INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

NOSQL DATABASE								
VI Semester: CSE(DS)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACDD15	Elective	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Basic understanding of database management systems, data structures, and programming fundamentals.								

I. COURSE OVERVIEW:

This course introduces the fundamental concepts of NoSQL databases, exploring their need, architecture, and data models, with emphasis on document, key-value, column-family, and graph databases. Students will learn to design, query, and manage NoSQL systems such as MongoDB, Cassandra, and Neo4j, enabling them to handle large-scale, unstructured, and semi-structured data common in modern data science applications.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The need for NoSQL databases in handling big data, real-time applications, and unstructured data.
II. The core principles, architectures, and data models used in various types of NoSQL systems.
III. How to work with document, key-value, column-family, and graph-based databases.
IV. The practical usage of popular NoSQL databases like MongoDB, Cassandra, and Neo4j for scalable data management.

III. COURSE OUTCOMES:

CO1 **Explain** the limitations of traditional relational databases and the need for NoSQL databases.
CO2 **Classify** different types of NoSQL databases such as key-value, document, column-family, and graph databases.
CO3 **Demonstrate** the design and use of document databases like MongoDB for storing semi-structured data.
CO4 **Apply** key-value and column-family data models for distributed and scalable data storage.
CO5 **Use** graph databases to represent and query complex relationships among data.
CO6 **Compare** and **evaluate** NoSQL systems based on their use cases, scalability, consistency models, and performance.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO NOSQL DATABASES. (09)
Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

MODULE-II: COMPARISON OF RELATIONAL DATABASES AND NOSQL STORES (09)
Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and Sharding, to-Peer MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer- Replication, Combining Sharding and Replication.

MODULE-III: NOSQL KEY/VALUE DATABASES USING MONGODB (10)
NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented 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, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

MODULE–IV: COLUMN- ORIENTED NOSQL DATABASES USING APACHE HBASE (10)
Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

MODULE–V: KEY-VALUE AND GRAPH NOSQL DATABASES (10)
NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

V. TEXTBOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.

VI. REFERENCE BOOKS:

1. Redmond, E. & Wilson, J. R. Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement 1st Edition, O′Reilly, 2012.

VII. ELECTRONICS RESOURCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)