



TECHNICAL UNIVERSITY OF MOMBASA

**Faculty of Engineering &
Technology**

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING (DME J14)

AMA 2104: ENGINEERING MATHEMATICS I

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) A system of mechanical forces according to the following set of simultaneous equations.

$$\begin{aligned} 3F_1 + F_2 + 4F_3 &= 6 \\ F_1 + 2F_2 - F_3 &= 15 \\ 2F_1 - 3F_2 - 2F_3 &= -5 \end{aligned}$$

Solve the system of forces using elimination method. (8 marks)

b) Solve for x in the equation:

$$2 \log_2 x + \log_x 2 = \frac{7}{2}$$

(i)

$$\log 6x - \log(1 + \sqrt{x}) = 2$$

(ii)

(22 marks)

Question Two

a) Solve for θ in the following trigonometric equations.

$$2 \sin \theta + 7 \cos \theta = 4$$

(i)

$$\cos(\theta + 20^\circ) - \cos(\theta - 70^\circ) = 0$$

(ii)

(13 marks)

b) A triangular roof truss measures 14.3cm by 17.5cm by 7.72cm. Determine the angles between the respective truss members. (7 marks)

Question Three

a) Find the first four terms of the expansion $(1+8)^{\frac{1}{2}}$ in ascending powers of x and by putting $x = \frac{1}{100}$

determine the value $\sqrt{23}$ correct to five decimal places. (8 marks)

b) Find the first four terms of:

(i) $\frac{1+x}{1-x}$

(ii)

$$\frac{1}{(3-x)^2}$$

(ii)

(6 marks)

c) (i) Show that, if x is small enough for its cube and higher powers to be neglected:

$$\sqrt{\frac{1+x}{1-x}} = 1 - x + \frac{x^2}{2}$$

(ii) By put $x = \frac{1}{8}$ show that $\sqrt{7} = 2\frac{83}{128}$

(6 marks)

Question Four

$$\left(x^2 - \frac{2}{x}\right)^6$$

a) Determine the constant term in the expansion of **(3 marks)**

b) Solve by completing the square the quadratic equations:

$$ax^2 + bx + c = 0$$

(i)

$$3x^2 + 2x - 18 = 0$$

(ii)

(10 marks)

c) Arithmetic progression has thirteen terms whose sum is 143. The third term is five. Determine the first term. **(7 marks)**

Question Five

a) The second fourth and eight terms of an AP are in geometric progression and the sum of the third and fifth terms is 20. Determine the first term of the arithmetic progression. **(8 marks)**

b) The sum of the first two terms of a geometric progression is 3 and the sum of the second and the third term is 6. Determine:

(i) The first term

(ii) Common ratio

(5 marks)

c) A man pays a premium of £100 at the beginning of every year to an insurance company on the understanding that at the end of fifteen years he can receive back the premiums with $2\frac{1}{2}$ percent compound interest. How much will he receive after that period? **(7 marks)**