MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

FIRST YEAR **SECOND** SEMESTER EXAMINATION FOR, DIPLOMA ELECTRICAL AND ELECTRONICS ENGINEERING

ECU 054 – ENGINEERING MATHEMATICS II

DURATION: 2 HOURS

DATE: 11/12/2018

TIME: 2 – 4 P.M.

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a. Given that f $(x) = 5x^2 + x - 7$, determine;

i. f (2) ÷ f (1)

ii. f (3 + a)

iii. f (3 + a) – f (3)

iv. $\frac{\text{f (3 + a) – f (3)}}{\text{a}}$ (6 Marks)

b. Differentiate from first principles f $(x) = 2x^3$ (6 Marks)

c. Differentiate the following with respect to the variable;

i. y = 2 sin 5ø

ii. f (t) = 3 cos 2t

d. Evaluate; (4 Marks)

$$\int_{-1}^{1} \left(\frac{x^4 - 5x^2 + x}{x}\right) dx$$

e. If $A = A_1\tilde{i} + A_2\tilde{j} + A_3\tilde{k}$ and $B_1\tilde{i} + B_2\tilde{j} + B_3\tilde{k}$

Prove that;

$A.B = A_1B_1 + A_2B_2 + A_3B_3$ (4 Marks)

f. Determine the integration area bounded by three straight lines y = 4- x, y = 3 x and 3y = x (6 Marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a. Determine;

i. $\int \left(\frac{3x^2 - 1}{x}\right) dx$ (2 Marks)

ii. $\int 5 \cos 3x \, dx$ (2 Marks)

iii. $\int (2x - 5)^7 \, dx$ (3 Marks)

b. A sinusoidal voltage v = 100 sin wt volts. Use integration to determine over half a cycle

i. The mean value

ii. The r.m.s value (13 Marks)

QUESTION THREE (20 MARKS)

a. Find the differential coefficient of: (6 Marks)

$$y = \frac{4 \sin 5x}{5x^4}$$

b. The voltage across the plates of a capacitor at any time t seconds is given by $v = Ve^{-t/CR}$ where V, C and R are constants. Given that V = 300 volts, $C = 0.12 \times 10^{-6}$F and $R = 4 \times 10^{6}\Omega$.

Determine;

i. The initial rate of change of voltage

ii. The rate of change of voltage after 0.5 sec (6 Marks)

c. Determine the maximum and minimum values of the curve $y = x^3 - 3x + 5$ by;

i. Examining the gradient on either side of the turning points

ii. Determining the sign of the second derivative (8 Marks)

QUESTION FOUR (20 MARKS)

a. For vectors: $a = i + 4j - 2k$ and

$b = 2i - j + 3k$

Determine:

i. $a \times b$

ii. $|a \times b|$ (10 Marks)

b. Sketch the graph $y = x^3 + 2x^2 - 5x - 6$ between $x = -3$ and $x = 2$ and determine the area enclosed by the curve and the x axis (10 Marks)