PVP20

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(Autonomous)

Kanuru, Vijayawada-520007

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (Data Science)

III B. Tech – I Semester CSE (Data Science)

NO SQL DATABASES

Course Code	20DS4501B	**Year**	III	**Semester**	I
Course Category	PEC	**Branch**	CSE(Data Science)	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Database Management System
Continuous Internal Evaluation	30	**Semester End Examination**	70	**Total Marks**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Describe the fundamental concepts, principles, and applications of NoSQL databases.	**L2**
CO2	Apply concepts of MongoDB, a Document-Oriented NoSQL databases to perform various data operations and management tasks.	**L3**
CO3	Use Cassandra, a column-family NoSQL database, to create distributed data models, interacts with data using CQL and manages a Cassandra Cluster.	**L3**
CO4	Analyze the performance of MongoDB and Cassandra Databases, for handling large-scale data and ensuring high availability, fault tolerance, and Data Consistency in Distributed Systems.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Moderate, 1:Low)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2												2	3	
CO3	3											2		
CO4		3										2		

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to NoSQL**: Overview of NoSQL Databases, Comparison with traditional Relational Databases, Dealing with Unstructured and Semi-Structured Data, Types of NoSQL databases (document-oriented, key-value, column-family, graph), Benefits and Trade-offs of NoSQL Databases. **CAP Theorem**-Consistency, Availability, Partition Tolerance.	CO1
II	**Introduction to MongoDB:** Overview of MongoDB, Features and Benefits, Architecture and Components. **CRUD Operations**-Creating Documents, Reading Documents, Updating Documents, Deleting Documents. **Indexes**: Creating Indexes, Types of Indexes, Index Optimization. **Data Modeling**: Schema Design and Data modeling Techniques, Embedding vs. Referencing.	CO1, CO2
III	**MongoDB Advanced Topics:** **Aggregation**-Introduction to Aggregation, Using the Aggregation Pipeline Common Aggregation operators. **Advanced Querying**: Query Operators, Text Search, Geospatial Queries. **Replication and Sharding**: Replication Setup and Configuration, Sharding for Horizontal Scaling, Load Balancing and High Availability, Data Security and Administration. **Authentication and Authorization**: Backup and Restore Strategies, Monitoring and Performance Tuning.	CO1, CO2, CO3
IV	**Introduction to Cassandra**: Overview of Cassandra, Features and Benefits, Architecture and Components. **Data Model**: Key spaces, Tables, Columns, Partition Keys and Clustering Columns, Data Types and Collections. **CQL (Cassandra Query Language**): Introduction to CQL, Basic CQL syntax and operations, Creating and Managing Key spaces and Tables. **Data Operations:** Writing Data to Cassandra, Reading Data from Cassandra, Batch Operations and Lightweight Transactions.	CO1, CO2, CO3
V	**Advanced Cassandra:** **CRUD Operations:** Create Insert, Update, Delete Operations**,** Batch operations, Lightweight Transactions. **Data Modeling in Cassandra:** Denormalization and Query-driven Modeling, Time-series Data Modeling, Advanced Data Modeling Techniques. **Consistency and Availability:** Consistency Levels and Tunable, Consistency, Availability and Fault Tolerance. **Performance Tuning and Maintenance:** Monitoring and Metrics, Compaction Strategies, Repair and Backup Strategies.	CO1, CO2, CO3, CO4

Learning Resources
Text Books
1. MongoDB: The Definitive Guide, Kristina Chodorow, Third Edition, 2020, O'Reilly. 2. Cassandra: The Definitive Guide, Jeff Carpenter and Eben Hewitt, Third Edition, 2020, O'Reilly.
Reference Books
1. NoSQL Explained: A Practitioner's Guide to Mastering Distributed Databases, Pramod J. Sadalage and Martin Fowler Addison, Professional, 2022, Wesley. 2. Mastering Cassandra, Nate Nader, 2019, Packt Publishing.
e- Resources & other digital material
1. https://learn.mongodb.com/ 2. https://cassandra.apache.org/doc/latest/ 3. https://www.mongodb.com/docs/ 4. https://www.mongodb.com/blog 5. https://www.mongodb.com/resources/basics/databases/nosql-explained 6. https://www.youtube.com/user/MongoDB 7. https://www.w3schools.com/mongodb/