



TECHNICAL UNIVERISTY OF MOMBASA

# Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN MECHANICAL ENGINEERING (DME)

AMA 2150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION

SERIES: OCTOBER 2014

TIME: 2 HOURS

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Attempt question **ONE** 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) Evaluate the following:

(i)  $\left(\frac{81}{16}\right)^{\frac{3}{4}}$  (2 marks)

(ii)  $\frac{3(2^{n+1}) - 4(2^{n-1})}{2^{n+1} - 2^n}$  (3 marks)

b) Solve the following equations

$\log x - 1 + \log x + 8 = 2 \log x + 2$

(i)  $3x - 11x - 4 = 0$  (4 marks)

(ii) by completing the square. (4 marks)

$\frac{x}{8} + \frac{5}{2} = y$

$11 + \frac{y}{3} = 3x$

(iii) Simultaneously by elimination method. (4 marks)

$\log x - 1 + \log x + 8 = 2 \log x + 2$

c) Expand using the binomial series. (4 marks)

$z_1 = 3 - j4$  and  $z_2 = -2 + j5$

d) Given determine in a + jb form:

$\frac{z_1 z_2}{z_1 - z_2}$

$\frac{\tan x + \sec x}{\sec x \left(1 + \frac{\tan x}{\sec x}\right)} = 1$

e) Show that (4 marks)

**Question Two**

$\frac{\sqrt[3]{y^{-c}}}{\sqrt[3]{y^3}}$

a) (i) Express with positive indices. (3 marks)

$\frac{3^2 + 5^5 + 3^3 \times 5^3}{3^4 \times 5^4}$

(ii) Evaluate (4 marks)

$$\frac{1}{2} \log 16 + \frac{1}{3} \log 27 - 2 \log 5$$

- b) (i) Express as the logarithm of a single number. (4 marks)  
 (ii) Evaluate  $\log 0.001$  (3 marks)

$$2x^2 - 7x - 4 = 0$$

- c) (i) Solve by factorization. (3 marks)

$$Q = \frac{-1}{2} p + 20$$

$$Q = \frac{3}{2} P + 10$$

- (ii) Solve the simultaneous equations: (3 marks)

### Question Three

$$\left(2p - \frac{1}{2q}\right)^{10}$$

- a) (i) Determine the middle term of (5 marks)

$$(1.002)^9$$

- (ii) Evaluate using the binomial theorem, correct to 7 significant figures. (5 marks)

- b) Expand the following in ascending powers of x as far as the term in  $x^3$  using binomial theorem.

$$\frac{1}{(4-x)^2}$$

- (i) (6 marks)

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

- (ii) (4 marks)

### Question Four

$$2 < 30^\circ + 5 < -45^\circ - 4 < 120^\circ$$

- a) Evaluate in polar form (10 marks)

- b) (i) Determine the value of  $(-7 + j5)^4$  in rectangular form. (5 marks)

- (ii) Determine in polar form

$$\ln(3 + j4)$$

(5 marks)

### Question Five

$$\sin \theta = 0.625 \quad \text{and} \quad \cos \theta = 0.500$$

- a) Given that and determine without using trigonometric tables or calculator the values of:

$$\operatorname{cosec} \theta$$

(i)

$$\sec \theta$$

(ii)

$$\tan \theta$$

(iii)

$$\cot \theta$$

(iv)

(4 marks)

$$\cos(y - \pi) + \sin\left(y + \frac{\pi}{2}\right) = 0$$

**b) (i) Prove that** **(6 marks)**

(ii) Solve  $4\sec t = 5$  for values of  $t$  between  $0^\circ$  and  $360^\circ$ . **(5 marks)**

$$\frac{1 + \cot \theta}{1 + \tan \theta} = \cot \theta$$

(iii) Show that **(5 marks)**