Mathematics II

Course Title: Mathematics II
Course No: MTH163
Nature of the Course: Theory
Semester: II

Full Marks: 80 + 20
Pass Marks: 32 + 8
Credit Hrs: 3

Course Description: The course contains concepts and techniques of linear algebra. The course topics include systems of linear equations, determinants, vectors and vector spaces, eigen values and eigenvectors, and singular value decomposition of a matrix.

Course Objectives: The main objective of the course is to make familiarize with the concepts and techniques of linear algebra, solve system of linear equation with Gauss-Jordon method, to impart knowledge of vector space and subspace, eigenvalues and eigenvectors of a matrix and get the idea of diagonalization of a matrix, linear programming, Group, Ring, and Field.

Course Contents:

Unit 1: Linear Equations in Linear Algebra (5 Hrs.)
System of linear equations, Row reduction and Echelon forms, Vector equations, The matrix equations $A\mathbf{x} = \mathbf{b}$, Applications of linear system, Linear independence

Unit 2:Transformation (4 Hrs.)
Introduction to linear transformations, the matrix of a linear Transformation, Linear models in business, science, and engineering

Unit 3: Matrix Algebra (5 Hrs)
Matrix operations, The inverse of a matrix, Characterizations of invertible matrices, Partitioned matrices, Matrix factorization, The Leontief input output model, Subspace of R^n, Dimension and rank

Unit 4: Determinants (4 Hrs.)
Introduction, Properties, Cramer's rule, Volume and linear transformations

Unit 5: Vector Spaces (5 Hrs.)
Vector spaces and subspaces, Null spaces, Column spaces, and Linear transformations, Linearly independent sets: Bases, Coordinate systems

Unit 6: Vector Space Continued (4 Hrs.)
Dimension of vector space and Rank, Change of basis, Applications to difference equations, Applications to Markov Chains

Unit 7: Eigenvalues and Eigen Vectors (5 Hrs.)
Eigenvectors and Eigenvalues, The characteristic equations, Diagonalization, Eigenvectors and linear transformations, Complex eigenvalues, Discrete dynamical systems, Applications to differential equations

Unit 8: Orthogonality and Least Squares (5 Hrs.)
Inner product, Length, and orthoganility, Orthogonal sets, Orthogonal projections, The Gram-Schmidt process, Least squares problems, Application to linear models, Inner product spaces, Applications of inner product spaces

Unit 9: Groups and Subgroups (5 Hrs.)
 Binary Operations, Groups, Subgroups, Cyclic Groups

Unit 10: Rings and Fields (4 Hrs.)
Rings and Fields, Integral domains

Text Books:
1. Linear Algebra and Its Applications, David C. Lay, 4th Edition, Pearson Addison Wesley.
2. Linear Algebra and Its Applications, Gilbert Strang, 4th Edition, Addison, CENGAGE Learning.