



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

ECU 0201 ENGINEERING MATHS III

DATE 23/9/2019

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer question ONE and any other TWO questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Differentiate with respect to x

i) $y = \cos(2x + 3)^4$ (3 marks)

ii) $x^2 + y^2 + 2xy + x = 6$ (4 marks)

b) Differentiate $y = \cos 2x$ from the first principles (5 marks)

c) The parametric equations of a curve

$$y = 3\sin\theta - \sin^2\theta \quad x = \cos^2\theta$$

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$ (8 marks)

d) If $z = 2e^t \cos 5t$ show that $\frac{d^2z}{dx^2} - 8\frac{dz}{dx} + 41z = 0$ (5 marks)

e) Find the equation of the tangent and the normal to the curve

$y = 3x^3 - 2x^2 + 3x - 1$ at point (2,5) (5 marks)

QUESTION TWO (20 MARKS)

a) If $v = 2x^2 + 4xy + y^2$

Determine

i) $\frac{\delta v}{\delta x}$ (2 marks)

ii) $\frac{\delta^2 v}{\delta y^2}$ (2 marks)

ii) $\frac{\delta^2 v}{\delta y \delta x}$ (3 marks)

b) Given that $y = e^{2x} \ln x$ find $\frac{dy}{dx}$ (3 marks)

c) Differentiate with respect to x

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

ii) $y = \cos(2x - 1)$ (2 marks)

iii) $y = \frac{x^3}{\sin x}$ (2 marks)

iv) $y = 6e^{x^2+2}$ (3 marks)

QUESTION THREE (20 MARKS)

a) Given the function $y = e^{2x} \ln 5x$ obtain $\frac{dy}{dx}$ (5 marks)

b) Use logarithmic differentiation to obtain the differential coefficient of the functions

i) $y = x^4 e^{3x} \tan x$ (5 marks)

ii) $y = \frac{x^3 \cos 2x}{\sin 3x}$ (5 marks)

c) Obtain the Differential coefficient of the function

$$y = x^3 + y^3 + 3xy^2 = 8 \quad (5 \text{ marks})$$

QUESTION FOUR (20 MARKS)

a) Given $x = 3\cos\theta - \cos^3\theta$ and $y = 3\sin\theta - \sin^3\theta$

Express $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of θ (10 marks)

b) If $y = x + 3x^2 - x^3$ Find R at $x=0$ (5 marks)

c) Differentiate with respect to x

$$y = \sin^{-1} 5x \quad (5 \text{ marks})$$

QUESTION FIVE (20 MARKS)

- a) Find the stationary points and points of reflection on the graph of the function

$$y = 2x^3 - 5x^2 + 4x - 1 \quad (6 \text{ marks})$$

- b) The parametric equations of a function are given by

$$y = 2\sin^3\theta \quad \text{and} \quad x = 2\cos^3\theta \quad \text{Find the equation of the normal and the tangent at which } \theta = \frac{\pi}{4} \quad (10 \text{ marks})$$

- c) If $I = \frac{V}{R}$ and $V = 250\text{volts}$ and $R = 50\text{ohms}$ find the change in I resulting from an increase of 1volt in V and an increase of 0.5ohms in R

(4 marks)