Machakos University College

(A Constituent College of Kenyatta University)

UNIVERSITY EXAMINATIONS 2013/2014

SCHOOL OF COMPUTING AND APPLIED SCIENCES

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION

SCO 111: DIFFERENTIAL CALCULUS FOR COMPUTER SCIENCE

DATE: Monday, 7th April, 2014 TIME: 8.30 a.m. – 10.30 a.m.

INSTRUCTIONS:

*Answer Question **ONE** which is compulsory and any other **TWO***

Question 1

(a) Given $f(x) = \frac{x}{x+1}$ and $g(x) = \frac{x}{1-x}$. Determine $(f.g)^{-1}$ (6 marks)

(b) What dimensions of one litre oil circular cylinder can would minimize the material used to make it. (6 marks)

(c) State L' Hopital's rule

Use the L'Hopital's rule to evaluate $\lim_{x\to 1} \frac{sin\pi x}{Sin(\pi x + x - 1)}$ (6 marks)

(d) A point is moving on the graph of $y^3 = x^2$. When the point is at $(-8, 4)$ its y coordinate is decreasing at 3 units per sec. How fast is the *x* coordinate changing? (6 marks)

(e) Find$\frac{dy}{dt}$ given $y = \frac{2te^t}{cos2t}$ (6 marks)

Question 2

(a) (i) Given that $x^2 sin\theta - 3x^2 = sec\theta$ Determine the value of $\frac{dx}{d\theta}$ when $\theta = \pi$

(ii) If $y = 3e^{2x}\cos(2x-3)$, verify that $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 8y = 0$ (12 marks)

(b) (i) Given $y = x^2 cos3x \text{In} 2x$

Find $\frac{dy}{dx}$

(ii) Find the inflection point of $f(x) = x^3 - 6x^2 + 9x + 1$ (8 marks)

Question 3

(a) If $x^2 + 2xy - y^2 = 16$ $show\ that$ $\frac{dy}{dx} = \frac{y+x}{y-x}$ (6 marks)

(b) (i)Determine the gradient function of the curve $x^2 + 2xy - 2y^2 + x = 2$ Hence determine the gradient of the curve at $(-4, 1)$ (6 marks)

(c) Differentiate the following functions

(i) $\ln(2t^2 + 1)$

(ii) $e^{2x}(3sinh\ 3x + 2cosh3x)$ $with\ respect\ to\ x.$ (8 marks)

Question 4

(a) Determine the values of the gradients of the tangents drawn to the circle

$x^2 + y^2 - 3x + 4y + 1 = 0$ at $x = 1$ correct to 4s.f. (8 marks)

(b) The equation of a normal to a curve at point $(x_1 y_1)$ is given by $y - y_1 = \frac{-1}{\frac{dy_1}{dx_1}}(x - x_1)$

Determine the equation of the asteroid $x = a\ cos^3\theta, y = a\ sin^3\theta\ at\ \theta = \frac{\pi}{4}$

(12 marks)

Question 5

(a) Investigate the critical points on the curve

$y = x^2 e^{-x}$ (6 marks)

(b) Given that $y = x^2 e^x$

Prove that $y_n = e^x[x^2 + 2nx + n(n-1)]\ \forall\ n > 0$ (8 marks)

(c) Given $z = f(x, y)$ and $z = x\cos(x + y)$ show that $\frac{d^2z}{dxdy} = \frac{d^2z}{dydx}$ (6 marks)