

Lecture Plan		
Name of the College: Government College of Arts, Science and Commerce, Sanquelim-Goa		
Name of Faculty: Brian D’Souza	Subject: Mathematics	
Paper code: MAT-6002 Graphs and Networks	Program: M.Sc. (Mathematics)	Division: -
Academic year: 2026-27	Semester: III	Total Lectures: 60
Course Objectives: 1. To introduce the foundational concepts of Graphs and Networks, fostering a strong theoretical understanding of their definitions and properties. 2. To develop the learner's ability to construct and understand rigorous mathematical proofs related to key Graphs and Networks concepts and theorems. 3. To equip learners with the skills necessary to identify and apply appropriate Graphs and Networks methods and techniques to solve structured problems. 4. To encourage analytical thinking and creativity in solving unfamiliar problems in Graphs and Networks, enabling learners to construct logically sound and precise mathematical arguments.		
Expected Course Outcome: 1) Display familiarity and knowledge of Graphs and Networks and associated concepts. 2) Demonstrate proofs to establish truths related to Graphs and Networks and associated concepts. 3) Choose the appropriate procedures, modify them if needed and apply them to solve method-based problems in Graphs and Networks. 4) Analyze and solve unseen problems in Graphs and Networks and create mathematically precise arguments to justify their solutions. 5) Prove various results in Riemann integration. 6) Analyze and compare various number theoretic functions. 7) Examine the convergence of improper integrals.		
Student Learning Outcome: Student will be able to		

- 1) Have a skill of proving theorems specifically in Graph Theory, including results on connectivity, planarity, and colorings.
- 2) Apply graph algorithms (Prim's, Kruskal's, Ford–Fulkerson, Dijkstra's) to solve network optimization problems.
- 3) Apply the theory of Riemann integration in evaluating integrals.

Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June	22/06/2026	27/06/2026	4	Graphs, subgraphs, operations on graphs		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	29/06/2026	04/07/2026	4	Degree sequences; graphic sequences		Smart Board, PPT, PDF	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	06/07/2026	11/07/2026	4	Distance in graphs; walks, trails, paths, circuits, cycles		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
July	13/07/2026	18/07/2026	4	Matrices and isomorphism; complement of a graph; bipartite graphs		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	20/07/2026	25/07/2026	3	Digraphs and multidigraphs; cut-vertices, bridges and blocks; classes of graphs, Petersen graphs, regular graphs, Harary graphs		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.

Jul/Aug	27/07/2026	01/08/2026	4	Elementary properties of trees; minimal spanning trees; Prim's algorithm		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
August	03/08/2026	08/08/2026	4	Kruskal's algorithm; connectivity and edge-connectivity		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	10/08/2026	15/08/2026	4	Connectedness of digraphs; Prüfer sequence		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	17/08/2026	22/08/2026	3	Eulerian graphs and digraphs; Hamiltonian graphs and digraphs; Fleury's algorithm and Hierholzer's algorithm		Smart Board, PPT	G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman & Hall/CRC, 3rd Ed., 1996.
	24/08/2026	29/08/2026	4	Planar graphs: Euler's formula; characterizations of planar graphs		Smart Board, PPT	G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman & Hall/CRC, 3rd Ed., 1996.
August/Sep t	31/08/2026	05/09/2026	4	Crossing number and thickness		Smart Board, PPT	G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman & Hall/CRC, 3rd Ed., 1996.
Sep	07/09/2026	12/09/2026	5	Graph colorings: vertex colorings, edge colorings, map colourings; Five Color Theorem		Smart Board, PPT	G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman & Hall/CRC, 3rd Ed., 1996.

	14/09/2026	19/09/2026	0	Ganesh Chaturthi Break (14–19 Sep)			
	21/09/2026	26/09/2026	4	Matchings and independence in graphs; vertex cover, edge cover		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
Sep/Oct	28/09/2026	03/10/2026	3	Domination number of a graph; independence domination number of a graph		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
Oct	05/10/2026	10/10/2026	3	Networks: relevance of maximum flow; Ford–Fulkerson Algorithm		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.
	12/10/2026	14/10/2026	3	Dijkstra's algorithm to find the shortest route; review and problem solving		Smart Board, PPT	D. B. West, Introduction to Graph Theory, Prentice Hall of India, 2006.

*** Assessment Rubrics**

Component	Max Marks
ISA 1	15
Mid Point Exam	30
ISA 2	15
Practical	Nil

Project	Nil
Semester End Exam	40