

# **MG- Mathematics- Graph Theory and Linear Algebra**

## **Unit 1. Introduction**

- 1.1 What is a Graph?
- 1.2 Application of Graphs
- 1.3 Finite and Infinite Graphs
- 1.4 Incidence and Degree
- 1.5 Isolated Vertex, Pendant Vertex and Null Graph

## **Unit 2. Paths and Circuits**

- 2.1 Isomorphism
- 2.2 Subgraphs
- 2.4 Walks, Paths, and Circuits
- 2.5 Connected Graphs, Disconnected Graphs, and Components
- 2.6 Euler Graphs
- 2.7 Operations on Graphs
- 2.8 More on Euler Graphs
- 2.9 Hamiltonian Paths and Circuits
- 2.10 The Traveling Salesman Problem

## **Unit 3. Trees and Fundamental Circuits**

- 3.1 Trees
- 3.2 Some Properties of Trees
- 3.3 Pendant Vertices in a Tree
- 3.4 Distance and Centers in a Tree
- 3.5 Rooted and Binary Trees
- 3.6 On Counting Trees
- 3.7 Spanning Trees
- 3.8 Fundamental Circuits
- 3.10 Spanning Trees in a Weighted Graph

## **Unit 4. Cut-Sets and Cut-Vertices**

- 4.1 Cut-Sets
- 4.2 Some Properties of a Cut-Set
- 4.3 All Cut-Sets in a Graph
- 4.4 Fundamental Circuits and Cut-Sets

## 4.5 Connectivity and Separability

### **Unit-5: Matrices and System of Linear Equations**

- 5.1. Row echelon form of a matrix, reduced row echelon form of a matrix.
- 5.2. Definition of rank of a matrix using row echelon or row reduced echelon form.
- 5.3. System of linear equations- Introduction, matrix form of linear system, definition of row equivalent matrices.
- 5.4. Consistency of homogeneous and non-homogeneous system of linear equations using rank, condition for consistency.
- 5.5. Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.

### **Unit-6: Vector Spaces-I**

- 6.1. Definition and Examples.
- 6.2. Subspaces.
- 6.3. Linear Dependence and Independence
- 6.4. Basis of Vector Space

### **Unit-7: Vector Spaces-II**

- 7.1. Dimension of a Vector Space.
- 7.2. Row, Column and Null Space of a matrix.
- 7.3. Rank and nullity.

### **Unit-8: Linear Transformations**

- 8.1. Definition and Examples, Properties, Equality.
- 8.2. Kernel and range of a linear Transformation
- 8.3. Rank-Nullity theorem.
- 8.4. Composite and Inverse Transformation.
- 8.5. Matrices and Linear Transformation.
- 8.6. Basic Matrix Transformations in  $\mathbb{R}^2$  and  $\mathbb{R}^3$
- 8.7. Linear Isomorphism.