

## B.Sc. (Hons) Mathematics, Semester-III, DSE-Courses

### DISCIPLINE SPECIFIC ELECTIVE COURSE -1(i): GRAPH THEORY

#### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
Graph Theory	4	3	1	0	Class XII pass with Mathematics	Nil

#### Learning Objectives

The primary objective of this course is to introduce:

- Problem-solving techniques using various concepts of graph theory.
- Various properties like planarity and chromaticity of graphs.
- Several applications of these concepts in solving practical problems.

#### Learning Outcomes

This course will enable the students to:

- Learn modelling of real-world problems by graphs.
- Know characteristics of different classes of graphs.
- Learn representation of graphs in terms of matrices.
- Learn algorithms to optimize a solution.
- Understand some properties of graphs and their applications in different practical situations.

#### SYLLABUS OF DSE - 1(i)

##### **Unit – 1** (12 hours)

##### **Graphs, Paths and Circuits**

Definition, Examples and basic properties of graphs, Subgraphs, Pseudographs, Complete graphs, Bipartite graphs, Isomorphism of graphs, Paths and circuits, Connected graphs, Eulerian circuits, Hamiltonian cycles, Adjacency matrix, Weighted graph, Travelling salesman problem, Shortest path, Dijkstra's algorithm.

##### **Unit – 2** (15 hours)

##### **Applications of Paths and Circuits, Trees**

Applications of Path and Circuits: The Chinese Postman Problem, Digraphs, Bellman-Ford Algorithm, Tournaments, Scheduling Problem, Trees, Properties of Trees, Spanning Trees, Minimum Spanning Tree Algorithms.

##### **Unit – 3** (18 hours)

##### **Connectivity and Graph Coloring, Planar Graphs**

Cut-vertices, Blocks and their Characterization, Connectivity and edge-connectivity, Planar graphs, Euler's formula, Kuratowski theorem, Graph coloring and applications, Matchings, Hall's theorem, Independent sets and covers.

### Essential Readings

1. Goodaire, Edgar G., & Parmenter, Michael M. (2006). Discrete Mathematics with Graph Theory (3rd ed.). Pearson Education Pvt. Ltd. Indian Reprint.
2. Chartrand, Gary, & Zhang, Ping (2012). A First Course in Graph Theory. Dover Publications.

### Suggestive Readings

- Bondy, J. A., and Murty, U.S.R. (2008). Graph Theory. Graduate Texts in Mathematics, Springer.
- Diestel, Reinhard (2017). Graph Theory (5th ed.). Graduate Texts in Mathematics, Springer.
- West, Douglas B. (2001). Introduction to Graph Theory (2nd ed.). Prentice Hall. Indian Reprint.

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

## DISCIPLINE SPECIFIC ELECTIVE COURSE– 1(ii): MATHEMATICAL PYTHON

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice		
Mathematical Python	4	3	0	1	Class XII pass with Mathematics	Basic knowledge of Python

### Learning Objectives

The Learning Objectives of this course are as follows:

- To be able to model and solve mathematical problems using Python Programs.
- To experience utility of open-source resources for numerical and symbolic mathematical software systems.

### Learning Outcomes

This course will enable the students to use Python:

- For numerical and symbolic computation in mathematical problems from calculus, algebra, and geometry.
- To tabulate and plot diverse graphs of functions and understand tracing of shapes, geometries, and fractals.
- To prepare smart documents with LaTeX interface.

### SYLLABUS OF DSE - 1(ii)