leq 360^{o}$

for   (10 marks)

b) A power piton 30m high stands on a sloping ground. The angle of the ground is 15°. The angle of elevation to the top of the piton point A is 25° and point A.   (10 marks)

Question 5 (20 marks)

a) Show that
$$Co +^{2}\left(\frac{90 - Q}{2}\right) = \frac{1 + \sin\theta}{1 - \sin\theta}$$
        (8 marks)

b) A surveyor is at station P N30ºW from the foot of an electric pole. The angle of elevation to the top of the pole is 18º. The surveyor moves to station Q N40ºE from the foot of the pole and find the angle of elevation to the top of the pole to be 22º. If the distance between the foot of the pole and station P is 100m find;
(i)   The height of the pole
(ii)   Distance between the pole and station Q
(iii)   Distance between station P and station Q   (12 marks)