



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MECHANICAL ENGINEERING/DIPLOMA IN BUILDING AND
CIVIL ENGINEERING

AMA 2150: ENGINEERING MATHEMATICS I
SPECIAL/ SUPPLEMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: Pick Date Sep 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID, Scientific calculator, a ruler

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question 1

a) Solve for x in the equation

i) $21 = 33(1 - e^{-x/2})$ (5 Marks)

ii) $9^{x+1} + 3^{2x-1} = 28$ (5 Marks)

b) The displacement of a body from a certain fixed position is given by

$$A = Ce^{-0.1t}$$

Where A is the displacement, C is a constant and t is time in seconds.

Determine the time it takes for the displacement to reduce to half the initial amount (6 Marks)

c) If $X = -2$ is one of the solutions to the equation $5x^3 + 2x^2 - 26x - 20 = 0$.

Determine the other roots of x (5 Marks)

d) Prove the identity

$$\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

(5 marks)

e) 250 grams of a radioactive substance disintegrate at a rate of 2.5% per annum. How much of the substance is remaining after 15 years. (4 Marks)

Question 2

a) Derive the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Hence solve for x in equation

$2^{2x} - 2^x - 6 = 0$ (10 Marks)

b) When the expression $X^5 + 4X^2 + aX + b$ is divided by $X^2 - 1$, the remainder is $2X + 3$

Determine the values of 'a' and 'b' (5 Marks)

c) River Tana flows at a rate of 5 miles per hour. A petrol boat travels 40 miles upriver and returns to its original point in 6 hours.

Determine the speed of the boat in still water. (5 Marks)

Question 3

- a) Solve for θ in the following trigonometric equation,
- $\cos \theta - 7 \sin \theta = 2$ (8 Marks)
 - $\cos(2\theta + 10^\circ) + \cos(2\theta - 10^\circ) = 0$ (7 Marks)
- b) A room 9m wide has a span roof which slopes at 32° on one side and 41° on the other. Determine the length of the roof slopes. (5 Marks)

Question 4

- a) Express the following in partial fraction form:

$$\frac{5x^2 - 19x + 3}{(x - 2)^2(x + 1)}$$

- b) The tensions in a simple framework, T_1, T_2 and T_3 are given by the equations:

$$6T_1 + 6T_2 + 6T_3 = 8.4$$

$$T_1 + 2T_2 + 4T_3 = 2.4$$

$$4T_1 + 2T_2 = 4.0$$

Use substitution method to determine T_1, T_2 and T_3 (7 Marks)

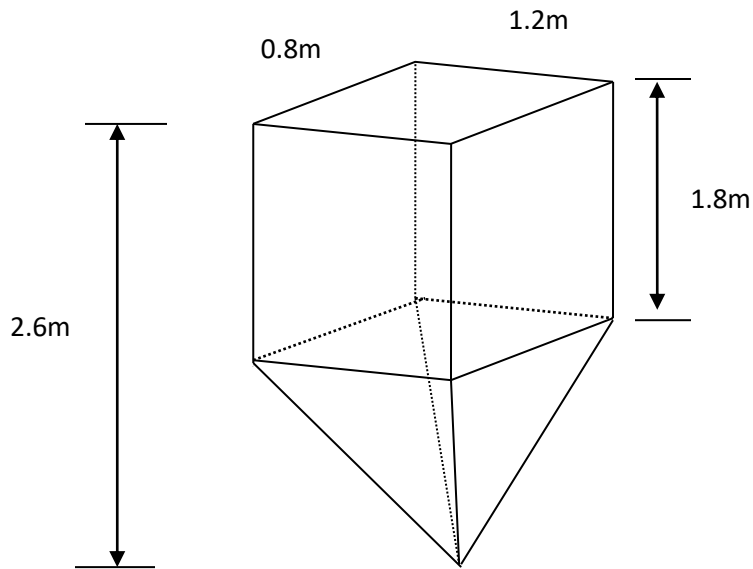
- c) If $f(x) = 4x^4 - 15x^2 + 5x + 6$

- Show that $(x + 2)$ is a factor of $f(x)$ (2 Marks)
- Determine

$$\frac{4x^4 - 15x^2 + 5x + 6}{x + 2} \quad (3 \text{ Marks})$$

Question 5

- a) When full, a swimming pool is 2m deep at one end and 1.2 m deep at the other end. The pool is 15m long and 5.5m wide.
- Sketch the swimming pool. (2 marks)
 - Find the volume of the pool. (5 Marks)
- b) A grain storage bin is in the shape of a rectangular prism on top of a pyramid. If the total height of the bin is .6m.



Determine its volume

(6 marks)

- c) A community has a large rectangular room with a semi – cylindrical roof.
- i) Find the area to one decimal of all the four walls and the roof given the floor measures 10m by 18m and the wall is 3m high (4 Marks)
 - ii) Sketch room with the roof (2 marks)