TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN NEUTICAL SCIENCE (DNSC 13M)

AMA 2113: MATHEMATICS

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

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
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 **THREE** printed pages
Question One (Compulsory)

a) If $\log_{10} 3 = 0.4771,\ \log_{10} 2 = 0.010$, obtain the following without using tables:

  (i) $\log_{10} 60$

  (ii) $\log_{10} 15$ **(8 marks)**

b) Use logarithms table to evaluate:

  (i) $\dfrac{2347 \times 0.4666}{\sqrt[3]{0.0924}}$ **(4 marks)**

  (ii) $\dfrac{34.33}{\sqrt{5.25 \times 0.042}}$ **(4 marks)**

  (iii) $\dfrac{(0.0056)^{\frac{1}{2}}}{1.38 \times 27.42}$ **(4 marks)**

Question Two

a) Solve for θ such that $0 \le \theta \le 360^{o}$ and $2\sin^{2}\theta + \sin 2\theta - 1 = 0$ **(5 marks)**

b) For the following trigonometric graphs, state the wavelength, amplitude and phase angles:

  i. $-2y = 3\cos(x + 30^{o})$ **(3 marks)**

  ii. $y = -\sin(3x + 60^{o})$ **(3 marks)**

  iii. $y = 3\cos(x + 40^{o})$ **(3 marks)**

c) Determine the inverse T^{-1} of the Matrix $T = \begin{pmatrix} 1 & 2 \\ 2 & -1 \end{pmatrix}$ Hence find the coordinates of the point at which

the two lines $x + 2y = 7$ and $x - y = 1$ intersect. **(7 marks)**

Question Three

a) Draw the graph of $y = 3\cos(2\theta + 30)°$ for the values of θ from $O°$ to 180° taking the interval of 30°.

(5 marks)

b) Use your graph to solve:

(i) $3\cos(2\theta + 30)° = -1$

(ii) $\cos(2\theta + 30)° = \dfrac{-2}{3}$

(3 marks)

c) State the phase angle and wavelength of $y = 3\cos(2\theta + 30)°$

(2 marks)

d) PQRS is a trapezium where PQ is parallel to SR PR and SR intersect at x so that SX = kSQ and Px = hPR where k and h are constants. Vectors PQ = $3\underset{\sim}{q}$ and PS = $\underset{\sim}{s}$ SR = $\underset{\sim}{q}$.

    (i) Show this information on a diagram

    (ii) Express vector $\vec{SQ}$ in terms of $\underset{\sim}{s}$ and $\underset{\sim}{q}$

    (iii) Express SX in terms of K, $\underset{\sim}{Q}$ and $\underset{\sim}{S}$

    (iv) Express SX in terms of $\underset{\sim}{h}$, $\underset{\sim}{Q}$ and $\underset{\sim}{S}$

    (v) Obtain h and k

    (vi) In what ratio does X divide SQ? **(10 marks)**

Question Four

a) If $S = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and $T = \begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$ find:

    i. S^2 **(2 marks)**

    ii. 2ST **(2 marks)**

    iii. S(S+T) **(3 marks)**

b) (i) Construct a table of values for the function $y = x^2 - x - 6$ for $-2 \leq x \leq 3$ **(3 marks)**

(ii) Draw the graph of the function $y = x^2 - x - 6$ for $-2 \leq x \leq 4$ **(4 marks)**

(iii) By drawing a suitable line on the same grid, estimate the roots of the equation $x^2 - 2x - 2 = 0$

(3 marks)

c) Solve for θ given that $\sin(\theta + 20°) = (\cos 3\theta + 30°)$ **(3 marks)**

Question Five

a) Calculate the length of a tangent to a circle of radius 4cm from a point P, 7cm from the centre of the circle. **(3 marks)**

b) (i) An arc of length 24cm subtends an angle of 60° at the center of a circle. Calculate the diameter of the circle. (Take $\pi = 3.142$) **(4 marks)**

   (ii) Given that a chord subtends 80o at the center of a circle radius 4.2cm. Calculate the length of the chord. **(4 marks)**

c) Three trees A, B and C at Mt Kenya Forest are such that AC = 10km, $\angle$BAC = 40° and $\angle$BCA = 30°, calculate:
   (i) AB
   (ii) BC **(9 marks)**