



IIT Mandi Proposal for a New Course

Course number : **MA 530**
Course Name : **Graph Theory**
Credit Distribution : **L-T-P-C:(3-1-0-4)**
Intended for : **UG/PG**
Prerequisite : **Basic understanding of mathematics**
Mutual Exclusion : **None**

1. Preamble:

This is a basic course on Graph Theory. The main objective of this course is to introduce the basic concepts of Graph Theory. It is a field that has great importance in mathematics and has tremendous applications in various fields of Science and Technology, like applications to Engineering, Computer Sciences, Network analysis, etc. This course will provide the students an opportunity to learn the fundamental concepts of Graph Theory.

2. Course Modules with quantitative lecture hours:

- 1. Basics:** Graphs, subgraphs, isomorphism, representation of graphs, degrees, walks, trails, paths, cycles, bipartite graphs. **[5 Hours]**
- 2. Trees and connectivity:** Characterizations of trees, minimum-spanning-trees, number of trees, Cayley's formula, shortest path algorithms. **[5 Hours]**
- 3. Eulerian and Hamiltonian graphs:** Characterizations, Necessary/sufficient conditions. **[4 Hours]**
- 4. Graph Coloring:** vertex coloring, chromatic polynomials, edge coloring. **[4 Hours]**
- 5. Planar graphs:** Properties, Euler's formula and its consequences, Kuratowski's Characterization. **[6 Hours]**
- 6. Matching and Factorizations:** matching in bipartite graphs, maximum matching in general graphs, Hall's marriage theorem, factorization; Tutte's perfect matching theorem and consequences. **[7 Hours]**
- 7. Networks:** The Max-flow min-cut theorem, connectivity and edge connectivity,

Menger's theorem.

[6 Hours]

8. Graph and Matrices: Adjacency matrix, Laplacian matrix, Eigen Values. [5 Hours]

1. Text books:

1. J. A. Bondy and U.S.R Murthy, *Graph Theory with Applications*, Macmillan, 1976.
2. D. B. West, *Introduction to Graph Theory*, Vol:2, Prentice hall, 2001.

2. References:

1. F. Harary, *Graph Theory*, Addison-Wesley publishing company, 1969.
2. R. Diestel, *Graph Theory*, 3rd ed. Graduate texts in mathematics 173, 2005.
3. R. B. Bapat, *Graphs and Matrices*, Vol. 27. London: Springer, 2010.

1. Similarity with the existing courses: No

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

6. Justification of new course proposal if cumulative similarity content is >30%: