TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN TELECOMMUNICATION ENGINEERING

AMA 2101: ENGINEERING MATHEMATICS

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

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
- *Calculator*
- *SMP Table*

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) Given that $\log_2 = 0.3010$, calculate:
    (i) log 5
    (ii) log 0.125

       Using laws of logarithms   **(4 marks)**

b) Solve the following equations:
    (i) $8x^2 + 2x - 15 = 0$ by completing the square.   **(3 marks)**

    (ii)
$$3x + 4y + z = 10$$
$$2x - 3y + 5z = -9$$
$$x + 2y - z = 6$$
                                        (5 marks)

c) (i) Use binomial theorem to determine $\sqrt{(1.05)}$ correct to 4 decimal places.   **(3 marks)**

    (ii) In how many ways can an escort of four soldiers be selected from nine soldiers?   **(2 marks)**

d) (i) Evaluate $j\left(\dfrac{1+j3}{1-j2}\right)^2$ **(4 marks)**

    (ii) Solve the complex equation for a and b.

$$\left(2 - j3\right) = \sqrt{\left(a + jb\right)}$$

                                          (3 marks)

e) (i) Express sin 1220° in terms of the trigonometical ratios of positive acute angles.   **(3 marks)**

    (ii) Use the addition formula to show that $\cos\left(90° + A\right) = -\sin A$ **(3 marks)**

Question Two

a) Convert $7 < -145°$ into rectangular form of a complex number   **(4 marks)**

b) Express the roots of $\left(-14 + j3\right)^{-\frac{2}{5}}$ in polar form   **(6 marks)**

c) Determine the resistance and series inductance or capacitance for each of the following impedances, assuming a frequency of 50Hz.

(i) $(4.0 + 57.0)\Omega$ **(3 marks)**

(ii) $-\sqrt{20}\Omega$ **(3 marks)**

(iii) $15 < -60^{\circ}\,\Omega$ **(4 marks)**

Question Three

a) (i) Given the equations $x^{3.2} = 41.15$. Solve for, correct to 4 significant figures. **(4 marks)**

(ii) Solve $-5x^2 + 6x - 1 = 0$ by using the quadratic formula. **(4 marks)**

b) Given the following equations:
$$4x + 8y + 4z = 80$$
$$2x + y - 4z = 7$$
$$3x - y + 2z = 22$$

Solve the equations by Cramer's rule **(12 marks)**

Question Four

a) (i) Determine all the angles which satisfy the equation $4\sec^2\theta = 3\tan\theta + 5$ **(5 marks)**

(ii) If $\tan\theta = \frac{4}{3}$ where $0^{\circ} < \theta < 360^{\circ}$ determine without tables the possible values of $\tan\frac{1}{2}\theta$ and $\sin\frac{1}{2}\theta$ **(7 marks)**

b) (i) Using surd forms, evaluate:

$$\frac{3\tan 60^{\circ} - 2\cos 30^{\circ}}{\tan 30^{\circ}}$$

(4 marks)

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

Question Five

a) Using the binomial series determine the expansion of $(2a - 3b)^5$ **(4 marks)**

b) The radius of a cylinder is reduced by 4% and its height is increased by 2%. Determine the approximate percentage change in:
   (i) Its volume
   (ii) Its curved surface area neglecting the products of small quantities **(12 marks)**

c) Expand $\dfrac{1}{\sqrt{1-2t}}$ in ascending powers of t as far as the term is t^3. **(4 marks)**