MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR THE DIPLOMA IN BUILDING AND CIVIL ENGINEERING

SEB 1351 – MATHEMATICS V

DURATION: 2 HOURS

DATE: 24TH 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. Show all the working clearly.
4. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Solve

    i. $\frac{dy}{dx} = \frac{x^2 + y^2}{xy}$ (4 marks)

    ii. $(x^2 + y^2)\frac{dy}{dx} = xy$ (4 marks)

    iii. $y = Axe^x$ (4 marks)

b) Solve

    i. $x\frac{dy}{dx} + y = x^3$ (4 marks)

    ii. $\frac{dy}{dx} + y\cot x = Cos\ x$ (4 marks)

    iii. $(x+1)\frac{dy}{dx} + y = (x+1)^2$ (4 marks)

c) Find the Eigen values and Eigen vectors of $B = \begin{pmatrix} 3 & 2 & 2 \\ 0 & -4 & -2 \\ 0 & 5 & 3 \end{pmatrix}$ (6 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) Solve

    i. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 9y = 0$ (3 marks)

    ii. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ (2 marks)

    iii. $\frac{d^2y}{dx^2} + 7y = 0$ (2 marks)

    iv. $2\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 0$ (3 marks)

b) Use Gaussian elimination method to solve

    $x_1 + x_2 + x_3 = 6$

    $2x_1 + x_2 + 3x_3 = 13$

    $3x_1 + 3x_2 + 4x_3 = 20$ (10 marks)

QUESTION THREE

a) Find the inverse of

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 1 & 5 \\ 6 & 0 & 2 \end{pmatrix}$$ (10 marks)

b) Given that

$$A = \begin{pmatrix} 4 & 3 \\ 2 & 5 \end{pmatrix} \text{ and } B = \begin{pmatrix} 4 & 4 \\ 3 & 3 \end{pmatrix}$$

Evaluate

   i.   A-B

   ii. $2A - 3B$

   iii. $5A + 4B$ (10 marks)

QUESTION FOUR

a) Solve

   i. $(x - 2)\dfrac{dy}{dx} - y = (x - 2)^2$ (4 marks)

   ii. $x\dfrac{dy}{dx} - 5y = x^7$ (4 marks)

   iii. $x\dfrac{dy}{dx} = 5x^2 + 4$ (4 marks)

b) Use matrices to solve the simultaneous equations

   $x + y + z = 4$

   $2x - 3y + 4z - 33 = 0$

   $3x - 2y - 2z - 2 = 0$ (8 marks)

QUESTION FOUR

a) i.   determine A x B if

$$A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & 2 \\ 1 & 3 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 2 & 0 \\ 1 & 3 & 2 \\ 3 & 2 & 0 \end{bmatrix}$$ (5 marks)

   ii. Determine the inverse of the matrix

$$\begin{bmatrix} 3 & 4 & -1 \\ 2 & 0 & 7 \\ 1 & -3 & -2 \end{bmatrix}$$ (5 marks)

b) From the differential equation from the following functions:

   i. $y = Ae^{-4x} + Be^{-6x}$ (3 marks)

   ii. $y = Axe^x$ (2 marks)

   iii. $y = x + \dfrac{A}{x}$ (2 marks)

   iv. $y = A\,Sin\,x + B\,Cos\,x$ (3 marks)