



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Marine Engineering
Diploma in Nautical sciences
AMA 2214 & EMR 2211 : Engineering Mathematics IV
SPECIAL/ SUPPLEMENTARY EXAMINATION
SERIES 2019
TIME: 2 HOURS
DATE: Pick Date Aug 2019

Instruction to Candidates:

You should have the following for this examination

- Student I.D. Card & Examination Pass
- Answer booklet
- Non-Programmable scientific calculator

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

Maximum marks for each part of a question are as shown.

Do not write on the question paper.

Question ONE COMPULSORY (30 MARKS)

a) Evaluate $\int_2^3 \frac{4}{x^2} dx$ (3mks)

ii) Determine $\int 2x(4x^2 + 3)^2 dx$ (4mks)

iii) Find $\int \sin^3 x dx$ (5mks)

b) Given $Z = x^3 y^2 - \frac{y}{x^2} + \frac{1}{y}$. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ (4mks)

ii) Determine the differential coefficient of $\sec x$ (4mks)

iii) Differentiate from first principle $y = x^2$ (4mks)

c) Define the following terms:

- i) Mutually exclusive event
- ii) Independent event

iii) Dependent event

(3mks)

d) One bag contain 3 red and 5 black marbles and second bag contain 4green and 7 white marbles. One marble is drawn from the first and two marbles from second bag without replacement. Determine probability of either one black and two green or one black and two white balls.

(3mks)

Question TWO (20 MARKS)

a) The mean height of 500 people is 150cm and standard deviation is 9cm. assuming the height are normally distributed. Determine the number of people likely to have height between 130cm and 165cm

(7mks)

b) The relationship between expenditure on welfare services and absenteeism for similar periods of time is shown below for a small company.

Expenditure (£_000)	3.5	5.0	7.0	10	12	15	18
Days lost	241	318	174	110	147	122	86

Determine the coefficient of linear correlation for this data

(13mks)

Question THREE (20 MARKS)

a) Find $\frac{dy}{dx}$ given $y = 2x^4 + \sin 5x - \frac{1}{2x^2} + \frac{1}{\sqrt{x}} - 5$

(3mks)

b) Determine the value of $\frac{dy}{dx}$ when $x=4$ given that $x^2 + y^2 = 25$

(4mks)

c) Find the maximum and minimum values of the curve $y = x^3 - 3x + 5$

(8mks)

d) Show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ given $y = 2xe^{-3x}$

Question FOUR (20 MARKS)

a) A Continous random variable has pdf Kx^2 for $0 \leq x \leq 3$ Find

i) Value of constant K

(4mks)

ii) P ($1 \leq x \leq 2$)

(2mks)

iii) The mean (3mks)

b) If 3% of the gearwheels produced by a company are defective, determine the probabilities that in a sample of 80 gearwheels;

(i) Two will be defective (3mks)

(ii) More than two will be defective (3mks)

c) Discrete random variable X has pdf as shown

$$P(X = x) \begin{cases} \frac{kx}{x^2 + 1}, & x = 2, 3 \\ \frac{2kx}{x^2 - 1}, & x = 4, 5 \\ 0, & \text{otherwise} \end{cases}$$

Show the value of $K = \frac{20}{33}$ (5mks)

Question FIVE (20 MARKS)

a) Using integration by parts, evaluate $\int 2e^x \sin 3x \, dx$ (7mks)

b) Find $\int \frac{2x^2 - 9x - 35}{(x+1)(x-2)(x+3)} \, dx$ (8mks)

c) Evaluate $\int_1^3 (2x - 5)^2 \, dx$ (5mks)