UNIVERSITY OF DELHI

CNC-II/093/1/Misc./2025/36
Dated: 17.02.2026

NOTIFICATION

Sub: Amendment to Ordinance V

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

Add the following:

The syllabus of Discipline Specific Elective paper titled “Graph Theory” to be offered in Semester-IV of Department of Computer Science under Faculty of Mathematical Sciences based on Undergraduate Curriculum Framework 2022, is notified for the information of all concerned as per ***Annexure-1*.**

20/2/26

REGISTRAR

Annexure-1

DSE : Graph Theory [3-0-1]

Course Code	Credits	Credit distribution of the course			Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/Practice	
	4	**3**	**0**	**1**	**NA**

Course Objectives: This course will cover fundamental definitions and concepts of graph theory, as well as properties and formulations of typical graph problems. Students will be able to apply their knowledge of graph theory to problems in computing and social sciences.

Course Learning Outcomes: Upon successful completion of the course, student will-
1. understand and apply the basic concepts of graph theory, like Paths, Cycles, Eulerian circuit, degree, vertex, trees, Hamiltonian paths & circuits, bipartite and planar graphs.
2. be able to read and write rigorous mathematical proofs involving graphs.
3. acquire basic knowledge to solve problems using basic graph theory, i.e., matchings, covers, network flows, connectivity, vertex & edge colorings.
4. be recognition of the numerous applications of graph theory and solve real-world problems.

Syllabus:

Unit 1: **(11 hours)**
What is Graph- definition, model, matrices, isomorphism, special graph; Paths, Cycles, and Trails- connection, bipartite, Eulerian circuit; finite and infinite graph, incidence and degree, isolated vertex, pendant vertex, null graph.

Unit 2: **(11 hours)**
Vertex Degree and Counting- counting, bijection; Directed Graphs- definition, examples, vertex degree, Eulerian diagraphs; Trees and Distances- properties of trees, enumeration of trees; walks, paths, circuits, Euler graphs, operations on graphs, Hamiltonian paths and circuits.

Unit 3: **(12 hours)**
Matchings and covers-maximum matchings, min-max theorems, independent set, covers; Algorithms and Applications- maximum bipartite matching; network flows; incidence matrix, submatrices, circuit matrix, cut-set matrix, path matrix, adjacent matrix.

Unit 4: **(11 hours)**
Cuts and Connectivity- connectivity, edge- connectivity, blocks; Vertex Colorings- definition, examples; Planar Graphs- drawing in the plane, dual graph, Euler's formula; Edges-coloring, Hamiltonian cycles; Detection of Planarity.

Essential/ Recommended readings:

1. Douglas B West, Introduction to Graph Theory, 2nd edition, Pearson, 2017.

2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India Learning Private Limited, New edition, 1979.

Additional References:

3. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata McGraw Hill Education, 2017.

4. Mark Anderson, Jonathan L. Gross, and Jay Yellen, Graph Theory and Its Applications, 3rd Edition, Taylor & Francis, 2018.

Suggested Practical Exercises:

You may choose a suitable programming language and define all necessary/relevant inputs/ problems.

1. Write a program to find the path, cycles, and degree in the graph. **(2 Hours)**

2. Write a program to implement the bipartite, and circuits in the graph. **(2 Hours)**

3. Write a program to examine whether the graph is: Eulerian, Hamiltonian or a Tree. **(4 Hours)**

4. Write a program to implement the maximum and maximal matching of the graph. **(3 Hours)**

5. Write a program to find the incidence matrix, submatrices, circuit matrix, cut-set matrix, path matrix, and adjacent matrix of the graph. **(4 Hours)**

6. Write a program to implement the vertex and edge colouring of the graph. **(4 Hours)**

7. Write a program to check whether the graph is planar or not. **(3 Hours)**

8. Write a program to implement the blocks and dual graph. **(4 Hours)**

9. Write a program to find the Maximum and Minimum flow of a graph. **(4 Hours)**