MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND SEMESTER EXAMINATIONS FOR

CERTIFICATE IN ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE IN BUILDING AND CIVIL ENGINEERING

EPC 210: MATHEMATICS IV

Date: 1/8/2016 **Time: 2.00-4.00 PM**

Answer question ONE and any other TWO questions

1. a) Convert the following
   (i) 3 radians to degrees
   (ii) 350 degrees to radians (4 marks)

   b) Solve the following equations

   $0^0 \leq x \leq 360^0$

   i) $\tan 2x = 1$
   ii) $\cos^2 x = 0.64$
   iii) $3 \sin x = -2$ (10 marks)

   c) A man starts from a point O and walks 320m East and then 140m North. What is now his bearing from point O (4 marks)

d) A farmer has a triangular piece of land for growing vegetables. Given that AB=39.5 m, BC = 68.6m and angle ABC = 43^0. Calculate the area of the piece of land. (3 marks)

e) if $\underset{\sim}{a} = \begin{bmatrix} 15 \\ -20 \end{bmatrix}$ and $\underset{\sim}{b} = \begin{bmatrix} 7 \\ 24 \end{bmatrix}$ find

i) $2\underset{\sim}{a} - 3\underset{\sim}{b}$

ii) $\left| \frac{1}{5}\underset{\sim}{a} \right|$

(6 marks)

f) P(-3,4) and Q(4,-3) and O is the origin. Given that $\underset{\sim}{OT} = \underset{\sim}{OP} + \underset{\sim}{OQ}$, express $\underset{\sim}{OT}$ as a column vector

(3 marks)

2 a) Given that X is an acute angle and $\cos X = \frac{2}{\sqrt{5}}$ Find without using tables or calculator;

i) Sin X

ii) Tan (90-X) (4 marks)

b) A ladder 10m long leans against a wall and makes an angle of 27^0 with the wall.

i) How high up the wall does the ladder reach?

ii) How far from the wall is the foot of the ladder? (6 marks)

c) Solve the following equations

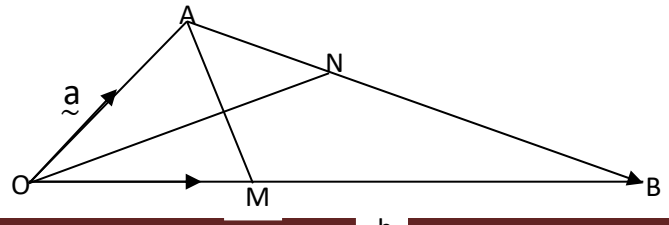
for $0^0 \leq \theta \leq 360^0$

i) $8\cos^2\theta + 3\sin^2\theta + 5\sin\theta + 1 = 0$

ii) $\sin(2\theta + 20^0) = 0.8$ (10 marks)

3 a) Given $\underset{\sim}{OP} = \begin{pmatrix} 20 \\ 7 \end{pmatrix}$, $\underset{\sim}{OQ} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$, calculate the length of vector $\underset{\sim}{PQ}$ and coordinates of the mid-point M of P and Q (7 marks)

b)Three vectors are $\overrightarrow{OA}$,$\overrightarrow{OB}$ and $\overrightarrow{AB}$ form a triangle as shown below.



b

N divides $\overrightarrow{AB}$ in the ratio 1:1 while M divides $\overrightarrow{OB}$ in the ratio 1:3

Find in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

i) $\overrightarrow{ON}$

ii) $\overrightarrow{AM}$ (8 marks)

c) if $\underset{\sim}{OA} = 3\underset{\sim}{i} + 2\underset{\sim}{j} - 3\underset{\sim}{k}$ and $\underset{\sim}{OB} = -4\underset{\sim}{i} + 7\underset{\sim}{j} + 5\underset{\sim}{k}$, express $\underset{\sim}{AB}$ in terms of $\underset{\sim}{i}$, $\underset{\sim}{j}$ and $\underset{\sim}{k}$ and hence find $\left|\underset{\sim}{AB}\right|$ (5 marks)

4 a) Two sides of a triangular plate are 40 cm and 25cm respectively. If its area is 405cm^2, find the length of the 3rd side and the angles of the plate (10 marks)

b) i) Evaluate cot 165^0

ii) Prove the identity $\dfrac{\sec^2 x - 2}{2 - \operatorname{cosec}^2 x} = \tan^2 x$ (10 marks)

5 a) If $\underset{\sim}{p} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$, $\underset{\sim}{q} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ and $2\underset{\sim}{p} + K\underset{\sim}{q} = \begin{pmatrix} 6 \\ -5 \end{pmatrix}$

Find K (5 marks)

b) Given that $\underset{\sim}{OA} = \underset{\sim}{a}$, $\underset{\sim}{OB} = \underset{\sim}{b}$, and C is a point on AB such that AC: CB = 1:2. Find in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

i) $\underset{\sim}{AB}$ ii) $\underset{\sim}{AC}$ iii) $\underset{\sim}{OC}$ (7 marks)

c) i)Resolve the vector (8.72, 140^0) into its vertical and horizontal components

ii)In a triangle STU, s=18m, t = 21m and u=25m, calculate the largest angle of the triangle (8 marks)