GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Subject Code: BE05016031

Subject Name: Advanced Database Management System

w.e.f. Academic Year:	2024 - 25
Semester:	5
Category of the Course:	Professional Elective Course - 1

Prerequisite:	Understanding of Database, transaction, SQL, DBMS software etc
Rationale:	Advanced Database Management Systems (ADBMS) provides an in-depth understanding of concepts related to database systems, database design, and database management. The course broadly covers topics such as parallel and distributed database systems, database transactions, big data management, and recent advancements in database technologies. Students gain a detailed introduction to database administration and management, along with an understanding of the role of machine learning in big data management. The course also includes the study of structured and unstructured databases such as SQL, MongoDB, and XML for effective data management.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
1	Explain and compare different types of database architectures.	R, U
2	Design and execute Object-Oriented and advanced XML-based queries on databases.	R, A
3	Perform data manipulation and management operations using MongoDB commands.	U, A
4	Analyze and apply Big Data concepts for large-scale data processing.	N, A
5	Understand and apply principles of Data Mining	U, A

**Revised Bloom's Taxonomy(RBT)*

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA (I)	PBL (I)	ESE (V)	
45	0	30	15	90	03	70	30	20	30	50	200

* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

Course Content:

Unit No.	Content	No. of Hours
1	**Database Architecture**: Introduction to Client–Server Database Models: Overview of client–server architecture, including two-tier and three-tier client–server database models., Concurrency Control Techniques: Study of concurrency control mechanisms, including lock-based protocols, lock granting methods, and the two-phase locking protocol, Introduction to Parallel Databases: Concepts of parallel database systems, parallel database system architecture, types of parallelism, and parallel database implementation strategies., Introduction to Distributed Databases: Fundamentals of distributed database systems, distributed database architecture, advantages of distributed databases, and issues and challenges associated with distributed database systems.	**8**
2.	**Object-Based Databases and XML**: Overview of Object-Based Databases, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object Identity (OI) and Reference Types in SQL, XML: Introduction and Structure of XML Data, XML Document Schema, XPath, XQuery (FLWOR Expressions), Joins, Nested Queries, Aggregate Functions, and User-Defined Functions	8
3.	**Advanced Database Techniques:** Structured Vs Unstructured Data, NoSQL Database Concepts: Types of NoSQL databases, NoSQL data modeling, advantages of NoSQL databases, and comparison between SQL and NoSQL database systems, NoSQL Using MongoDB: Introduction to MongoDB, MongoDB Shell, MongoDB Client, basic operations, basic data types, arrays, and embedded documents, Querying with MongoDB: find() function, projection of fields, query criteria, OR queries, and type-specific querying, Aggregation Concepts: Introduction to aggregation pipeline, aggregation using MapReduce, and single-purpose aggregation operations	10
4.	**Advance transaction Processing**: Basics of transaction and ACID properties, Transaction processing monitors- architecture, transactional workflows, workflow architectures, Recovery of workflow, Real-time transaction systems, Long duration transactions, Implementation issues-nesting, compensating, concurrency	9
5.	**Modern developments in database technologies**: Introduction to Data Mining Techniques: Data mining technology and its relationship with data warehousing, association rules, classification, clustering, and applications of data mining, Introduction to Business Intelligence: Features, frameworks, and types and approaches for machine learning, Introduction to Multimedia Databases, Mobile Databases, and Digital Databases	10

Suggested Specification Table with Marks(Theory):

Distribution of Theory Marks (in%)					
RLevel	**ULevel**	**ALevel**	**NLevel**	**E Level**	**CLevel**
40	**20**	**30**	**10**	**--**	**-**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Database Management Systems Application **Kogent Learning Solutions Inc.** Dreamtech Press 2014, ISBN-978-93-5119-476-7
2. Database System Concepts Abraham Silberschatz, Henry F. Korth, S. Sudarshan
3. Fundamentals of Database Systems, Ramez Elmasri & Shamkant B. Navathe
4. Database Management Systems, Raghu Ramakrishnan & Johannes Gehrke
5. Object-Oriented Database Systems: Concepts and Architectures, O. M. D. Madnick, J. J. Donovan
6. Definitive XML Schema, Priscilla Walmsley
7. MongoDB: The Definitive Guide, Kristina Chodorow
8. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage & Martin Fowler
9. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei

(b) Open source software and website:

1. MongoDB University free courses — Great for hands-on MongoDB practice.
2. W3Schools / W3C XML/XQuery tutorials — For quick XML learning.
3. Postgrss tutorials- https://www.postgresql.org/docs/current/tutorial.html

Suggested Course Practical List:(List can be change according to Latest Development)

1. Implement Locking protocols
2. Create database using XML attributes and Elements.
3. Implement queries based on FLOWER expressions and joins using XQuery.
4. Implement queries based on Nested queries and sorting of results using XQuery.
5. Implement queries based on functions and types using XQuery.
6. Execute queries using structured type in SQL
7. Execute queries using type inheritance and table inheritance in SQL
8. Implement queries using Array and Multiset types in SQL
9. Execute queries using object identity and reference types in SQL
10. Design and Develop MongoDB CRUD operations
11. Implement aggregation Queries using MongoDB
12. Implement MongoDB Queries Usinf find() function
13. Case study: eCommerce work-flow, Loan Processing work flow

List of suggested activities for Problem Based Learning:

Sl. No	Name of the activity	No. of hours	Evaluation Criteria
1	Seminar / Presentation	Duration for study and preparation=10h Report writing=3h Presentation=2h Total=15h	Topic can be selected technical content beyond syllabus
2	Poster/chart/power point preparation on technical topics	Duration = 15h	Based on poster/chart preparation and presentation skills
3	Real world case studies-based learning	Duration of data collection/study = 5h Report	Based on in-depth study, technical depth, data collected, fact finding,

		preparation = 10h Total = 15h	etc.
4	Self-learning on-line course	Minimum duration of the course should be 15h.	Examination based assessment at the end of course. Based on the certificate produced.
5	Application/Software development(Mini Project)	Duration = 15 h	Depending on the complexity of the Application/Software
6	Technical Video based learning related to the subject	Duration of video = 5h Report preparation & Presentation = 10h Total = 15h	Report /presentation based on the video learning outcomes.

Note:

- All the suggested activity should be related to the subject.
- Min 1 activities must be carried out as per the availability of faculties and students.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
- Rubrics for the evaluation can be prepared by the faculty.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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