



Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Course Structure and Syllabus (DJS23)

of
Honors Degree Program

in
Data Science

Revision: 1 (2024)

With effect from the Academic Year: 2024-2025

Scheme for Honours in Data Science (Computer Engineering) (Autonomous) (DJS23 Scheme)

| Sr. No. | Course Code | Course | Teaching Scheme | | | | Semester End Examination (SEE) | | | | | | Continuous Assessment (CA) | | | Aggregate (A + B) | Credits Earned | | |
|---------------------|--------------|--|-----------------|-----------------|----------------|-----------|--------------------------------|------------|-----------|-----------|------------------|-------------|----------------------------|-----------------|-----------|-------------------|----------------|-----------|-----------|
| | | | Theory (Hrs) | Practical (Hrs) | Tutorial (Hrs) | Credits | Duration (Hrs) | Theory | Oral | Practical | Oral & Practical | SEE (Total) | Theory | Term Work Total | CA Total | | | | |
| Semester III | | | | | | | | | | | | | | | | | | | |
| 1 | DJS23CCH1301 | Statistics for Data Science | 3 | | | 3 | 2 | 60 | | | | | 60 | 40 | | 40 | 100 | 3 | 3 |
| Semester IV | | | | | | | | | | | | | | | | | | | |
| 2 | DJS23CCH1401 | Visualization in Data Science | 3 | | | 3 | 2 | 60 | | | | | 60 | 40 | | 40 | 100 | 3 | 4 |
| | DJS23CLH1401 | Visualization in Data Science Laboratory | | 2 | | 1 | | | | 25 | | | 25 | | 25 | 25 | 50 | 1 | |
| Semester V | | | | | | | | | | | | | | | | | | | |
| 3 | DJS23CCH1501 | Graph Data Science | 3 | | | 3 | 2 | 60 | | | | | 60 | 40 | | 40 | 100 | 3 | 4 |
| | DJS23CLH1501 | Graph Data Science Laboratory | | 2 | | 1 | | | | 25 | | | 25 | | 25 | 25 | 50 | 1 | |
| Semester VI | | | | | | | | | | | | | | | | | | | |
| 4 | DJS23CCH1601 | Essentials of Generative AI and Prompt Engineering | 3 | | | 3 | 2 | 60 | | | | | 60 | 40 | | 40 | 100 | 3 | 3 |
| Semester VII | | | | | | | | | | | | | | | | | | | |
| 5 | DJS23CCH1701 | Cloud Computing for Data Analysis | 3 | | | 3 | 2 | 60 | | | | | 60 | 40 | | 40 | 100 | 3 | 4 |
| 6 | DJS23CLH1701 | Cloud Computing for Data Analysis Laboratory | | 2 | | 1 | | | | 25 | | | 25 | | 25 | 25 | 50 | 1 | |
| Total | | | 15 | 6 | | 18 | 10 | 300 | 75 | | | | 375 | 200 | 75 | 275 | 650 | 18 | 18 |



Program: Computer Engineering

T.Y B.Tech. Semester: V

Course: Graph Data Science (DJS23CCH1501)

Course: Graph Data Science Laboratory (DJS23CLH1501)

Pre-requisite:

1. Database Management Systems

Objectives:

1. Analyze real-world problems and design graph-based solutions.
2. Evaluate graph databases and construct efficient data models.
3. Develop an applications using Neo4j and graph database concepts

Outcomes: On completion of the course, the learner will be able to:

1. Solve fundamental graph theory problems including shortest paths and cycles.
2. Compare graph databases with relational/NoSQL alternatives.
3. Create efficient graph data models while avoiding common pitfalls.
4. Implement graph database applications using Neo4j and Cypher.

| Big Data Analytics (DJS23CCPE611) | | |
|--|--|-----------------|
| Unit | Description | Duration |
| 1 | Introduction to Graph Definitions and examples, Three puzzles, Paths and cycles, Connectivity, Eulerian graphs, Hamiltonian graphs, shortest path, Chinese postman problem, traveling salesman problem, trees, properties of trees | 05 |
| 2 | Introduction Graph databases A High-Level View of the Graph Space, Graph Databases, Graph Compute Engines, The Power of Graph Databases, Performance, Flexibility, Agility, Options for Storing Connected Data, Relational Databases Lack Relationships, NOSQL Databases Also Lack Relationships, Graph databases embraces relationship | 07 |
| 3 | Data Modelling with Graphs Models and Goals, The Labelled Property Graph Mode Querying Graphs, A Comparison of Relational and Graph Modelling, Cross-Domain Models, Common Modelling Pitfalls, Identifying Nodes and Relationships, Avoiding Anti-Patterns | 08 |
| 4 | Building a Graph Database Application Data Modelling, Application Architecture, Testing, Capacity Planning, Importing and Bulk Loading Data | 07 |
| 5 | Graphs in the Real World Why Organizations Choose Graph Databases, Common Use Cases, Real-World Examples, Authorization and Access Control, Geospatial and Logistics, Graph Database Internals, Native Graph Processing, Native Graph Storage Programmatic APIs, Kernel API, Core API, Traversa Framework, Non-functional Characteristics | 07 |
| 6 | Neo4j Neo4j – About, Neo4j – Installation, Neo4j – Browser Neo4j - Query Language (Cypher), Neo4j - Create a Node Neo4j - Create a Relationship, Neo4j - Create an Index Neo4j - Create a Constraint, Neo4j - Select Data with MATCH, Neo4j - Import Data from CSV, Neo4j - Drop an Index, Neo4j - Drop a Constraint, Neo4j - Delete a Node, Neo4j - Delete a Relationship | 05 |
| | Total | 39 |

| Graph Data Science Laboratory (DJS23CLH1501) | |
|---|--|
| Exp. | Suggested experiments |
| 1 | Install and set up a graph database system (e.g., Neo4j) on a local machine and familiarize yourself with the graph database environment, including the query language (Cypher) and browser interface. |
| 2 | Design a data model using the labeled property graph model for a specific domain (e.g., social network, e-commerce). |
| 3 | Implement the data model in the graph database and populate it with sample data. |
| 4 | Perform basic graph queries using Cypher to retrieve nodes, relationships, and their properties. |
| 5 | Explore different query patterns, such as finding paths, filtering nodes, and ordering results. |
| 6 | Learn and practice essential administrative tasks, such as managing users, roles, and access control. |
| 7 | Perform backup and restore operations to ensure data integrity. |
| 8 | Import data from external sources (e.g., CSV files) into the graph database. |
| 9 | Export graph data to different formats for analysis or sharing. |
| 10 | Apply graph algorithms to analyze and extract insights from your graph data. |
| 11 | Explore and navigate the graph visually to gain a better understanding of its structure and relationships. |
| 12 | Choose a specific real-world use case (e.g., recommendation systems, fraud detection) and apply graph database techniques to solve the problem. |

Batchwise laboratory work of minimum 8 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books:

1. Dave Bechberger, Josh Perryman, “Graph Databases in Action”, 1st Edition, Manning Publications, 2020.
2. Ian Robinson, Jim Webber & Emil Eifrem, “Graph Databases”, 2nd Edition, O’Reilly, 2015
3. Robin J. Wilson, “Introduction to Graph Theory”, 4th Edition,
4. Dr. Jim Webber and Rik Van Bruggen, “Graph Databases for Dummies, Neo4j Special Edition”, John Wiley and Sons, 2020

Reference Books:

1. Ian Robinson, Jim Webber & Emil Eifrem, “Graph Databases: New Opportunities for Connected Data”, 2nd Edition, O’Reilly, 2015.
2. Tjortjis Christos, “Graph Databases: Applications on Social Media Analytics and Smart Cities”, 1st Edition, CRC Press, 2023.
3. Aleksa Vukotic, Nicki Watt, Tareq Abedrabbo, Dominic Fox, and Jonas Partner, “Neo4j in Action”, Manning Publication, 2014.

Prepared by

Checked by

Head of the Department

Principal

Program: Computer Engineering

T.Y B.Tech. Semester: VI

Course: Essentials of Generative AI and Prompt Engineering (DJS23CCH1601)

Course:

Pre-requisite:

1. Artificial Intelligence, Data Mining, Introduction to Machine Learning

Objectives:

1. To equip students with the skills to understand and apply generative AI models and prompt engineering techniques to create and optimize AI-generated content across diverse applications.

Outcomes: On completion of the course, the learner will be able to:

1. Understand and apply generative AI techniques for real-world problem-solving.
2. Design and refine effective prompts to generate high-quality outputs from AI models.

| Essentials of Generative AI and Prompt Engineering (DJS23CCH1601) | | |
|--|---|-----------------|
| Unit | Description | Duration |
| 1 | Introduction to Generative Models Definition and purpose of generative models, Difference between generative and predictive (discriminative) models, Types of Data Generated by AI, Text, images, and sound generation, Examples of popular generative tools and applications, How Generative Models Work, Ethical Considerations in Generative AI, Responsible use of generative AI: copyright, misinformation, and bias | 07 |
| 2 | Prompt Engineering Definition of prompts and prompt engineering, Basic Principles of Writing Prompts, Characteristics of a good prompt: clarity, detail, and specificity, Types of Prompts and Their Effects, Instructional prompts, questions, and open-ended prompts, Applications of Prompt Engineering, Real-life applications: content creation, summaries, creative writing | 08 |
| 3 | Generative Models Generative Adversarial Networks (GANs), Language models (e.g., GPT, BERT) and diffusion models, Overview of encoder-decoder frameworks and transformers | 08 |
| 4 | Generative AI in Text and Image Creation Text Generation with AI: How AI generates text responses to prompts, Examples of applications: story generation, chatbot conversations, AI tools for text generation Image Generation with AI: Basics of text-to-image AI models, Examples of image generation applications: art, design, marketing, AI tools for image generation Evaluating AI Outputs: Evaluating the quality and relevance of AI-generated text or images, Adjusting prompts for better results | 08 |
| 5 | Prompt Engineering Techniques and Approaches Text-to-Text Prompt Techniques, Interview Pattern Approach, Chain-of-Thought Approach, Tree-of-Thought Approach, Few-Shot Approach | 08 |

| | | |
|--|--|-----------|
| | Writing Effective Prompts for Various Purposes, Crafting prompts for specific tasks: summarization, image creation, Q&A, Emerging applications in entertainment, education, and business | |
| | Total | 39 |

Books Recommended:

Text Books:

1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly Media, 2019
2. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
3. Rajalingappaa Shanmugamani, Deep Learning for Computer Vision" Packt Publishing, 2018
4. James Phoenix, Mike Taylor, Prompt Engineering for Generative AI, O'Reilly Media, Inc., 2024
5. Rafael Valle, Hands-On Generative Adversarial Networks with Keras: Build Advanced GAN Architectures Using Keras and TensorFlow", Packt Publishing, 2019

Reference Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach" 3rd Edition, Pearson Education 2010
2. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) "The Handbook of Computational Linguistics and Natural Language Processing", July 2010
4. Navveen Balani, Prompt Engineering: Unlocking Generative AI: Ethical Creative AI for All", Amazon Digital Services LLC – Kdp, 2023

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