COURSE CONTENT

GRAPH ANALYTICS								
III Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2435834	Foundation	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: Knowledge of Design and Analysis of Algorithms								

Course Overview:

This course introduces the concepts and techniques for analyzing large-scale graph-structured data from domains such as social networks and bioinformatics. It covers graph representations, data structures, and fundamental as well as advanced graph algorithms. Students learn scalable approaches including parallel and distributed graph processing methods.

Course Objectives:

1. To understand the fundamental concepts, models, and applications of graph analytics in data science and network analysis.
2. To study graph representations, graph traversal techniques, and graph processing algorithms for large-scale datasets.
3. To learn graph mining methods such as community detection, link analysis, clustering, and centrality measures.
4. To analyze social networks, web graphs, and connected data using graph analytics techniques and tools.
5. To develop the ability to design and implement graph-based solutions for solving real-world analytical and optimization problems.

Course Outcomes: After Completion of the Course, Students should be able to

1. Understand the fundamental concepts of graph theory, network structures, and graph-based data representation techniques.
2. Analyze large-scale graph data using graph traversal, clustering, centrality, and community detection algorithms.
3. Apply graph analytics methods to solve real-world problems in social networks, web mining, cybersecurity, and recommendation systems.
4. Design and implement graph processing solutions using modern graph databases and big data analytics frameworks.
5. Evaluate the performance, scalability, and efficiency of graph algorithms for handling complex and connected datasets.

UNIT - I

Introduction and Application of Large-scale Graph: Characteristics, Complex Data Sources - Social Networks, Simulations, Bioinformatics; Categories- Social, Endorsement, Location, Co-occurrence graphs; Graph Data structures, Parallel, Multicore and Graph Algorithms

UNIT - II Algorithms: Search and Paths

A Work-Efficient Parallel Breadth-First Search Algorithm (or How To Cope With the Nondeterminism of Reducers), Multi-Objective Shortest Paths

UNIT - III Algorithms: Structure

Multicore Algorithms for Graph Connectivity Problems, Distributed Memory Parallel Algorithms for Massive Graphs, Massive-Scale Distributed Triangle Computation and Applications

UNIT - IV Models

Recent Advances in Scalable Network Generation, Computational Models for Cascades in Massive Graphs, Executing Dynamic Data-Graph Computations Deterministically Using Chromatic Scheduling.

UNIT - V Frameworks and Software

Graph Data Science Using Neo4j, A Cloud-Based Approach to Big Graphs, Interactive Graph Analytics at Scale in Arkouda

TEXT BOOKS:

1. David A. Bader, Massive Graph Analytics, CRC Press

REFERENCE BOOKS

1. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications", (Structural Analysis in the Social Sciences), Cambridge University Press, 1995.
2. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press, 2010.
3. Tanja Falkowski, "Community Analysis in Dynamic Social Networks", (Dissertation), University Magdeburg, 2009.

ELECTRONIC RESOURCES:

1. https://nptel.ac.in/courses/111106050
2. https://nptel.ac.in/courses/106106183
3. https://snap.stanford.edu/
4. https://neo4j.com/docs/
5. https://spark.apache.org/graphx/

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)