GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Subject Code : BE03000091

Subject Name : Database Management System

w. e. f. Academic Year:	A.Y. 2024-25
Semester:	3
Category of the Course:	Professional Core Course

Prerequisite:	Basic knowledge of Computer Programming.
Rationale:	The course will equip student with the knowledge and skills to design, implement, and manage database systems. It covers database design, modeling, and structures like relational, hierarchical, and network models. Students will learn data manipulation languages for querying and managing databases, along with key DBMS concepts such as security, integrity, concurrency, and storage strategies. Hands-on practice with SQL and PL/SQL ensures practical experience in database management.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Understand DBMS fundamentals, database architecture, relational models, and user roles.	R, U
2	Design databases using E-R diagrams, normalization, and relational schemas.	C
3	Apply SQL and PL/SQL for database queries, constraints, procedures, and triggers.	A
4	Use transaction management, concurrency control, and recovery techniques.	N
5	Demonstrate query optimization, indexing, hashing, and database security.	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	45	120	04	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	% of Weightage
1.	**Introductory concepts of DBMS** Purpose of database system, View of data, Database Languages, Relational Databases, Database Architecture, Database users, DBA	3	10
2.	**Relational Model** Structure of relational databases, Database Schema, Keys, Schema Diagrams, Relational algebra operators, relational algebra queries.	4	10
3	**Introduction to SQL:** Overview of SQL Query Language, Basic structure of SQL Queries, DDL, DML, Additional Basic Operations, defining constraints – Primary key, foreign key, unique, not null, check, Set operations, Null values, Aggregate functions, Built-in functions –numeric, date, string functions, nested sub- queries, Modification of the Database, DCL and TCL.	6	15
4	**Entity-Relationship Model:** Design process, E-R Model, constraints, Removing redundant attributes in Entity Sets, E-R diagrams, Reduction of E-R database schema to Relational schema, Design issues.	5	10
5.	**Relational Database Design:** Features of good relational designs, Dependency preservation, Functional Dependency–definition, Trivial and Non-Trivial FD, Closure of FD set, Closure of attributes, Irreducible set of FD, Decomposition using FD, Normalization – 1Nf, 2NF, 3NF,BCNF, Multivalued dependency, 4NF.	6	15
6.	**Transaction Management:** Transactions: Transaction concepts, transaction model, ACID Properties of transactions: Serializability of transactions, testing for serializability, Concurrency Control: Lock based protocols, deadlock handling, Timestamp protocols, Recovery System: Types of failure, Storage, Recovery and atomicity, Recovery Algorithms.	6	10
7.	**Query Processing & Optimization:** Overview, measures of query cost, selection and join operation,evaluation of expressions. Transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views.	4	10
8.	**Database Security** Security – Security and Authentication, authorization in SQL, access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	4	5
9	**Indexing and Hashing** Basic Concepts, Ordered Indices, B+-Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL	4	10
10	**PL/SQL Concepts** Cursors, Stored Procedures and Database Triggers	3	5

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**30**	**20**	**--**	**20**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Fundamentals of Database Systems", 7th Edition by R. Elmasri and S. Navathe, Pearson
3. "An introduction to Database Systems", C J Date, Pearson.
4. "Modern Database Management", Hoffer , Ramesh, Topi, Pearson.
5. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
6. "SQL- PL/SQL", Ivan bayross

(b) Open source software and website:

7. NPTEL Course: **Introduction to Database Systems** by Prof. Sreenivasa Kumar- IIT Madras
8. NPTEL Course: **Data Base Management System** by y Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay- IIT Kharagpur

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

Sr	Aim
1	Design and implement sample schema and insert data in tables.
2	Implement Data Definition Language (DDL) and Data Manipulation Language (DML) commands.
3	Implement Data Constraints: Add primary key, foreign key, unique key, and check constraints, define and remove integrity constraints using the ALTER TABLE command.
4	Execute value-matching and pattern-matching conditions on any sample schema to retrieve specific data based on given requirements.
5	Perform oracle functions: aggregate, numeric, string, conversion, date conversion, date functions and set operations functions, to manipulate and retrieve data effectively.
6	Study of group by and having clauses.
7	Solve queries using the concept of sub query.
8	Displaying data from Multiple Tables using join operations.
9	Study & Implementation of Database Backup & Recovery commands.
	Study & Implementation of Rollback, Commit, Savepoint
10	Study & Implementation of PL/SQL using Cursor and Trigeers.
11	Design and implement sample schema and insert data in tables.

12	Implement Data Definition Language (DDL) and Data Manipulation Language (DML) commands.

- **List of suggested activities for Problem Based Learning:**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1	Assignment writing. Numerical based assignment is preferable.	5 assignments of 3h each. Total = 15h	Based on the assignment submitted.
2	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding-based problems of 3h each. Total = 15h	Based on the coding solution submitted.
3	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.
4	Discussion on research paper based on relevant subject	3 research paper = 15h	Summarize research paper and evaluation critical parameters
5	Poster/chart/power point preparation on technical topics	Duration = 10 h	Based on poster/chart preparation and presentation skills
6	Application/Software development	Duration = 15 h	Depending on the complexity of the Application/Software
7	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
8	Seminar / Presentation	Duration for study and preparation=5h Report writing=3h Presentation=2h Total=10h	Topic can be selected technical content beyond syllabus
9	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 10h Total = 15h	Based on in-depth study, technical depth, data collected, fact finding, etc.
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	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.
12	Complex problem solving	Maximum 3 problem. Study of	Based on the depth of the solution submitted.

		the problem and solution finding, Total = 15h	
13	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
14	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
15	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment /health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions

Note:

- All the suggested activity should be related to the subject.
- Min 3 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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