MURANGA UNIVERSITY COLLEGE

UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

YEAR TWO SEMESTER ONE

FOR THE DIPLOMA OF

MECHANICAL ENGINEERING

COURSE CODE: SEM 1201 DATE:20 APRIL 2015**COURSE TITLE:**ENGINEERING MATHEMATICS III

QUESTION ONE (COMPULSORY) 30 MARKS

a) Differentiate from first principles $y = 12x^2$ and determine the value of the gradient of the curve at$x = 2$ (4 Marks)

b) Find the differential coefficients of

(i) $y = 3sin4x$ (4 Marks)

(ii) $y = \sqrt{x}ln2x$ (5Marks)

c) Determine the value of $(-7 + 5i)^4$ expressing the result in polar and rectangular forms. (6 marks)

d) The length l metres of a certain metal rod at temperature θ^oC is given by $l = 1 + 0.00005\theta + 0.0000004\theta^2$. Determine the rate of change of length in $mm/^oC$, when the temperature is

i) 100^oC

ii) 400^oC (6Marks)

e) Determine

i) $\int \frac{2x^3-3x}{4x} dx$ (3 Marks)

ii) $\int (1-t)^2 dt$ (3 Marks)

Question Two (20 Marks)

a) Use logarithmic differentiation to differentiate the function

$y = \frac{(x+1)(x-2)^3}{(x-3)}$ (5 Marks)

b) Given $y = 2xe^{-3x}$ show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ (6 Marks)

c) Find the area of the region bounded by the curves $y = x^2$ *and*

$y = 4x - x^2$ (9 Marks)

Question Three (20 Marks)

a) Find the derivative $\frac{dy}{dx}$ given the functions

i) $y = (2x^3 - 3x)\cos x$ (3 Marks)

ii) $y = \frac{\sin 2x}{x^2-1}$ (3 Marks)

iii) $y = \sqrt{x^3 - x}$ (3Marks)

b) Find and classify the stationary points of the function

$y = 4x^3 + 9x^2 - 12x + 5$ (8 Marks)

c) If $z = 5x^4 + 2x^3y^2 - 3y$ find $\frac{\partial z}{\partial y}$ (3 Marks)

Question Four (20 Marks)

a) Use logarithmic differentiation to differentiate the function

$y = (x^2 + 4)^x$ (5Marks)

b) Find the gradient of the curve $y = 3x^4 - 2x^2 + 5x - 2$ at the point (0,-2) (5 Marks)

c) Determine $\frac{dy}{dx}$ when $y = \frac{4sin5x}{5x^4}$ (4Marks)

d) Find the derivative of $y = (4t^3 - 3t)^6$ (6 marks)

Question Five (20 Marks)

a) Find $\frac{dy}{dx}$ given the functions

(i) $y = Sin(2x^3 - 3)$ (3 Marks)

(ii) $y = (3x^2 + 4)\tan x$ (3Marks)

b) The parametric equations of a function are given by $y = 3cos2t, x = 2sint$. Determine $\frac{d^2y}{dx^2}$ (5Marks)

c) Differentiate $y = 3\tan^4 3x$ (6Marks)

d) Determine the differential coefficient of $y = th\ x$ (3 Marks)