Nirma University

Institute of Technology, School of Technology

M Tech Computer Science and Engineering (Data Science)

Semester – II

L	T	P	C
3	0	2	4

Course Code	6CS364
Course Title	Large Scale Graph Algorithms

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to

1. visualize real-life networks as large scale graphs
2. transform basic graph algorithms in to large scale graph algorithms for parallel and distributed environment
3. practice large scale graph algorithms on appropriate tools for complex data sources
4. comprehend various optimization techniques and considerations for achieving parallel scalability when processing irregular graph data

Syllabus:	**Teaching hours**
Unit I Introduction and Application of Large-scale Graph, Real-World and Synthetic Graphs, Complex Data Sources like Social Networks, Location networks, Co-occurrence graphs, biological networks, web networks	**7**
Unit II Basic graph algorithms and Large-scale Graph Analysis in parallel and distributed environment: search, traversal, connectivity, triangle calculation, sub graph finding traversal, List Ranking, Link Analysis, Page Ranking Algorithms	**10**
Unit III Distributed Computation for Massive Data Sets- Spectral, Modularity-based Clustering, Random Walks, Graph Coloring Graph Decomposition and Prefetching Parallel Shortest Paths and Priority Queues	**10**
Unit IV Introduction to graph processing frameworks, disk based frameworks, shared memory frameworks and streaming frameworks for large scale graph computations, V-Graph Representation, MapReduce, Surfer, GraphLab etc.	**10**

Unit V **8**

Power Law Distribution, Game-Theoretic Approach, Rank Aggregation and Voting Theory, Recommendation Systems, Social network analysis with suitable case studies

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

Suggested readings^:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, MIT Press
2. David Easley and Jon Kleinberg, Networks, Crowds, and Markets, Cambridge University Press
3. Matthew O. Jackson, Social and Economic Networks, Princeton University Press.
4. Stanley Wasserman, Katherine Faust, Social Network Analysis Methods and Applications (Structural Analysis in the Social Sciences), Cambridge University Press
5. Tanja Falkowski, Community Analysis in Dynamic Social Networks, sierke VERLAG
6. Ladislav Novak, Alan Gibbons, Hybrid Graph Theory and Network Analysis, Cambridge Tracts in Theoretical Computer Science, Cambridge University Press
7. Eric D. Kolaczyk, Statistical Analysis of Network Data Methods and Models, Springer Series in Statistics
8. Akihito Hora, Nobuaki Obata, Quantum Probability and Spectral Analysis of Graphs, Springer Science and Business Media
9. Deo Narsinh, Graph Theory with applications to engineering and computer science, Courier Dover Publications

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list