



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**DIPLOMA IN MECHANICAL ENGINEERING (PLANT)
DIPLOMA IN AUTOMOTIVE ENGINEERING**

AMA 2105: ENGINEERING MATHEMATICS II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012

TIME: 2HOURS

INSTRUCTION TO CANDIDATES

You should have the following for this examination

- *Answer booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions.

Attempt any **THREE** questions

Maximum marks for each part of a question are as shown.

This paper consists of **THREE** printed pages

QUESTION ONE (20 MARKS)

a) Prove the following hyperbolic identities

$$\cosh^2 x - \sinh^2 x = 1$$

(i) (3 marks)

$$\sinh 2x = 2 \sinh x \cosh x$$

(ii) (3 marks)

$$\cosh 2x = 2 \cosh^2 x - 1$$

(iii) (3 marks)

b) Express the following in the form $a + ib$

$$z = \frac{1}{2+3i} + \frac{1}{1-2i}$$

(i) (3 marks)

$$z = \frac{2+3i}{i(4-5i)} + \frac{2}{i}$$

(ii) (3 marks)

$$3 \cosh 2x = 3 + \sinh 2x$$

c) Solve for the real values of x (5 marks)

QUESTION TWO (20 MARKS)

a) Differentiate with respect to x :

$$y = e^{3x} \sin 4x$$

i) (3 marks)

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

ii) (3 marks)

$$y = \ln(\sin 3x)$$

iii) (3 marks)

$$y = e^{-2mx} \sin 4mx \qquad \frac{d^2y}{dx^2} + 4m \frac{dy}{dx} + 30m^2y = 0$$

b) (i) Show that $y = e^{-2mx} \sin 4mx$ is a solution of the equation (8 marks)

$$y = x^3 \sin 5x$$

c) Differentiate $y = x^3 \sin 5x$ with respect to x (3 marks)

QUESTION THREE (20 MARKS)

a) (i) Determine, algebraically from first principles the gradient of the curve of $y = 5x^2 + z$ at the point P where $x = -1.6$ (6 marks)

(ii) If $y = -2x^4 - 3x^3 + 4x - x + 5$, obtain an expression for $\frac{dy}{dx}$ and hence calculate the value of

$$\frac{dy}{dx}$$

at $x = -3$

(4 marks)

$$\cos 4\theta = 8 \cos^4 \theta - 8 \cos^2 \theta + 1$$

b) (i) Show that

(7 marks)

$$5(\cos 225^\circ + i \sin 225^\circ)$$

(ii) Express

in the form $a + ib$

(3 marks)

QUESTION FOUR (20 MARKS)

a) Determine the following integrals

(12 marks)

$$\int (1 - 4x)^2 dx$$

(i)

$$\int 3 \sin(2x + 1) dx$$

(ii)

$$\int (3 - 2x)^{-5} dx$$

(iii)

$$\int \sqrt{3 - 4x} dx$$

(iv)

b) Integrate the following integral by partial fractions:

(8 marks)

$$\int \frac{5x + 2}{3x^2 + x - 4} dx$$

QUESTION FIVE (20 MARKS)

a) Calculate the areas bounded by the curves

(10 marks)

$$y = 3x^2 + 14x + 15$$

(i) , the x-axis and ordinates at $x = -1$ and $x = 2$

$$y = -6x^2 + 24x + 10,$$

(ii) the x-axis and the ordinates $x = 0$ and $x = 4$

b) Evaluate each of the following definite integrals

$$\int_0^{\pi/2} (\sin x - \cos x) dx$$

(i)

(4 marks)

$$\int_0^1 e^{2x} dx$$

(ii)

(3 marks)

(iii) $\int_2^4 3x^5 dx$

(3 marks)