

**SYLLABUS OF GE-7(ii)****UNIT-I: Topology of Metric Spaces (18 hours)**

Inequalities, Definition and examples, Sequences and Cauchy sequences, Complete metric space; Open and closed balls, Neighborhood, Open set, Interior of a set, Limit point of a set, Closed set, Closure of a set; Subspaces.

**UNIT-II: Continuity and Uniform Continuity in Metric Spaces (15 hours)**

Continuous mappings, Sequential criterion, and other characterizations of continuity; Uniform continuity; Homeomorphism, isometry, and equivalent metrics.

**UNIT-III: Connected and Compact Spaces (12 hours)**

Connected subsets of  $\mathbb{R}$ , Connectedness and continuous mappings; Compactness and boundedness, Characterizations of compactness, Continuous functions on compact spaces.

**Essential Reading**

1. Shirali, Satish & Vasudeva, H. L. (2009). Metric Spaces. Springer. Indian Reprint 2019.

**Suggestive Reading**

- Kumaresan, S. (2014). Topology of Metric Spaces (2nd ed.). Narosa Publishing House.

**GENERIC ELECTIVES (GE-7(iii)): INTRODUCTION TO 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		
Introduction to 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:

- Good familiarity with all initial notions of graph theory and related results and seeing them used for some real-life problems.
- Learning notion of trees and their enormous usefulness in various problems.
- Learning various algorithms and their applicability.
- Studying planar graphs, Euler theorem associated to such graphs and some useful applications like coloring of graphs.

**SYLLABUS OF GE-7(iii)****UNIT-I: Graphs, Types of Graphs and Basic Properties (12 hours)**

Graphs and their representation, Pseudographs, Subgraphs, Degree sequence, Euler's theorem, Isomorphism of graphs, Paths and circuits, Connected graphs, Euler trails and circuits, Hamiltonian paths and cycles, Adjacency matrix, Weighted graphs, Travelling salesman problem, Dijkstra's algorithm.

**UNIT-II: Directed Graphs and Applications, Trees (18 hours)**

The Chinese postman problem; Digraphs, Bellman-Ford algorithm, Tournaments, Directed network, Scheduling problem; Trees and their properties, Spanning trees, Kruskal's algorithm, Prim's algorithm, Acyclic digraphs and Bellman's algorithm.

**UNIT-III: Planar Graphs, Graph Coloring and Network Flows (15 hours)**

Planar graphs, Euler's formula, Kuratowski theorem, Graph coloring, Applications of graph coloring, Circuit testing and facilities design, Flows and cuts, Max flow-min cut theorem, Matchings, Hall's theorem.

**Essential Reading**

1. Goodaire, Edgar G., & Parmenter, Michael M. (2011). Discrete Mathematics with Graph Theory (3rd ed.). Pearson Education Pvt. Ltd. Indian Reprint.

**Suggestive Readings**

- Bondy, J. A. & Murty, U.S.R. (2008), Graph Theory with Applications. Springer.
- Chartrand, Gary, & Zhang, P. (2012). A First Course in Graph Theory. Dover Publications.
- Diestel, R. (1997). Graph Theory (Graduate Texts in Mathematics). Springer Verlag.
- West, Douglas B. (2001). Introduction to graph theory (2nd ed.). Pearson India.

**GENERIC ELECTIVES (GE-7(iv)): TOPICS IN MULTIVARIATE CALCULUS****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		
Topics in Multivariate Calculus	4	3	1	0	Class XII pass with Mathematics	Calculus

**Learning Objectives:** The primary objective of this course is to introduce the:

- Extension of the studies of single variable differential and integral calculus to functions of two or more independent variables.
- Applications of multivariable calculus tools to physics, economics, and optimization.