United International University
School of Science and Engineering
Final Examination Trimester: Spring-2022
Course Title: Calculus and Linear Algebra
Course Code: Math 183/ Math 2183 Marks: 40
Time: **2 hour**

Answer all questions.

1. a) Solve the following system by Gauss-Jordan elimination method

$$x - y + 2z + 3p = 3$$
$$3x + y - 2z + p = 0$$
$$-x + 2y - z - p = -1$$

[5]

b) Solve the homogeneous system of linear equations

$$x - 2y + z - w = 0$$
$$2x - 3y + 2z + w = 0$$
$$3x - 2y + z - w = 0$$

[5]

2. a) Find the Eigenvalues and corresponding Eigenvector of Matrix $A = \begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$. Also draw the Eigen space in xy −plane. [5]

b) Find the inverse of $A = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 1 & 0 \\ 0 & 3 & 1 \end{bmatrix}$ by applying inversion algorithm. [5]

3. Consider a Matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 2 & 4 & 0 \\ 0 & -1 & 1 \end{bmatrix}$ [4]

i) Find the Cofactor Matrix of A [2]

ii) Find $\det(A)$. [4]

iii) Find $P(A)$, where $P(x) = -A^2 + 5 + 2A + A^T$

4. a) Solve $y'' + y' + y = e^{-2x} + sin3x + ln5 - 4^x + e^x cos2x$. [6]

b) Solve the following second order ordinary differential equation [4]

$$y'' - 4y' + 4y = 0 \qquad y(0) = -1 \quad y'(0) = 1$$