TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

CERTIFICATE IN:
BUILDING & CIVIL ENGINEERING
MECHANICAL ENGINEERING
ELECTRICAL & ELECTRONIC ENGINEERING

AMA 1151: ENGINEERING MATHEMATICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Mathematical Table*

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) If $A = 3/4$ and $\tan B = 12/5$ where A and B are acute angles, find $\sin(A+B)$, $\tan(A+B)$ and cos 2 B **(6 marks)**

b) Given that $\cot 2\theta = 3$, find without using tables: $\dfrac{\sin\theta\cos\theta}{\sin 2\theta - \cos 2\theta}$ **(3 marks)**

c) Express (-5, -12) in polar coordinates **(2 marks)**

d) Resolve $\dfrac{7x^2+5x+3}{(x^2+2)(x+1)}$ into partial fraction **(5 marks)**

e) Find the equation of the tangent to the curve $y = 2x^3 + 3x^2 - 2x - 3$ at the point P, x = 1, y = 0 **(4 marks)**

f) The distance x metres moved by a body in a time t seconds is given by $x = 2t^3 + 3t^2 - 6t + 2$. Find the velocity and acceleration in term of t and find their values when t = 4 seconds **(4 marks)**

g) Differentiate sin x from first principles **(6 marks)**

Question Two

a) Find the coordinates of the maximum and minimum values of the graph of $y = \dfrac{2x^3}{3} - 5x + 12x - 7$ and distinguish between them. **(7 marks)**

b) Differentiate cos x from first principles **(5 marks)**

c) If $z_1 = 5 - 6j$ and $z_2 = 3 + 2j$, determine $\dfrac{z_1 z_2}{z_1 + z_2}$ in a simplified form where a + jb has 'a' as the real term and 'jb' as the imaginary term. **(5 marks)**

d) Determine the gradient of the curve $y = 4x^3 - 3x^2 + 2x - 4$ at point (1, -1) **(3 marks)**

Question Three

a) Find dy/dx for:

(i) $y = \sin x^3$

$y = \left(x^2 + 1\right)^3$

(ii) **(4 marks)**

b) A rectangular area is formed using a piece of wire 36cm long. Find the length and breadth of the rectangle if it is to enclose the maximum possible area. **(6 marks)**

c) If the distance x metres travelled by a car in time t seconds after the breaks are applied is given by $x = 15t - \frac{5}{3}t^2$

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(i) What is the speed (in km/h) at the instant the breaks are applied

(ii) How far does the car travel before it stops **(4 marks)**

d) Find the roots of $z^3 - 1 = 0$ and represent them in an Argand diagram. **(4 marks)**

Question Four

a) If $z_1 = 6 < 45^o$ and $z_2 = 4 < -30^o$ Find:

(i) $z_1 z_2$

(ii) z_1 / z_2 (5 marks)

b) Solve $\frac{11 - 3x}{x^2 + 2x - 3}$ into partial fractions **(5 marks)**

c) Differentiate the following with respect to x:

(i) $y = x^2 \sin x$

(ii) $y = \frac{x^3 + \sin x}{\sqrt{x^2 + 1/x^2}}$ (7 marks)

d) Find dy/dx for $y = 3x$ from first principles. **(3 marks)**

Question Five

a) 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. **(6 marks)**

b) Sketch the curves for the following trigonometric functions between 0° and 360°:

(i) $y = \cos x$

(ii) $y = \sin x$

$y = \tan x$

(iii) **(6 marks)**

c) Express in Cartesian form:

(i) $8 < 150^{o}$

(ii) $3.6 < -25^{o}$ **(5 marks)**

d) A man climbs a hill 500m high with a slope of 12^{o} from the ground level. Determine the distance, the man walks **(3 marks)**