



Murang'a University College

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

University Examination

School of Engineering

Supplementary Examination for the Diploma in Electrical Engineering

SEE 1102: ENGINEERING MATHEMATICS II

Date: August 2015

2 Hours

INSTRUCTIONS: Attempt Question One and any other Two Questions.

Question One (30 Marks)

a) Find the derivative $\frac{dy}{dx}$ given the function $y = (x^3 + 2)\tan(2x)$ (4 Marks)

b) Differentiate the function $y = 2^{x-1}$ (3 Marks)

c) Use the method of partial derivatives to find the derivative $\frac{dy}{dx}$ of the implicit function
 $3x^2y^3 - 3y^2 - y^2 + x^3 = 0$ (4 Marks)

d) Evaluate

$$\int_0^1 \frac{2x+1}{x^2+x} dx$$

(5 Marks)

e) Find the area bounded by the curve $y = x^2 - 9x + 14$ and the x -axis (5 Marks)

f) Find the orthogonal projection of the vector $\vec{A} = 2\tilde{i} + \tilde{j} + 5\tilde{k}$ in the direction of the vector
 $\vec{B} = 4\tilde{i} + 2\tilde{j} - 3\tilde{k}$ (5 Marks)

g) Given the vectors $\vec{A} = 2\tilde{i} + \tilde{j} - \tilde{k}$ and $\vec{B} = \tilde{i} + 4\tilde{j} + 2\tilde{k}$, find $\vec{A} \times \vec{B}$ (4 Marks)

Question Two (20 Marks)

a) Given the function of two variables $z = xy - 3x^3 - 4y^2$, find the second order partial derivatives (5 Marks)

b) The base radius r of a right circular cone is decreasing at the rate of 2.50 cm/sec while the perpendicular height h is increasing at the rate of 1.0 cm/sec. Determine the rate at which the volume is changing at an instant when $r = 5.0\text{cm}$ and $h = 2.0\text{cm}$ (5 Marks)

- c) Find and classify the stationary points of the surface $z = x^3 - 3x + xy^2$ (10 Marks)

Question Three (20 Marks)

- a) Evaluate

$$\int_0^1 x^2 \sqrt{x^3 - 2} dx$$

(7 Marks)

- b) Find the solution to the following indefinite integrals

(i) $\int (2x + 1)e^{2x} dx$ (4 Marks)

(ii) $\int \frac{3x}{4x^3 - x} dx$ (9 Marks)

Question Four (20 Marks)

- a) Differentiate the function $y = \frac{4x + \tan(2x)}{\sin(x)}$ (3 Marks)

- b) Given that the vectors $\vec{A} = b\tilde{i} - 2\tilde{j} + \tilde{k}$ and $\vec{B} = 2b\tilde{i} + b\tilde{j} - 4\tilde{k}$ are orthogonal, find the possible values of the constant b (6 marks)

- c) Find the angle between the vectors $\vec{U} = 4\tilde{i} - 2\tilde{j} + \tilde{k}$ and $\vec{V} = 2\tilde{i} - \tilde{j} + 2\tilde{k}$ (5 Marks)

- d) Find the direction cosines of the vector $\vec{A} = \tilde{i} + 3\tilde{j} + \tilde{k}$ hence verify the vector direction cosine law (6 Marks)

Question Five (20 Marks)

- a) Given that $u = x^2y + 2xy^2$, find $\frac{du}{dx}$ along the curve $y = x^2 - 2x + 1$ (7 Marks)

- b) Find the mean value of the function $y = 2x - x^2$ between the point where $x = 1$ and $x = 2$ (5 Marks)

- c) Find the volume of the solid generated when the area of the region enclosed between the curve $y = x^2 - 3x + 2$ and the x -axis is rotated about the x -axis by one complete turn. (8 Marks)