Machakos University College

(A Constituent College of Kenyatta University)

UNIVERSITY EXAMINATIONS 2012/2013

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 $\lim_{x\to 1} \frac{sinx}{x+x-1)}$ (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_1y_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

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

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

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 $\frac{d^2z}{d_xd_y} = \frac{d^2z}{d_{yd_x}}$ (6 marks)

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SMA 104: CALCULUS 1

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) (i) At what points is the function continuous

$f(x) = \frac{x^2+x-6}{x^2-4}$ (4 marks)

(c) Obtain and classify the stationary points of $y = x^2e^x$ (6 marks)

(i) Evaluate the limits

$lim_{x\to 1}\frac{x^2+x-2}{x^2-x}$ (4 marks)

(d) Determine the dimensions for which the total surface area of the cube having a volume of 32m^{3}is minimum. (4 marks)

(e) 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 2 units per sec. How fast is the *x* coordinate changing?

(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 $y = x^2 cos3x$ 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) Given $z = f(x, y)$ and $z = x\cos(x + y)$ show that $\frac{d^2z}{dxdy} = \frac{d^2z}{dydx}$

(b) 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 $y = 3e^{tanx}$ (4 marks)

Question 4

(a) Determine the stationary points on the surface $z = (x^2 + y^2)^2 - 2(x^2 - y^2)$ and state their nature. (10 marks)

(b) Given the Hyperbola $x = 2.3\sec\theta$ and $y = 3.4\tan\theta$ find:

(i) $\frac{dy}{dx}$ (ii) $\frac{d^2y}{dx^2}$ at $\theta = 1\, radian.$ (10 marks)

Question 5

(a) Investigate the critical points on the curve

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

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

Prove that $y_n = e^x[x^2 + 2nx + n(n-1)]\ \forall\ n > 0$ (10 marks)

(b) The pressure (P) Volume (V) and temperature (T) of unit mass of gas are related by the formula PV=RT where R is a constant. Show that;

(i) $dp = \frac{P}{T}dT - \frac{P}{V}dv$

(ii) $dT = \frac{T}{V}dV + \frac{T}{p}dp$ (6 marks)

(c) The pressure P and Volume V of a gas are related by the equation $PV^{1.4}=C$

Estimate the percentage change In C when the pressure is increased by 2.3% and volume decreased by 0.84%. (4 marks)