TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

CERTIFICATE IN MECHANICAL ENGINEERING (Y1 S1)

AMA 1150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 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) Express the following with positive indices:

$$\frac{2b^{-3}x^2}{7c^{-4}y^2}$$

(i)

$$\frac{\sqrt[3]{\left(y^{-c}\right)}}{\sqrt[3]{y^2}}$$

(ii) **(4 marks)**

$$\left(\frac{81}{16}\right)^{\frac{3}{4}}$$

b) Evaluate **(3 marks)**

c) Solve the following equations:

$$2\log\left(x^2-5\right)=4\log 2$$

(i) **(3 marks)**

$$\log(x-2)+\log(x-6)-\log 5=0$$

(ii) **(11 marks)**

d) A, N, R, V are connected by the relation Log V – log N = log A + 2 log R By first expressing R in

$$A=4\times10^{-5},\ N=1.44\times10^{-3}$$

terms of A, N and V find without using tables the value of R when and

$$v=3.24\times10^{-2}$$

(6 marks)

$$\sqrt[4]{0.0007256}$$

e) Simplify **(3 marks)**

Question Two

a) The sum of the second and fourth terms of an arithmetic progression is 15 and the sum of the fifth and sixth term is 25. Find the first term and the common difference **(7 marks)**

b) The sum of the first two terms of a geometric progression is 3, and the sum of the second and third term is -6. Find the first term and the common ratio. **(7 marks)**

c) Solve the following quadratic equation:

$$2x^2+x-1=0$$

(i)

$$2x^2-11x+3=0$$

(ii) **(6 marks)**

Question Three

a) A ball falls vertically after being dropped. The ball falls a distance d metres in a time of t seconds. d is directly proportional to the square of t. The ball falls 20 metres in a time of 2 seconds.
    (i) Find a formula for d in terms of t
    (ii) Calculate the distance the ball falls in 3 seconds
    (iii) Calculate the time the ball takes to fall 505m   **(7 marks)**

b) The force F between two magnets is inversely proportional to the square of the distance, x between them. When x = 3, F = 4 :
    (i) Calculate F when x = 2
    (ii) Calculate x when F = 64   **(7 marks)**

c) MN and KL are two chords that intersect in a circle at 0. Given that AO = 4cm, KO = 5cm and OL = 3cm. Find MN.   **(6 marks)**

Question Four

a) Determine the volume and surface area of a cone with a base radius of 21cm and height of 30cm
    (7 marks)
b) Determine the area of the minor sector in the circle below: **(3 marks)**

r = 7cm

c) Solve the following simultaneous equations:
$$4x + 2y = 14$$
$$3x + 5y = 21$$
    (i)

$$5x + 7y = 19$$
$$6x + 3y = 12$$
    (ii)   **(10 marks)**

Question Five

$$V_o e^{-kt}$$

a) The charge on a capacitor is falling and the voltage V at any time t seconds is given by   , where V_o is the original voltage and K is a constant. If V_o = 200, e = 2.718 and K = 0.0075, find the value of V after 3.5 seconds.   **(10 marks)**

b) The attenuation (α) of a telephone cable (in dB) is given by:

$$\alpha = 10 \log \left(\frac{power \ sent}{power \ received} \right)$$

If a length of cable has an attenuation of 27dB, determine the power that must be transmitted at the sending end in order to measure 0.1mW at the receiver end. **(10 marks)**