MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

CALCULUS 1

DATE: 3/8/2016 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Answer QUESTION ONE and Any other TWO Questions

Show all workings

QUESTION ONE

a) Differentiate the following functions with respect to x

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

ii) $y = \ln(x^2 + 1)$ (4 marks)

iii) $y = \sqrt[3]{(9x + 1)}$ (4 marks)

b) Determine the turning values for the function

$y = 4\sin x + 3\cos x$ and state the nature of the turning points (9 marks)

c) A spherical balloon is inflated at the rate 0f $2cm^3$ every second.

Determine the rate at which the radius is increasing. (5 marks)

d) Given the function $x = 3t + 1$ and $y = 3t(t - 2)$. Express $\frac{dy}{dx}$ in terms of the parameter t (4 marks)

QUESTION TWO

a) Differentiate the following functions with respect to x

i) $y = \cos(3x + 1)$

ii) $y = x^2 \sin 5x$

iii) $2y^2 + y^2 = x^4 + 3$ (12 marks)

b) Given that $y = 4x^3 - 3x^2 - 6x + 2y + 11$ and that $\frac{dy}{dx} = 0$.Determine the values of x and y. (8 marks)

QUESTION THREE

a) Given that $z = 3x^2 y + 2y^3 + 2x^2 + 4$, show that $\frac{d^2z}{dx^2} - \frac{1}{2}\frac{d^2z}{dy^2} = 12x$ (6 marks)

b) The displacement s meters of an object at any time t seconds is given by the equation

$s = \frac{1}{3}t^3 + \frac{5}{2}t^2 + 6t + 2.$

Determine the

i) time when its velocity is zero

ii) acceleration when t = 6 seconds (8 marks)

c) The side of a square is 5cm. The side expands by 0.01cm. Determine the increase in the area of the square . (6 marks)

QUESTION FOUR

a) Given the parametric equations $y = \sin t - 3\sin^3 t$ and $x = \cos^3 t$. Determine $\frac{dy}{dx}$ in terms of the parameter t (11 marks)

b) Determine $\frac{dt}{dx}$ given that (i) $t = (x^4 + 3x)^5$ (4 marks)

ii) $t = \frac{sin3x}{x^4}$ (5 marks)

QUESTION FIVE

a) Determine the gradient of the curve $x^2 + 2xy - 2y^2 + x = 2$ at the point (-4, 1) (7 marks)

b) Differentiate the function $f(x) = \frac{e^{5x}\, sinx}{x^3 - 4}$ (5 marks)

c) Determine the gradient function of $y = \frac{5}{x^3}$, using first principles. (8 marks)