# Lecture Plan

**Name of the College:** Government College of Arts, Science and Commerce, Sanquelim-Goa

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| **Name of Faculty:** Rohit R. Redkar | **Subject:** Mathematics | |
| **Paper code:** MAT-605 Advanced Graph Theory | **Program:** M.Sc. | **Division: -** |
| **Academic year:** 2025-26 | **Semester: IV** | **Total Lectures:** 60 |

**Course Objectives:** Give a deeper insight into basic concepts in Graph Theory, so as to be able to embark into research in the field.

**Expected Course Outcome:**

1. Understand the concepts required to pursue research in Graph Theory.
2. Learn labelling of graphs and properties.
3. Learn coloring of graphs.
4. Learn about domination of graphs.

**Student Learning Outcome:** Student will be able to

1. Learn labelling of graphs and properties.
2. Learn coloring of graphs.
3. Learn about domination of graphs.

| Month | Lecture From | Lecture To | No. of lectures allotted | Topic, Subtopic to be covered | Exercise/ Assignment | ICT Tools | Reference books |
|---|---|---|---|---|---|---|---|
| December | 01/12/2025 | 06/12/2025 | St. Francis Xaviers Feast 02 | Review of Basic Concepts: Graphs, Trees, minimal spanning trees, connectivity and edge-connectivity, Eulerian graphs, Hamiltonian graphs. | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 08/12/2025 | 13/12/2025 | 04 | Review of Basic Concepts: Euler's formula, Planar graphs, Colourings, Matchings, Independence and Domination in a graph. | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 15/12/2025 | 20/12/2025 | Liberation Day 00 | Nil | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 22/12/2025 | 23/12/2025 | 02 | Cliques, Ramsey Number | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, |

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| | | | | | | | Chapman & Hall/CRC, Sixth edition |
| January | 02/01/2026 | 03/01/2026 | 00 | Nil | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 05/01/2026 | 10/01/2026 | 04 | Cliques, Ramsey Number | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 12/01/2026 | 17/01/2026 | 04 | Chromatic Polynomials, Independent Sets, Matchings & Covers | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 19/01/2026 | 24/01/2026 | 04 | Maximum Matchings, Matchings in bipartite Graphs | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, |

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| | | | | | | | Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 26/01/2026 | 31/01/2026 | 02 Republic Holiday | Hall's Matching Condition, Min-Max Theorems, Perfect Matching | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| February | 02/02/2026 | 07/02/2026 | 04 | Factorizations and Decompositions | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 09/02/2026 | 14/02/2026 | 04 | Graceful Labeling | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 16/02/2026 | 21/02/2026 | 04 | Graceful Labeling, Harmonious Labeling | | Smart Board, | Gary Chartrand, |

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| | | | | | | Beamer Presentation | Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Third edition |
| | 23/02/2026 | 28/02/2026 | 04 | Bandwidth Labeling. k-Connected Graphs | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Third edition |
| March | 02/03/2026 | 07/03/2026 | 02<br>Holi | Menger's Theorem, k-Edge Connected Graphs | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 09/03/2026 | 14/03/2026 | 04 | Dominating Queens, Dominating Sets in Graphs, Applications of Dominating Sets. | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 16/03/2026 | 21/03/2026 | 04 | Bounds on the Domination Number (in terms of order, in terms of order and | | Smart Board, Beamer | Gary Chartrand, Linda Lesniak, |

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| | | | Gudi Padva / Id-Ul Fitr | size). | | Presentation | Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 23/03/2026 | 28/03/2026 | 04 Ram Navami | Chromatic Number and Chromatic index, Brook's Theorem, Vizing's Theorem | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Sixth edition |
| | 30/03/2026 | 04/04/2026 | 04 | Extremal graph theory and Turan's Theorem | | Smart Board, Beamer Presentation | Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraphs, Chapman & Hall/CRC, Third edition |

*** Assessment Rubrics**

| Component | Max Marks |
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| ISA 1 | 20 |
| ISA 2 | 20 |
| ISA 3 | 20 |

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| Practical | Nil |
| Project | Nil |
| Semester End Exam | 40 |