



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS
DIPLOMA IN MECHANICAL ENGINEERING (DMAE Y1 S1)

AMA 2150: ENGINEERING MATHEMATICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 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)

$$P = P_0 e^{-h/c}$$

- a) The pressure P at height h above ground level is given by $P = P_0 e^{-h/c}$ where P_0 is 1.013×10^5 Pascal's and the pressure at height 1570 metres is 9.871×10^4 Pascal's. Determine the value of C. **(5 marks)**

$$y = 3(e^x - 4e^{-x})$$

- b) (i) Given $y = 3(e^x - 4e^{-x})$, determine the value of x when $y = 3.5$ **(8 marks)**

$$2^x \times 2^{x+1} = 10$$

- (ii) Solve for x in the equation $2^x \times 2^{x+1} = 10$ **(5 marks)**

- c) The twenty first term of an AP is 37 and the sum of the first twenty terms is 320. Determine the sum of the first term terms. **(6 marks)**
- d) The area of a triangle sheet of metal is 6cm^2 , $AB = 3\text{cm}$ and $AC = 5\text{cm}$. Calculate the two possible lengths of BC. **(6 marks)**

Question Two

- a) Determine the number of terms in the following series:

$$1\frac{1}{2} + 4\frac{1}{4} + 7 + 9\frac{3}{4} + \dots + 40$$

(i)

- (ii) $0.03 + 0.06 + 0.12 + \dots + 15.36$ **(8 marks)**

- b) Three numbers are in arithmetic progression. Their sum is 15 and their product is 45. Determine the three numbers. **(9 marks)**
- c) 250 grammes of radioactive substance disintegrates at a rate of 2% per annum. How much of the substance is left after 15 years. **(3 marks)**

Question Three

$$\theta^\circ \leq x \leq 360^\circ$$

- a) Sketch the curves for the following trigonometric functions for

(i) $y = \tan x$

(ii) $y = \sin (x + 60)$

(iii) $y = \sin x$ **(3 marks)**

- b) Solve for θ in the following equations for values of θ ranging between 0° and 360° .
 $\cos \theta - 7 \sin \theta = 2$

(i)

$$2 \sin(\theta + 15^\circ) \cos(x - 15^\circ) = 1$$

(ii) (17 marks)

Question Four

- a) (i) Obtain the first four terms of the expansion of $\left(\frac{1+x}{1-x}\right)$
(ii) Given x is very small that its square and higher powers can be ignored.

$$\frac{1}{(1+x)^2 \sqrt{1+x}} = 1 - \frac{5}{2}x$$

(8 marks)

- b) (i) Determine the first four terms of the expansion of $(1+5x)^{1/5}$

$$x = -\frac{1}{32} \quad \sqrt[5]{27} = 1.933$$

(ii) By substituting $x = -\frac{1}{32}$ show that (8 marks)

- c) The radius of a cylinder is reduced by 3% and its height is increased by 45. Determine the approximate percentage change in its volume. (4 marks)

Question Five

- a) The quadratic equation $3x^2 + 4x - 5 = 0$ has its roots as $x = \alpha$ or $x = \beta$. Determine the value of:

$$\frac{1}{\alpha} + \frac{1}{\beta}$$

(i)

$$\alpha^2 + \beta^2$$

(ii)

(6 marks)

- b) Show that $3x^3 + x^2 - 8x + 4$ is zero when $x = 2/3$ and hence factorize. (5 marks)

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

- c) Derive the quadratic formula (5 marks)

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

- d) Solve by completing the square the quadratic equation. (4 marks)