MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE, APPLED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2020/2021 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR, DIPLOMA IN CIVIL ENGINEERING AND DIPLOMA IN ELECTRICAL ENGINEERING

ECU059/SEB1351: ENGINEERING MATHEMATICS V

DURATION:2 HOURS

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) Define the following terms
   i) Square Matrix
   ii) Diagonal matrix
   iii) Unit matrix
   iv) Null matrix
   v) Singular matrix (5 marks)

b) Find L{e^{at}} where a is a consonant (3 marks)

c) Given that the determinant D= 35, D_x = 70, D_y = -105 and D_z = 175. Calculate the values of x, y, and z using Cramer's rule. (3 marks)

d) Given the matrices A= $\begin{pmatrix} 2 & 1 & -3 \\ 6 & 3 & -9 \end{pmatrix}$ and B = $\begin{pmatrix} 1 & 9 \\ 4 & -6 \\ 2 & 4 \end{pmatrix}$

   Show that A x B = 0 (3 marks)

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

   Find 2A – 3B + 4C

f) Given that L{sin 4t}= $\frac{4}{s^2+16}$ Find L{t sin 4t} (5 marks)

g) Calculate the determinant of $\begin{pmatrix} 1/2 & 2/3 \\ -1/3 & -3/5 \end{pmatrix}$ (2 marks)

h) Use the Laplace transform of the first derivative to find L {$3t^2$} (5 marks).

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) Find the Laplace transform of the function f (t) = $\cos^2$ (t) (5 marks)

b) Find the inverse of the matrix A $\begin{pmatrix} 2 & 7 & 4 \\ 3 & 1 & 6 \\ 5 & 0 & 8 \end{pmatrix}$ (5 marks)

c) Find $L^{-1}\left\{\frac{S^2 - 11S + 6}{(S+1)(S-2)^2}\right\}$ (10 marks)

QUESTION THREE (20 MARKS)

3. (a) Find the eigen values and the corresponding eigen vectors of matrix A where

A = $\begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$ (10 marks)

(b) Find the Laplace transform of f (t) = $\frac{1-Cos\ t}{t}$ (10 marks)

QUESTION FOUR (20 MARKS)

a) Find the particular solution to the initial value problem

the $\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 3x = e^{2t}$, x(0) = 2, x^1 (0) = 0 (12 marks)

b) What is a matrix? (2 marks)

c) Solve the following simultaneous equations using the inverse matrix method.

4x – 3y = 17

x + y+1 = 0 (6 marks)