MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR THE DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

SEE 1301 – ENGINEERING MATHEMATICS V

DURATION: 2 HOURS

DATE: 26TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** 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

a) If $A = \begin{pmatrix} -3 & 0 \\ 7 & -4 \end{pmatrix}$ $B = \begin{pmatrix} 2 & -1 \\ -7 & 4 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & 0 \\ -2 & -4 \end{pmatrix}$

Determine 2A – 3B +4C (4 marks)

b) Evaluate $\begin{vmatrix} (1+j) & j2 \\ -j3 & (1+j4) \end{vmatrix}$ (4 marks)

c) Use laplace transforms to solve the differential equation $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 13y = 0$, given that when x=0, y=3 and $\frac{dy}{dx} = 7$ (6 marks)

d) Determine the laplace transform of Sin^2t (4 marks)

e) Determine the inverse laplace transform of $\frac{4s-5}{S^2 - S - 2}$ (6 marks)

f) Determine the Eigen value λ that satisfy the following equation

$$\begin{vmatrix} (5-\lambda) & 7 & -5 \\ 0 & (4-\lambda) & -1 \\ 2 & 8 & (-3-\lambda) \end{vmatrix} = 0$$ (6 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) If $A = \begin{pmatrix} 3 & 4 & 0 \\ -2 & 6 & -3 \\ 7 & -4 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -5 \\ 5 & -6 \\ -1 & -7 \end{pmatrix}$

Determine A x B (5 marks)

b) Applying Kirchhoff's laws to an electric circuit results in the following equations

$$\begin{aligned} (9+j12)I_1 - (6+j8)I_2 &= 5 \\ -(6+j8)I_1 + (8+j3)I_2 &= (2+j4) \end{aligned}$$

Solve the equations for I_1 and I_2 (7 marks)

c) A d.c circuit comprises three closed loops. Applying Kirchhoff's laws to the closed loops give the following equations for current flow in milliamperes.

$$\begin{aligned} 2I_1 + 3I_2 - 4I_3 &= 26 \\ I_1 - 5I_2 - 3I_3 &= -87 \\ -7I_1 + 2I_2 + 6I_3 &= 12 \end{aligned}$$

Use determinants to solve for I_1, I_2 and I_3 (8 marks)

QUESTION THREE

a) If $A = \begin{pmatrix} 2 & 3 \\ 1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ 0 & 1 \end{pmatrix}$

Show that A x B ≠ B x A (4 marks)

b) Evaluate $\begin{vmatrix} 1 & 4 & -3 \\ -5 & 2 & 6 \\ -1 & -4 & 2 \end{vmatrix}$ (4 marks)

c) Show that

$\mathcal{L}\,\{3e^{-1/2x}\ \mathrm{Sin}^2 x\} = \frac{48}{(2s+1)(4s^2+4s+17)}$ (12 marks)

QUESTION FOUR

a) Determine the laplace transforms of:

i. $5e^{-3t}\mathrm{Sinh}2t$ (3 marks)

ii. $2e^{3t}(4\ \mathrm{Cos}\ 2t - 5\mathrm{Sin}2t)$ (3 marks)

b) Solve the following pair of simultaneous differential equations

$\frac{dy}{dx} + \ x = 1$

$\frac{dy}{dt} - \ y + 4e^t = 0$

Given that at t = 0, x = 0 and y = 0 (14 marks)