

20MCA134	ADVANCED DBMS LAB	CATEGORY	L	T	P	CREDIT
		PRACTICAL	0	1	3	2

**Preamble:** This course is to provide understanding on relational and non-relational database systems and its design. The course covers SQL, PL/SQL and NoSQL programs which are essential for the development and deployment of web based applications. Also this course serves as a prerequisite for many advanced courses in Data Science areas.

**Prerequisite:** Database Management Systems

**Course Outcomes:** After the completion of the course the student will be able to

CO 1	Design and build a simple relational database system and demonstrate competence with the fundamentals tasks involved with modelling, designing and implementing a database.
CO 2	Apply PL/SQL for processing databases.
CO 3	Comparison between relational and non-relational (NoSQL) databases and the configuration of NoSQL Databases.
CO 4	Apply CRUD operations and retrieve data in a NoSQL environment.
CO 5	Understand the basic storage architecture of distributed file systems.
CO 6	Design and deployment of NoSQL databases with real time requirements.

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	2	2					1	1	
CO 2	2	2	2		1							
CO 3	2	2	2	2						1	1	
CO 4	2	2	3	1	2		1			1	1	1
CO 5	3	2	2				1				1	1
CO 6	2	2	3	1	1			1		1	1	2



#### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember(K1)			
Understand(K2)			
Apply(K3)	10	10	10
Analyse(K4)	10	10	10
Evaluate(K5)	10	10	10
Create(K6)	20	20	20

#### Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	3 hours

#### Continuous Internal Evaluation Pattern:

Maximum Marks: 50	
Attendance	15%
Maintenance of daily lab record and GitHub management	20%
Regular class viva	15%
Timely completion of day to day tasks	20%
Tests/Evaluation	30%

#### End Semester Examination Pattern:

Maximum Marks: 50	
Verification of Daily program record and Git Repository	5 marks
Viva	10 marks
Problem solving	15%
Flowchart / Algorithm / Structured description of problem to explain how the problem can be solved	

**End Semester Examination Pattern:**

Maximum Marks: 50			
Verification of Daily program record and Git Repository			5 marks
Viva			10 marks
Problem solving (Based on difficulty level, one or more questions may be given)	Flowchart / Algorithm / Structured description of problem to explain how the problem can be solved / Interface Design	15%	35 marks
	Program correctness	50%	
	Code efficiency	15%	
	Formatted output and Pushing to remote Git repository	20%	
Total Marks			50 marks

**Course Level Assessment****Questions Course Outcome 1 (CO1):**

1. Creation of a database using DDL commands including integrity constraints. (K6)
2. Create an application to apply Data Manipulation Language (DML) commands to modify the database. (K6)
3. Apply DCL and TCL commands to impose restrictions on databases. (K3)
4. Create an application to retrieve data from databases using select, views. (K6)
5. Create an application to use joins for query optimization. (K6)

**Course Outcome 2 (CO2):**

1. Construct PL/SQL code for sample databases. (K6)

**Course Outcome 3(CO3):**

1. Compare relational and non-relational databases. (K5)
2. Understand the installation and configuration of NoSQL Databases. (K2)

**Course Outcome 4 (CO4):**

1. Build sample collections/documents to perform query operations. (K6)

**Course Outcome 5 (CO5):**

1. Build sample collections/documents to perform the shell commands like replica set, indexing etc. (K6)

**Course Outcome 6 (CO6):**

1. Develop sample applications using any of the front end tools and NoSQL. (K6)
2. Usage of concerned Online/Cloud Storage Management Systems like MongoDB Atlas, Cassandra DataStax etc. (K6)
3. Deployment of NoSQL in Cloud: Google Bigtable/ Amazon DynamoDB/ Azure Cosmos DB. (K6)

**Syllabus**

1. An overview of relational database design using MySQL/ MariaDB/ PostgreSQL etc. (Apply the following basic queries on an Employee/ Student database etc.)
  - a. DDL Commands
  - b. DML Commands
  - c. Imposing restrictions on database (DCL & TCL Commands)
  - d. Accessing database (SELECT, Filtering using WHERE, HAVING

## Syllabus

1. An overview of relational database design using MySQL/ MariaDB/ PostgreSQL etc. (Apply the following basic queries on an Employee/ Student database etc.)
  - a. DDL Commands
  - b. DML Commands
  - c. Imposing restrictions on database (DCL & TCL Commands)
  - d. Accessing database (SELECT, Filtering using WHERE, HAVING, GROUP BY, ORDER BY Clauses, Subquery and View)
  - e. Optimizing databases (Join, Aggregate & Set operations, Other operators like arithmetic, logical, special etc.)
2. PL/SQL Programs (Trigger, Cursor, Stored Procedures and Functions)
3. Introduction to NoSQL Databases.
  - a. Installation and configuration of any one of the NoSQL databases - MongoDB/ Cassandra/ HBase/ CouchDB/ Amazon DynamoDB/ Redis/ Neo4j etc.
4. Designing Databases using NoSQL
5. Query Processing
  - a. Performing CRUD operations
  - b. Retrieving Data from a NoSQL database
  - c. Usage of aggregate functions, regular expressions etc.
6. NoSQL Administration
  - a. Security, Monitoring & Backup
  - b. Create Users and Roles
7. NoSQL shell commands
  - a. Perform Sharding, Replication (Master-Slave/ Master-Less/ Peer-to-Peer Architectures), Clustering, Partitioning, Indexing (Corresponding to the selected NoSQL Database)



8. Deployment
  - a. Local Deployment
    - i. NoSQL and Front-End: PHP/Java/Python (MongoDB/ Cassandra etc.)
  - b. Cloud Deployment
    - i. NoSQL and Cloud: Amazon DynamoDB/ Google Bigtable/ Azure Cosmos DB
    - ii. Familiarization of Atlas/ DataStax corresponding to the selected NoSQL Database
9. **Micro project:** Students can be given a group micro project, so that they learn to work in a team environment.

### Text Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw Hill Education, 6th Edition (2011)
2. Guy Harrison, "Next Generation Databases: NoSQL, NewSQL, and Big Data", Apress, 1st Edition (14 December 2015)

### Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill, 3rd Edition (2014).
2. HBase: The Definitive Guide, Lars George O'Reilly Media; August 2011, ISBN: 9781449315771
3. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.



2. Databases: SQL <https://www.edx.org/course/databases-5-sql>
3. Introduction to MongoDB <https://www.coursera.org/learn/introduction-mongodb>
4. Apache Cassandra <https://www.edureka.co/cassandra>
5. NoSQL systems <https://www.coursera.org/learn/nosql-databases>
6. <https://hbase.apache.org/>
7. <https://couchdb.apache.org/> <https://aws.amazon.com/dynamodb/>
8. <https://aws.amazon.com/dynamodb/>

#### Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	<i>An overview of relational database design using MySQL/ MariaDB/ PostgreSQL etc. (Apply the following basic queries on an Employee/ Student database etc.)</i>	6 hrs
1.1	<ul style="list-style-type: none"> <li>DDL Commands</li> <li>DML Commands</li> <li>Imposing restrictions on database (DCL &amp; TCL Commands)</li> </ul>	3
1.2	<ul style="list-style-type: none"> <li>Accessing database (SELECT, Filtering using WHERE, HAVING, GROUP BY, ORDER BY Clauses, Subquery and View)</li> <li>Optimizing databases (Join, Aggregate &amp; Set operations, Other operators like arithmetic, logical, special etc.)</li> </ul>	3



No	Topic	No. of Lectures
2	<i>PL/SQL Programs</i>	4 hrs
2.1	<ul style="list-style-type: none"> <li>Trigger, Cursor, Stored Procedures and Functions</li> </ul>	4
3	<i>Introduction to NoSQL Databases</i>	2 hrs
3.1	<ul style="list-style-type: none"> <li>Installation and configuration of any one of the NoSQL databases - MongoDB/ Cassandra/ HBase/ CouchDB/ Amazon DynamoDB/ Redis/ Neo4j etc.</li> </ul>	2
4	<i>Designing Databases using NoSQL</i>	2 hrs
5	<i>Query Processing</i>	8 hrs
5.1	<ul style="list-style-type: none"> <li>Performing CRUD operations</li> <li>Retrieving Data from a NoSQL database</li> <li>Usage of aggregate functions, regular expressions etc.</li> </ul>	8
6	<i>NoSQL Administration</i>	2 hrs
6.1	<ul style="list-style-type: none"> <li>Security, Monitoring &amp; Backup</li> <li>Create Users and Roles</li> </ul>	2
7	<i>NoSQL shell commands</i>	6 hrs
7.1	<ul style="list-style-type: none"> <li>Perform Sharding, Replication (Master-Slave/ Master-Less/ Peer-to-Peer Architectures), Clustering, Partitioning, Indexing (Corresponding to the selected NoSQL Database)</li> </ul>	6
8	<i>Deployment</i>	16 hrs
8.1	<ul style="list-style-type: none"> <li>Local Deployment NoSQL and Front-End: PHP/Java/Python (MongoDB/ Cassandra etc.)</li> </ul>	4
8.2	<ul style="list-style-type: none"> <li>Cloud Deployment NoSQL and Cloud: Amazon DynamoDB/ Google Bigtable/ Azure Cosmos DB</li> </ul>	8
8.3	<ul style="list-style-type: none"> <li>Familiarization of Atlas/ DataStax corresponding to the selected NoSQL Database</li> </ul>	4
9	<i>Micro project</i>	10 hrs