Course Title: Graph Theory and Combinatorics

Course Code: CSIT743

Course Objectives:
- Explain basic concepts in combinatorial graph theory
- Define how graphs serve as models for many standard problems
- Discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.
- See the applications of graphs in science, business and industry.

Learning Outcomes:
- Understand and explain the basic concepts of graph theory.
- Apply the basic concepts of mathematical logic.
- Analyze the basic concepts of mathematical logic.
- Evaluate some real time problems using concepts of graph theory

Module I: Introduction to Graph Theory

Basic Terminology, Walks, paths, circuits, connectedness, Handshaking Lemma, Isomorphism, Sub graphs, Reach ability, Union and Interaction of Graphs

Module II: Graph Theory

Euler Graph, Shortest path problem, Hamiltonian graph, Traveling Salesman Problem, Bipartite graphs.

Module III: Trees

Introduction to trees, Rooted trees, path length in rooted trees, spanning trees, Fundamental circuits, spanning trees of a weighted graph, cut sets and cut vertices, Fundamental cut set, Minimum spanning tree.

Module IV: Directed Graph

Directed graphs and connectedness, directed trees, Network Flows, MaxFlow-MinCut Theorem, Matrix representation of a graph, Planar graphs: Combinatorial and Geometric Duals, Kuratowski"s graphs, Detection of planarity, thickness and crossing.

Module V: Combinatorics

Partitions, counting functions, number of partitions into odd or unequal parts. Necklaces, Euler's function, set of symmetries, enumeration in the odd and even cases.