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
END OF SEMESTER EXAMINATION
SERIES: AUGUST 2019
TIME: 2 HOURS
DATE: 15 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

a) i) Evaluate $\int \frac{2x^4-3x^2}{4x}\,dx$ **(3 marks)**

ii) Determine $\int \frac{2x}{\sqrt{4x^2-1}}\,dx$ **(4 marks)**

iii) Find $\int sin^2 t cos^4 t\, dt$ **(9 marks)**

b) i) Given z = $\frac{x}{y}$ find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ **(3 marks)**

ii) Determine the differential coefficient of cot x **(4 marks)**

iii) Differentiate from first principles y = $\frac{1}{2x}$ **(3 marks)**

c) Probability of three events happening are $\frac{1}{8}$ for event A, $\frac{1}{5}$ for event B, and $\frac{2}{7}$ for event C. determine:

i) Probability of only event A happening **(2 marks)**

ii) Probability of event A or event C happening but not B **(2 marks)**

Question TWO

a) A production department has 35 similar milling machines. The number of breakdowns on each machine averages 0.06 per week. Determine the probabilities of having:

(i) One machine breaking down in any week **(2 marks)**

(ii) Less than three machines breaking down in any week **(5 marks)**

b) Continuous random variable x has pdf where

$$f(x) = \begin{cases} k(x+2)^2 & -2 \leq x \leq 0 \\ 4k & 0 \leq x \leq 1\frac{1}{3} \\ 0 & otherwise \end{cases}$$

i) Find the value of constant k **(4 marks)**

ii) Find $P(-1 \leq x \leq 1)$ **(4 marks)**

iii) $P\ (x > 1)$ (2 marks)

c) Discrete random variable W has probability distribution as shown

W	-3	-2	-1	0	1
$P(W = w)$	0.1	0.25	0.3	0.15	d

Find:

i) Value of d **(2 marks)**

ii) $P(-3 \leq w < 0)$ **(2 marks)**

iii) $P\ (w > -1)$ **(1 mark)**

Question THREE

a) Given $4x^3 + 2x - \frac{1}{3x^2} + \frac{1}{\sqrt{x}} - 7$ find $\frac{dy}{dx}$ **(3 marks)**

b) Determine the coordinates of point on the graph $y = x^2 + x - 6$ where the gradient is -1. **(4 marks)**

c) Given y=2xe^{-3x} show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ **(5 marks)**

d) Determine the turning points of the graph $y = \frac{x^3}{3} - \frac{x^2}{2} - 6x + \frac{5}{3}$ and distinguish between them. **(8 marks)**

Question FOUR

a) Using integration by parts, evaluate $\int 2e^{x} sin3x\, dx$ **(7 marks)**

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

c) Evaluate $\int_1^3 (4x-3)^2\, dx$ **(5 marks)**

Question FIVE

a) The mean height of 500 people is 170cm and standard deviation is 9cm. Assuming the heights are normally distributed, determine the number of people likely to have heights between 150cm and 195 cm. **(7 marks)**

b) The parametric equations of function are $y = 3\cos 2t$, $x = 2\sin t$. Find:

i) $\frac{dy}{dx}$ **(4 marks)**

ii) $\frac{d^2y}{dx^2}$ **(3 marks)**

c) Given $y = 4x^2 - x$. Determine approximate change in y if x changes from 1 to 1.02 **(3 marks)**

d) The length l metres of metal rod at temperature θ°C is given by $l = 1 + 0.000005\theta + 0.0000004\theta^2$. Determine rate of change of length in mm/°C when temperature is 100°C and 400°C **(3 marks)**