

5. Zheng, Yixian, Wenchao Wu, Yuanzhe Chen, Huamin Qu, and Lionel M. Ni. "Visual analytics in urban computing: An overview." *IEEE Transactions on Big Data* 2, no. 3 (2016): 276-296.
6. Lo Piano, S. (2020). Ethical principles in machine learning and artificial intelligence: cases from the field and possible ways forward. *Humanities and Social Sciences Communications*, 7(1), 1-7.
7. Schönberger, D. (2019). Artificial intelligence in healthcare: a critical analysis of the legal and ethical implications. *International Journal of Law and Information Technology*, 27(2), 171-203.

### DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE):

#### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Network Science (DSE)	4	3	1	0	Class XII pass	Programming languages and Artificial intelligence, Data structure and design

#### Learning Objectives

This is an interdisciplinary course encompassing the recent groundbreaking research and its applications in complex problems and issues faced by humans and communities. It will explore the digital spaces and their entities from a network point of view.

**Keywords:** Social networks analysis; Communities; Network Dynamics; Complex issues.

#### Learning Outcomes

The course will have the following Course Learning Outcomes.

- Will have understanding of Network science concepts
- Will have understanding of Graphs and Networks
- Will have understanding of network dynamics and the practical problems associated with it.
- Will have an understanding of Intelligent transportation systems.
- Solve real-world problems modelled as complex networks

#### SYLLABUS

Unit I: Foundations of Network Science: Introduction to Network Science, Historical evolution and interdisciplinary nature of network science, Real-world examples: biological, technological, social, and economic networks, Basic Concepts Types of networks: undirected, directed, weighted, and bipartite networks, Representation of networks: adjacency matrix and

edge list Network motifs and substructures. (10 hours)

Unit II: Graph Theory and Social Network Analysis: Graph Theory Fundamentals Key concepts: paths, cycles, connectivity, cliques, and components, Properties of networks: degree distribution, clustering coefficient, and shortest path, Centrality measures: degree, betweenness, closeness, and eigenvector centrality Identifying influential nodes and authorities (e.g., PageRank), Social Network Analysis (SNA): Structural analysis of social systems and applications (10 hours)

Unit III: Communities, Spreading Phenomena, and Societal Impacts: Community Detection Modularity optimization and algorithms: Louvain, Girvan-Newman, and spectral clustering, Overlapping and hierarchical communities and applications, Spreading Phenomena in Networks Epidemic models, Measuring and mitigating polarization Case studies: social media platforms and political discourse. (15 hours)

Unit IV: Network Dynamics and Temporal Evolution: Network Dynamics Cascading behaviours: threshold and tipping-point models Influence maximization: greedy algorithms and heuristics Information diffusion models: independent cascade and linear threshold models, Applications: tracking disease spread, communication networks, and transportation systems. (15 hours)

#### References

1. Albert-László Barabási, Márton Pósfai, Network Science, Cambridge University Press, 2021
2. Borgatti, Stephen P., Ajay Mehra, Daniel J. Brass, and Giuseppe Labianca. "Network analysis in the social sciences." Science 323, no. 5916 (2009): 892-895.
3. Easley, D., & Kleinberg, J. (2010). *Networks, crowds, and markets: Reasoning about a highly connected world*. Cambridge University Press.

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Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical / Practice		
Deep Learning and Applications (DSE)	4	3	1	0	Class XII pass	Programming languages and Artificial intelligence, Data structure and design