MURANG'A UNIVERSITY COLLEGE

(A constituent College of Jomo Kenyatta university of Agriculture and Technology)

UNIVERSITY EXAMINATION 2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

SPECIAL/ SUPPLEMENTARY EXAMINATION FOR THE DIPLOMA IN CIVIL ENGINEERING

SEB 1231 : ENGINEERING MATHEMATICS III

DATE: 27TH JUNE, 2016 **2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 Marks)

a) Define the term differentiation (2mks

b) If $y = x^2 - 6x + 43$ find the derivative $\frac{dy}{dx}$ from the first principals (4mks)

c) Differentiate the following using chain rule

i. $y = ln(3x - 6)^3$ (4mks)

ii. $y = \tan(\sin(2x))$ (4mks)

d) Differentiate using either product or quotient rule

i. $y = (\cos(2x - 1))(\ln(4x - 9))$ (4mks)

ii. $y = \frac{\tan(4x-9)}{e^{2x+6}}$ (4mks)

e) Differerentiate implicitly $2xy^4 - 2x^3y + 3xy + 7y = 7$ (4mks)

f) Find f_x, f_y, f_{xy} of $f(x, y) = \tan(xy) + \ln(x + xy)$ (4mks)

QUESTION TWO (20 MARKS)

a) Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}, \frac{d^3y}{dx^3}, \frac{d^4y}{dx^4}$ of $y = \sin(e^{2x})$ (6kms)

b) A page is to contain 40 square inches of printed material. If the margins are 2 inch at top and bottom and I inch at the sides, find the most economical dimensions of the page (7mks)

c) A body moves in a straight line so that the distance moved S Metres is given in terms of the time t seconds by $S = \frac{t^3}{3} - \frac{3t^2}{2} + 2t + 1$ Find an expression for the acceleration of the body at time t and time t=3 . Also find the times at which the body is at rest. (7mks)

QUESTION THREE (20 MARKS)

a) Find the relative maximum and minimum values of the functions

i. $y = 2x^3 - 5x^2 + 4x - 1$ (4mks)

ii. $y = \frac{x(x-1)}{(x-2)}$ (4mks)

b) Find the gradient of the normal and tangent of the line $y = 3x^3 - 2x^2 - 2x + 7$ at the point (2,-2) (6mks)

c) The radius of a cylinder increases at the rate 0.1 cm/sec while the height decreases at the rate of 0.4 cm/sec. find the rate at which the volume is changing at the instant $r = 6cm$ and $h = 12cm$.

(6mks)

QUESTION FOUR (20 MARKS)

a) Find $\frac{dy}{dx}$ of

i. $y = (x + 2)^{\frac{1}{x}}$ (5mks)

ii. $y = (cos^{-1}(5x + 6))$ (5mks)

b) Find two integers whose sum is 24 and whose product is a maximum (5mks)

c) A cylinder has dimensions r=5cm, h=10cm. find the appropriate in volume when r increases by 0.2cm and h decreases by 0.1 cm (5mks)

QUESTION FIVE (20 MARKS)

a) Determine from first principals the slope of the graph of $y = x^2 - 9$ at the point $x = -3$ (6mks)

b) Find the inflexion point of the function $y = \frac{x^3}{3} - \frac{x^2}{2} - 2x + 5$ (6mks)

c) A box with a square base and an open top is to have 62.5 cm^3. Neglect the thickness of the material used to make the box, and find the dimensions that will minimize the amount of material used. (8mks)