

**School of Computer Science and Engineering**

**Dept. of Computer Science and Engineering**

**COURSE PLAN**

**Academic Year 2025-26 ODD SEMESTER**

|  |  |
| --- | --- |
| **School/Department of Students** | Computer Science and Engineering. |
| **Name of the Program(s) of Students** | Computer Science and Engineering. |
| **PRC Approval Ref. No.** | **PU/AC-24.5/SOCSE05/CSE/2022-2026** |
| **Semester/Year** | **V/III** |
| **Course Code & Name** | CSE3513 & NoSQL Data Management |
| **Credit Structure (L-T-P-C)** | 2-0-2-3 |
| **Contact Hours** | 4 Sessions per week = 56 Sessions |
| **Course In-Charge (IC)** | Sunil Kumar Sahoo |
| **Course Instructor(s)** | Dr.Sudha P Dr. Sivaramakrishnan S Mr. Sunil Kumar Sahoo Mr. Aadil Ferooz Ms. Delsy Jyothi |
| **Course URL** | [**https://presidencyuniversity.linways.com**](https://presidencyuniversity.linways.com) |

|  |
| --- |
| 1. **COURSE PRE-REQUISITES:** |
| CSE3156 & Database Management System |

|  |
| --- |
| 1. **COURSE DESCRIPTION:** |
| This course introduces students to the fundamentals of NoSQL data management, focusing on the limitations of traditional relational databases and the motivation behind the emergence of NoSQL systems. It covers key NoSQL data models—key-value, document, column-family, and graph—along with their use cases, structural differences, and performance characteristics. Students will learn to design scalable and schema-less applications using appropriate data modeling techniques, distribution strategies like sharding and replication, and consistency models. The course also includes hands-on practice with NoSQL technologies such as MongoDB, Cassandra, and Neo4j, and introduces data processing techniques like MapReduce for handling large-scale data efficiently. |

|  |
| --- |
| 1. **COURSE OBJECTIVES:** |
| The objective of the course is to equip learners with the theoretical knowledge and practical skills necessary to design, model, and query NoSQL databases, aligning with real-world use cases such as big data processing, distributed applications, and high-speed transactions, and attain **Skill Development** through **Participative Learning** techniques. |

1. **COURSE OUTCOMES:**

|  |  |  |
| --- | --- | --- |
| **TABLE 1: COURSE OUTCOMES** | | |
| **CO Number** | **Statement of CO** | **Blooms Cognitive Level** |
| *On successful completion of the course the students shall be able to* |
| CO1 | Understand the limitations of relational databases and explain the motivation behind the emergence of NoSQL databases. | Understand |
| CO2 | Differentiate between various NoSQL data models such as key-value, document, column-family, and graph databases based on structure, use cases, and performance. | Analyze |
| CO3 | Analyze and apply appropriate distribution strategies including sharding, replication, and consistency models in distributed NoSQL systems. | Analyze |
| CO4 | Apply data access patterns using aggregate-oriented modeling and schema-less approaches for scalable NoSQL applications. | Apply |
| CO5 | Utilize Map-Reduce and other data processing techniques to handle large-scale data operations efficiently in NoSQL environments. | Apply |

1. **MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:** 
   1. ***PROGRAM OUTCOMES*:**

On successful completion of the Program, the students will be able to:

|  |  |
| --- | --- |
| PO1. | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2. | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3. | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| PO4. | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5. | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6. | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7. | Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8. | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9. | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10. | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11. | Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12. | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 2a: CO-PO Mapping** | | | | | | | | | | | | |
| **CO.**  **No** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | M | L | L | L | - | - | - | - | - | - | - | M |
| **CO2** | M | H | H | H | - | - | - | - | - | - | - | M |
| **CO3** | M | H | H | H | - | - | - | - | - | - | M | M |
| **CO4** | M | M | H | H | - | - | - | - | - | - | M | M |
| **CO5** | H | M | M | L | - | - | - | - | - | - | M | M |

* 1. **PROGRAM SPECIFIC OUTCOMES:**

On successful completion of the Program, the students will be able to:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PSO1 | Problem Analysis: Identify, formulate, research literature, and analyse complex engineering problems related to Software Engineering principles and practices, Programming and Computing technologies reaching substantiated conclusions using first principle of Mathematics, Natural Sciences and Engineering Sciences. | | | |
| PSO2 | Design/development of Solutions: Design solutions for complex engineering problems related to Software Engineering principles and practices, Programming and Computing technologies and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations. | | | |
| PSO3 | Modern Tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities related to Software Engineering principles and practices, programming and computing technologies with the understanding of the limitations. | | | |
| **TABLE 2b: CO-PSO Mapping** | | | | |
| **CO Number** | | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | | **H** | **M** | **-** |
| **CO2** | | **H** | **H** | **M** |
| **CO3** | | **H** | **M** | **M** |
| **CO4** | | **-** | **H** | **H** |
| **CO5** | | **-** | **M** | **H** |

1. **COURSE CONTENT:**

***6.a* Theory:**

|  |  |  |
| --- | --- | --- |
| Module  Number | Module Name | Number of Sessions |
|  | **Introduction to NoSQL and Aggregate-Oriented Data Models** Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing AggregateOriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access. | 14 |
|  | **Distributed Data Systems and Consistency Models**  Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes. | 12 |
|  | **Key-Value Stores and Map-Reduce Framework**  Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. | 12 |
|  | **Document-Oriented Databases and Use Cases**  Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E- Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure. | 10 |
|  | **Graph Databases and Connected Data Solutions**  Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. | 8 |

***6.b* Practical/ Laboratory:**

|  |  |  |
| --- | --- | --- |
| S. No | Name of the Experiment/Exercise | Number of Sessions |
|  | 1: Environmental Setup   * + Install MongoDB, create a collection and insert documents   + Understand JSON-like document structure and NoSQL CRUD operations | 1 |
|  | 2: Schema-less Collections   * + Create schema-less collections   + Demonstrate dynamic document structures in MongoDB | 1 |
|  | 3: Application of Aggregation Framework   * + Use aggregation pipeline to filter, group, and transform data   Compare with SQL aggregate functions | 1 |
|  | 4: Data Modeling in MongoDB   * + Model one-to-one, one-to-many, many-to-many relationships   + Evaluate normalization vs denormalization | 1 |
|  | 5: Replication SetUp   * + Set up a replica set in MongoDB   + Analyze automatic failover and data consistency | 1 |
|  | 6: Sharding in MongDB   * + Implement Sharding to scale collections   + Evaluate performance and balancing | 1 |
|  | 7: Redis Introduction, Environmental Set Up   * + Implement Key-Value stores with Redis   + Demonstrate session management in Redis | 1 |
|  | 8: Map-Reduce with MongoDB   * + Execute MapReduce Jobs using javascript in MongoDB   + Compare with aggregation pipeline | 1 |
|  | 9: Document Database Use case   * + Implement blog platform backend with MongoDB   + Insert and query nested-documents | 1 |
|  | 10: GraphDB with Neo4J   * + Install Neo4J, Create nodes and relationships   + Query with cypher | 1 |

**REFERENCE MATERIALS:**

**Textbook:**

1. **Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012.**
2. **Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015.**

**(ISBN- 13: 978-9332557338).**

**Reference Books:**

1. Luc Perkins, Eric Redmond, Jim Wilson, "Seven Databases in seven weeks: A Guide to Modern

Databases and the NoSQL Movement", 2nd Edition, Pragmatic Bookshelf, 2018.

(ISBN- 13: 978-1680502534).

2.  Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest

of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)

3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694).

**Additional web-based resources**

W1: <https://www.geeksforgeeks.org>

W2: <https://www.youtube.com/watch?v=obukQHokLK8.>

**PU Library Link :** https://puniversity.knimbus.com/user#/home

Or

**:** http://182.72.188.193/

1. **SCHEDULE OF INSTRUCTION**

**7.a Detailed Schedule of Instructions: Theory**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TABLE 3a: LESSON PLAN: THEORY** | | | | |
| **Session Number** | **Topic** | **Sub-Topic** | **CO Number** | **Reference** |
|  | Program Integration & Course Integration | Overview of the Course | CO1 | T1: Ch1 (Pg. 1–4) |
| **Module 1** | | | | |
|  | Introduction | Aggregate Data Models | CO1 | T1: Ch2 (Pg. 5–9) |
|  | Data Models | Key-Value, Document, Column-Family Models | CO1 | T1: Ch3 (Pg.10–15) |
|  | Data Models | Graph Databases & Schema-less Design | CO1 | T1: Ch4 (Pg.16–20) |
|  | Data Models | Modelling for Data Access & Materialized Views | CO2 | T1: Ch5 (Pg.21–24) |
|  | Data Models | Summary & Case Examples using MongoDB | CO2 | MongoDB Docs |
| **Module 2** | | | | |
|  | Distribution Models | Single Server, Sharding | CO2 | T1: Ch. No. 6  Page no: 25-28 |
|  | Consistency Models | Master-Slave Replication, Peer-to-Peer Replication | CO2 | T1: Ch7 (Pg.29–32) |
|  | Consistency Models | Combining Sharding and Replication Consistency. Relaxing Consistency & Quorums | CO2 | T1, Ch7 (Pg.33–35) |
|  | Consistency Models | Update Consistency, Read Consistency, Relaxing Consistency | CO2 | T1, Ch8 (Pg.36–38) |
|  | Consistency Models | The CAP Theorem, Relaxing Durability, Quorums. Version Stamps | CO3 | T1, Ch8 (Pg.39–41) |
|  | Consistency Models | Business and System Transactions, Version Stamps on Multiple Nodes. | CO3 | All Above |
| **Module 3** | | | | |
|  | Map-Reduce Framework | Map-Reduce, Basic Map-Reduce, Partitioning and Combining | CO5 | T1, Ch9 (Pg.42–45) |
|  | Map-Reduce Framework | Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce | CO5 | T1, Ch9 (Pg.46–48) |
|  | Key-Value Stores | Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, | CO3 | T1,Ch10 (Pg.49–51) |
|  | Key-Value Stores | Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases | CO3 | T1,Ch10 (Pg.52–54) |
|  | Key-Value Stores | Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data | CO3 | T1, Ch11 (Pg.55–58) |
|  | Key-Value Stores and Map-Reduce Framework | Multi operation Transactions, Query by Data, Operations by Sets. | CO3, CO5 | All |
| Midterm Exam Question Paper and Scheme of Evaluation – Discussion | | | | |
|  | Document-Oriented Databases | Course Integration - Introduction to Document Databases, Features, Consistency, Transactions, Availability | CO4 | T1,Ch12 (Pg.59–62) |
|  | Document-Oriented Databases Use Cases | Query Features, Scaling, Suitable Use Cases | CO4 | T1,Ch12 (Pg.63–66) |
|  | Document-Oriented Databases, Event Driven System | Event Logging, Content Management Systems, Blogging Platforms | CO4 | T1, Ch13 (Pg.67–70) |
|  | Document-Oriented Databases with Analytics | Web Analytics or Real-Time Analytics, E- Commerce Applications | CO4 | T1,Ch13 (Pg.71–73) |
|  | Document-Oriented Databases | When Not to Use, Complex Transactions Spanning Different Operations | CO4 | T1,Ch13 (Pg.74–76) |
|  | Document-Oriented Databases | Queries against Varying Aggregate Structure Module Review & Design Task | CO4 | All |
| **Module 4** | | | | |
| **25.** | Graph Databases and Connected Data Solutions | Graph Databases, What Is a Graph Database?, Features Consistency, Transactions, Availability, Query Features, Scaling in Graph DB | CO5 | T1, Ch14 (Pg.77–80) |
| **26.** | Graph Databases and Connected Data Solutions | Connected Data, Routing, Dispatch, and Location-Based Services | CO5 | T1, Ch14 (Pg.81–83) |
| **27.** | Graph Databases Use cases with real world Example | Use Case: Routing and Location Services | CO5 | T1, Ch15 (Pg.84–86) |
| **28.** | Graph Databases Use cases with real world Example | Use Case: Recommendation Engines | CO5 | T1, Ch15 (Pg.87–89) |
| **Module 5** | | | | |

* 1. **Detailed Schedule of Instructions: Practical**

|  |  |  |
| --- | --- | --- |
| **TABLE 3b:**  **LESSON PLAN: PRACTICAL** | | |
| **Session No** | **Experiment Title** | **Mapped CO** |
| P1 | 1: Environmental Setup   * + Install MongoDB, create a collection and insert documents   + Understand JSON-like document structure and NoSQL CRUD operations | CO1 |
| P2 | 2: Schema-less Collections   * + Create schema-less collections   + Demonstrate dynamic document structures in MongoDB | CO1 |
| P3 | 3: Application of Aggregation Framework   * + Use aggregation pipeline to filter, group, and transform data   + Compare with SQL aggregate functions | CO1, CO2 |
| P4 | 4: Data Modeling in MongoDB   * + Model one-to-one, one-to-many, many-to-many relationships   + Evaluate normalization vs denormalization | CO1, CO2 |
| P5 | 5: Replication SetUp   * + Set up a replica set in MongoDB   + Analyze automatic failover and data consistency | CO2 |
| P6 | 6: Sharding in MongDB   * + Implement Sharding to scale collections   + Evaluate performance and balancing | CO2 |
| P7 | 7: Redis Introduction, Environmental Set Up   * + Implement Key-Value stores with Redis   + Demonstrate session management in Redis | CO2 |
| P8 | 8: Map-Reduce with MongoDB   * + Execute MapReduce Jobs using javascript in MongoDB   + Compare with aggregation pipeline | CO3 |
| P9 | 9: Document Database Use case   * + Implement blog platform backend with MongoDB   + Insert and query nested-documents | CO4 |
| P10 | 10: GraphDB with Neo4J   * + Install Neo4J, Create nodes and relationships   + Query with cypher | CO5 |

**The main pedagogical methods in the course are as follows:**

* Lecture mode.
* Power Point Presentation.
* Seminar by students.
* Video based learning.
* Problem based learning method.
* Simulation Practical system case study/Model Design.

|  |  |  |  |
| --- | --- | --- | --- |
| **TABLE 4: SPECIAL DELIVERY METHOD** | | | |
| **S. No** | **Session Number** | **Subtopic**  **(as per lesson plan)** | **Pedagogical Method** |
|  | **8** | **Case Study – Recommendation System** | **Self-learning topic** |
|  | **12** | **Design backend architecture of a social network (Graph DB)** | **Problem Based Learning** |

1. **ASSESSMENT SCHEDULE**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 5: ASSESSMENT SCHEDULE** | | | | | | |
| **Sl. No** | **Assessment**  **Type** | **Coverage** | **CO**  **Number(s)** | **Duration**  **in Minutes** | **Marks** | **Weightage** |
|  | Continuous Assessment-1 | Module 1 –2 | CO1,CO2,CO3,CO4 | 1 HR | 10 | 5% |
|  | Continuous Assessment-1 (Lab Test) | Module 1 to 2 | CO1 To CO3 | 2 HRS | 20 | 10% |
|  | Mid Term | Module 1 to 3 | CO1 To CO3 | 2 HRS | 50 | 25% |
|  | Continuous Assessment-2 (Assignment) | Module 1 to 4 | CO1 To CO4 | - | 15 | 7.5% |
|  | Continuous Assessment-2(Lab Record) | Module 1 to 2 | CO1 and CO2 | 2 HRS | 5 | 2.5% |
|  | End Term | Module 1 to 4 | CO1 To CO4 | 3 HRS | 100 | 50% |

1. **COURSE CLEARANCE CRITERIA:**

This is in accordance with the Academic Regulations of the University and the Program Regulations and Curriculum of the respective program.

1. **SAMPLE QUESTIONS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TABLE 6: SAMPLE QUESTIONS** | | | | |
| **Sl. No** | **Question** | **Marks** | **CO Number** | **Blooms Cognitive Level** |
| 1 | Why did NoSQL databases emerge despite the dominance of relational databases for decades? Explain using real-world challenges faced by RDBMS systems. | 10 | CO1 | Understand |
| 2 | |  | | --- | |  |  |  | | --- | | Compare and contrast key-value, document, column-family, and graph databases. For each, describe a real-world use case where it performs best. | | 10 | CO1, CO2 | Understand |
| 3 | |  | | --- | |  |  |  | | --- | | Design a NoSQL data model using document-oriented databases for an e-commerce website. Explain how it handles scalability and performance. | | 10 | CO2 | Apply |
| 4 | How would you design a distributed system that maintains availability and partition tolerance for a social networking application? | 10 | CO1, CO2, CO3, CO4 | Apply |
| 5 | Demonstrate how MapReduce can be used to analyze logs from a web server to identify the most visited pages. | 5 | CO3, CO4 | Analyze |

1. **MAPPING WITH SUSTAINABLE DEVELOPMENT GOALS (SDGs):**

|  |  |  |  |
| --- | --- | --- | --- |
| **TABLE 7: SDG MAPPING** | | | |
| **S. No** | **Topic** | **SDG Number** | **Justification** |
| **1** | Introduction to NoSQL, Aggregate-Oriented Models, Schema-less Databases | SDG 9: Industry, Innovation & Infrastructure | **SDG 9** : Promotes understanding of innovative data models crucial for building modern IT infrastructure and scalable data systems. |
| **2** | Distributed Data Systems, Sharding, Replication, CAP Theorem | SDG 11: Sustainable Cities & Communities | **SDG 11** : Supports the creation of scalable, fault-tolerant systems essential for smart cities, urban services, and community-level applications. |
| **3** | Key-Value Stores, MapReduce Framework | SDG 12: Responsible Consumption & Production | **SDG 12** : Encourages efficient data processing, handling large-scale data while optimizing computing resources for sustainable computing practices. |
| **4** | Document-Oriented Databases, Use Cases like CMS, Analytics, E-commerce | SDG 9: Industry, Innovation & Infrastructure | **SDG 9** : Enables learners to build flexible, scalable applications for modern business and industry sectors like e-commerce and content management. |
| **5** | Graph Databases, Connected Data Use Cases (Routing, Recommendation, Location Services) | SDG 4: Quality Education | **SDG 4** : Provides hands-on learning of advanced data technologies, promoting quality education through applied problem-solving in real-world scenarios. |

1. **CRITERIA FOR COURSE OUTCOME ATTAINMENT CALCULATION:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TABLE 8: Threshold and Target Set for Course Outcomes** | | | | |
| **Sl. No** | **C.O. No.** | **Course Outcomes** | **Threshold in %** | **Target in %** |
|  | CO1 | Understand the limitations of relational databases and explain the motivation behind the emergence of NoSQL databases. (Understand) | 75% | 75% |
|  | CO2 | Differentiate between various NoSQL data models such as key-value, document, column-family, and graph databases based on structure, use cases, and performance.(Analyze) | 70% | 70% |
|  | CO3 | Analyze and apply appropriate distribution strategies including sharding, replication, and consistency models in distributed NoSQL systems.(Analyze) | 65% | 65% |
|  | CO4 | Design and implement data access patterns using aggregate-oriented modeling and schema-less approaches for scalable NoSQL applications.(Apply) | 65% | 65% |
|  | CO5 | Utilize Map-Reduce and other data processing techniques to handle large-scale data operations efficiently in NoSQL environments.(Apply) | 65% | 65% |

1. **SUMMARY:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TABLE 9: SUMMARY OF COURSE SCHEDULE** | | | | |
| **Sl. No.** | **Activity** | **Start date** | **End date** | **Total number of Sessions** |
|  | Overview of the course | 11-Aug-2025 | 11-Aug-2025 | 1 |
|  | **Module 1** | 12-Aug-2025 | 29-Aug-2025 | 6 |
|  | **Module 2** | 1-Sep-2025 | 20-Sep-2025 | 6 |
|  | Continuous Assessment-1 | 23-Sep-2025 | 27-Sep-2025 | 1 |
|  | **Midterm** Examination (Theory Exam) | 07-Oct-2025 | 11-Oct-2025 | 1 |
|  | Continuous Assessment-2 (Practical Exam) | 13-Oct-2025 | 17-Oct-2025 | 1 |
|  | **Module 3** | 14-Oct-2025 | 01-Nov-2025 | 6 |
|  | Continuous Assessment-3(Assignment) | 03-Nov-2025 | 05-Nov-2025 | 1 |
|  | **Module 4** | 06-Nov-2025 | 20-Nov-2025 | 6 |
|  | Continuous Assessment-4 (Record) | 21-Nov-2025 | 21-Nov-2025 | 1 |
|  | **Module 5** | 22-Nov-2025 | 28-Nov-2025 | 4 |
|  | End Term Exam | 1-Dec-2025 | 24-Dec-2025 | 1 |

**CONTACT TIMINGS IN THE CHAMBER FOR DISCUSSION**

Students can meet the respective course instructor during the Chamber Consultation Hour to clarify doubts related to the course.

**SPECIFIC GUIDELINES TO STUDENTS, IF ANY:**

* Attend all classes regularly.
* Bring a scientific calculator to every class.
* Refer to online study materials and watch the suggested videos available on the NPTEL website.

Name and Signature of the course In-Charge:

APPROVAL:

This course has been duly verified and approved by the Departmental Academic Committee (DAC).

Name and Signature of the Chairperson - DAC