**MATH 1051 :Graph Theory**

**B.Tech. (Second Semester)**

**(Syllabus for CSE)**

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**Preamble**

*This course introduces basic concepts in Graph Theory, including properties and characterization of graph/trees and graph theoretic algorithms, which are widely used in Mathematical modelling and has got applications across Computer Science and other branches in Engineering.*

**Course Objectives**:

* To introduce basics of group theory and its applications
* To impart knowledge onbasic concepts of paths and circuits
* To impart knowledge onTrees, spanning trees, shortest spanning trees
* To familiarize in the matrix representation of graphs
* To transform scientific problems into generic computational models

**Unit-1: Basics of graphs (5 hrs)**

Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, and Null Graph, complete graph, Bi-partite and complete Bi-partite graphs.

**Learning Outcomes:**

After completion of this unit, student will be able to

* understand the basic terminology of the graph theory (L2).
* find the vertex of the graph and identify the types of vertices of the graph(L3).

**Unit-2: Matrix representation of graphs: (5hrs)**

Adjacency Matrix, Incidence Matrix, Path Matrix(Definition and examples),

**Learning Outcomes:**

After completion of this unit, student will be able to

* identify the types of matrix representation of graph (L3)
* Find a path matrix of a connected graph (L3)

**Unit-3: Paths and circuits (6 hours)**

Paths, and Circuits, Connected Graphs, Disconnected Graphs, and Components, Euler Graphs,Hamiltonian graphs(Definition,examples and without proofs)

**Learning Outcomes:**

After completion of this unit, student will be able to

* identify different types of paths and their properties (L3)
* construct Euler and Hamiltonian graphs (L3)

**Unit-4: Trees (5 hrs)**

Trees and their properties, spanning trees, minimal spanning trees,

Kruskal’s algorithm for finding a minimal spanning tree,

**Learning Outcomes:**

After completion of this unit, student will be able to

* construct the spanning trees from graphs (L3)
* build minimal spanning tree by Kruskal’s algorithms (L3)

**Unit 5: Applications of Trees and Fundamental circuits (5 hrs)**

Preorder, in order and post order traversals, Prefix and Postfix notations of an arithmetic expression, parsing trees.

**Learning Outcomes:**

After completion of this unit, student will be able to

• Identify tree traversals (L3)

• construct parsing trees for algebraic expressions(L3)

**Text Book:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science,   
    Prentice Hall of India, 2006.

**Reference Book:**

1.Bhishma Rao, Mathematical Foundations of Computer Science, [SciTech Publications   
(India) Pvt Ltd](https://www.sapnaonline.com/shop/publisher/scitech-publications--india-pvt-ltd).

2. Kenneth H. Rosen, Discrete Mathematics and Applications, Seventh

edition, Tata McGrawHill,2012.

**Course Outcomes:**

Upon successful completion of this course the student should be able to

* analyze the concepts in graph theory (L4)
* apply graph theory concepts in core subjects such as data structures and network   
  theory effectively (L3)
* Identify different types of paths (L3)
* Construct minimum spanning tree using some algorithms (L3)
* Identify tree traversals (L3)
* Solve the graphical problems which are accessed in available software (L3)