SHRI GOVIND GURU UNIVERSITY
Syllabus for B. Sc. Semester-I (Mathematics)
BS23MN1MT1 Minor: Linear Algebra-I (Theory)

Hours: 2 /week **Credits: 2**

Prerequisite:Introduction to matrix and operation on matrices.

Course Objectives: The primary objective of the course is to encompass a comprehensive range of skills, knowledge and deep understanding of fundamental concepts in Matrix Algebra including matrices, determinant and systems of linear equations, Explore various techniques for system of linear equations, Recognize and analyze properties of matrices such as symmetry, skew-symmetry, transposition and inverses, Calculate determinants of matrices and understand their significance, Understand fundamental matrix operations, Study matrix properties, Explore eigenvalues and eigenvectors, their computation, and their significance in various fields and Develop problem-solving skills by using Linear Algebra techniques to solve real-world problems.

Course Learning Outcomes: The learning outcomes reflect the comprehensive understanding of the knowledge and skills. Upon completing the course, students should be able to:

1. Perform basic and advanced operations on matrices.
2. Identify and analyze properties of matrices.
3. Calculate determinants of matrices, understand their geometric and algebraic significance, and apply them in solving systems of equations.
4. Apply matrix methods to solve systems of linear equations.
5. Compute eigenvalues and eigenvectors, diagonalize matrices, and their applications in various disciplines.

Unit I: Special type of matrices and their properties, Elementary row operations on matrices, Linear dependence and independence of row and column vectors/matrices, Row reduced echelon form of a matrix and matrix inversion using it, Rank of a matrix.

Unit II: Existence of inverse of a square matrix, Cancellation law in matrix multiplication, Eigen values, Eigen vectors and the characteristic equation of a matrix, Cayley-Hamilton theorem and its applications.

Unit III: Definition and properties of determinant of a square matrix, Solving System of simultaneous linear equations using Cramer's method, Graphical method (two variables), RRE method and Inverse method.

Reference Books:

1. An Introduction to Linear Algebra- V. Krishnamurthy, V. P. Mainra, J. L. Arora, East-West Press, New Delhi.
2. A Textbook of Matrices - Shanti Narayan, P. K. Mittal, S. Chand Publishing, 2010.
3. Matrix and Linear Algebra - K. B. Dutta, Prentice-Hall of India, New Delhi, India.
4. Matrices, J. N. Kapur and M. K. Singal, R. Chand and Co., 1996.

5. A Textbook of Matrices, Hari Kishan, Atlantic publishers, 2008.

6. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, John Wiley and Sons .

Teaching Plan: The teaching plan may be followed as:
Weeks 1 and 2: Elementary operations on matrices, Linear dependence and independence of vectors/matrices.
Weeks 3 and 4: Rank of matrix, RRE and matrix inversion using it.
Weeks 5, 6 and 7: Square matrix, Eigen values, Eigen vectors and the characteristic equation of a matrix.
Weeks 8 and 9: Existence of inverse of a square matrix, Cancellation law in matrix multiplication, Cayley-Hamilton's Theorem and its application.
Weeks 10 and 11: Definition and Properties of determent of a square matrix.
Weeks 12, 13 and 14: Solving System of simultaneous linear equations using Cramer's method, Graphical method (two variables), RRE method and Inverse method.
Week 15: Discussion about learning outcomes of the course.

Minor: Linear Algebra-I (Practical)

Hours: 4 /week **Credits: 2**

Number of Practicals: 12

List of Practicals:

1. Examples of elementary row operations.
2. Examples of linearly dependent and independent vectors.
3. Examples on finding rank of a matrix using linearly independent row/column vectors.
4. Examples on finding rank of a matrix using RRE form.
5. Examples on finding the Eigenvalue and Eigenvector.
6. Examples on finding the characteristic equation of a matrix.
7. Examples on verification of Cayley-Hamilton Theorem.
8. Examples on applications of Cayley-Hamilton Theorem.
9. Examples on verifying properties of determinant of square matrices.
10. Examples on solving system of simultaneous linear equations using Cramer's rule.
11. Examples on solving system of simultaneous linear equations using RRE form.
12. Examples on solving system of simultaneous linear equations using Inverse method.

Reference Books:

1. An Introduction to Linear Algebra- V. Krishnamurthy, V. P. Mainra, J. L. Arora, East-West Press, New Delhi.
2. A Textbook of Matrices - Shanti Narayan, P. K. Mittal, S. Chand Publishing, 2010.
3. Matrix and Linear Algebra - K. B. Dutta, Prentice-Hall of India, New Delhi, India.
4. Matrices, J. N. Kapur and M. K. Singal, R. Chand and Co., 1996.
5. A Textbook of Matrices, Hari Kishan, Atlantic publishers, 2008.
6. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, John Wiley and Sons .