



Gyanmanjari
Innovative University

Syllabus
Gyanmanjari College Of Computer Application
Semester-I (BCA)

Subject : Database Concepts & Applications - BCA2XX11302

Type of course : Core Courses

Prerequisite : Basic knowledge of Computer

Rationale:

This course introduces the fundamentals of Database Management Systems (DBMS) with a focus on Oracle SQL and PL/SQL. It covers database concepts, SQL querying, normalization, transaction management, and data integrity. Students gain practical experience with PL/SQL, stored procedures, triggers, user management, and security. By the end, learners understand database design, implementation, and administration using Oracle/MySQL tools, combining both theoretical knowledge and practical skills.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	2	5	100	50	150

Legends: CI-Classroom Instructions; T-Tutorial; P-Practical; C -Credit; SEE - Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1.	Introduction to Database Systems and Basic SQL : Theory Topics : Basic Concepts of Data and Information : Data and Information, Data Items / Fields, Records and Files, Metadata, Data Dictionary and its Components, Need for Database Systems, Introduction to DBMS, Advantages of DBMS. Basics of SQL : Introduction to SQL, SQL Data Types, SQL Command : Data Definition Language (DDL) : CREATE, ALTER, DROP, Data Manipulation Language (DML): INSERT, UPDATE, DELETE, Data Query Language (DQL) : SELECT, SQL Operators : Arithmetic and Relational Operators, IN, LIKE, BETWEEN Operators, EXISTS, ANY, ALL. Practical : 1. Explore MySQL Workbench / phpMyAdmin interface – identify databases, tables, and records.	18	20%



2. Demonstration of SQL Data Types during table creation.
3. Creation of database tables using CREATE command.
4. Modification of table structure using ALTER command.
5. Deletion of database tables using DROP command.
6. Insertion of records into database tables using INSERT command.
7. Modification of records using UPDATE command.
8. Deletion of records from database tables using DELETE command.
9. Retrieval of records using SELECT command.
10. Demonstration of column selection and aliasing using SELECT statement.
11. Execution of queries using Arithmetic Operators in SQL.
12. Execution of queries using Relational Operators in SQL.
13. Execution of queries using IN operator.
14. Demonstration of pattern matching using LIKE operator.
15. Execution of range-based queries using BETWEEN operator.
16. Demonstration of queries using EXISTS operator.
17. Execution of queries using ANY operator.
18. Execution of queries using ALL operator.
19. Preparation and execution of SQL queries based on student database scenario.

Evaluation Method :

Sr. No.	Evaluation Methods	SEE	CCE
1.	Filter Matrix Challenge : Students will apply SQL operators and filtering conditions to identify the correct output records by logically evaluating the given dataset and writing the appropriate SELECT queries.	20	
2	VisualDB Knowledge Canvas : Students will design an informative infographic or poster on assigned DBMS concepts and upload the final PDF or image to the GMIU Portal.		05
3	Linkdin Profile : Students will create or update a professional LinkedIn profile, explore its career-related features, and submit their LinkedIn profile PDF or profile URL through the GMIU Portal.		05
	Total	20	10



	Examination Style : Filter Matrix Challenge [20 Marks] : The faculty will provide a master table of records and a set of mystery criteria. They must evaluate conditions using Arithmetic & Relational Operators, set filters (IN, BETWEEN), and conditional operators (EXISTS, ANY, ALL). With writing the SELECT query, they must logically trace the table and tick/cross which Records will survive the filtering matrix and appear in the final output, testing their pure logical evaluation speed. VisualDB Knowledge Canvas [05 Marks] : The faculty will provide DBMS concepts such as ER modeling, Database lifecycle, ACID properties and Students with an attractive infographic or poster explaining important using tools like Canva, PowerPoint, or any design software. Students need to upload the final poster/infographic in PDF or image format on the GMIU portal. Linkdin Profile [05 Marks] : Students will participate in a TPA (Training and Placement Activity) session on LinkedIn. During the activity, they will learn how to create a professional LinkedIn profile, update essential details such as education, skills, certifications, and projects, and explore LinkedIn features for networking, job opportunities, internships, and professional learning. Submit submit their LinkedIn profile pdf or URL in GMIU Portal.		
2.	Database System Architecture and Advance SQL Query : Theory Topics : Database System Architecture : Data Abstraction (Physical, Logical, View Level), Data Independence, Logical Data Independence, Physical Data Independence, Types of DBMS : Centralized DBMS, Distributed DBMS, SQL Clauses and Query Processing: WHERE Clause, ORDER BY Clause, GROUP BY Clause, HAVING Clause, SQL Functions : Numeric Functions, Aggregate Functions, String Functions, Date Functions, SQL Joins : Introduction to Joins, Inner Join Outer Join, Cross Join, Self Join. Practical: 20. Demonstration of filtering records using WHERE clause. 21. Retrieval and sorting of records using ORDER BY clause. 22. Grouping of records using GROUP BY clause 23. Demonstration of grouped data filtering using HAVING clause. 24. Preparation and execution of queries using multiple SQL clauses. 25. Study and demonstration of SQL Join operations 26. Execution of queries using INNER JOIN 27. Execution of queries using LEFT OUTER JOIN	18	20%



28. Execution of queries using RIGHT OUTER JOIN.
29. Execution of queries using FULL OUTER JOIN.
30. Demonstration of CROSS JOIN in SQL queries.
31. Execution of queries using SELF JOIN.
32. Preparation of queries using multiple table joins.
33. Demonstration of Numeric Functions in SQL.
34. Execution of queries using Aggregate Functions.
35. Demonstration of String Functions in SQL queries.
36. Execution of queries using Date Functions.
37. Preparation and execution of SQL queries using built-in functions.

Evaluation Method :

Sr. No.	Evaluation Methods	SEE	CCE
1.	Database Output Detective : Students act as detectives by finding and executing the SQL queries that generate a given output.	20	
2	Practical Business Analytics Activity : Students will use SQL functions, GROUP BY, HAVING, and Joins to generate reports and analyze the results.		10
	Total	20	10

Examination Style :**Database Output Detective [20 Marks] :**

Faculty will provide specific database outputs, result tables, or business requirements generated from SQL operations, and students must analyze the given information to identify and perform the appropriate SQL queries using clauses, joins, and functions required to achieve the expected result. Students will execute the queries, verify the outputs, and explain the logic used in query processing. The activity evaluates students' understanding of SQL concepts, logical thinking, and practical query execution skills.

Practical Business Analytics Activity [10 Marks] :

Faculty will provide a business dataset such as sales records, employee details, or student performance data. Students will generate reports using Aggregate Functions, String Functions, Date Functions, GROUP BY, HAVING, and Joins. Students must analyze the data and generate business insights from the outputs. Students need to upload SQL query screenshots, generated reports, and result analysis documents on the GMIU portal.



Constraints and Normalization

Theory Topics : Data Constraints : Concept and Need of Constraints, Types of Constraints : Primary Key, Foreign Key, Unique Key, NOT NULL, NULL Values, Business Constraints, **Database Design & Functional Dependency :** Introduction to Database Design, Functional Dependency, **Normalization :** Concept and Need of Normalization, Normal Forms : First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF), Comparison of 3NF and BCNF, **Set Operations:** UNION, INTERSECT, MINUS

Practical:

38. Write SQL to create a table with **PRIMARY KEY, FOREIGN KEY, NOT NULL** constraints.
39. Add a **UNIQUE** constraint to an existing table.
40. Demonstrate inserting records with **NULL values** and applying **NOT NULL constraint**.
41. Demonstrate **Business Constraints** by adding CHECK constraints for conditions like salary > 0.
42. Write SQL to combine results of two queries using **UNION**.
43. Write SQL to find common records between two queries using **INTERSECT**.
44. Write SQL to find records present in one table but not in another using **MINUS/EXCEPT**.
45. Identify **Functional Dependencies** in a given table and document them.
46. Demonstrate **Full and Partial Functional Dependencies** with examples.
47. Convert normalized data to **1NF** by removing repeating groups.
48. Convert a **1NF table to 2NF** by removing partial dependencies.
49. Convert a **2NF table to 3NF** by removing transitive dependencies.
50. Convert a **3NF table to BCNF** where applicable.
51. Compare a 3NF and BCNF table and document differences with examples.

Evaluation Method :

Sr. No.	Evaluation Methods	SEE	CCE
I.	Constraint Risk Investigation : Students will select and apply appropriate constraints such as Primary Key, Foreign Key, Unique, and NOT NULL	20	

18

20%



2	Real-Life DBMS Explorer : Students will study a real-world application and identify how databases are used. They will prepare a report.		10
Total		20	10

Examination Style :

Constraint Risk Investigation [20 Marks] :
The faculty will provide students with unconstrained table blueprints of a Real life Management System (e.g., Students, Courses, and Enrollments), acting as the core evaluator of structural logic rather than syntax. Inside the exam, **students must select at least three** distinct data constraints from a pool of *Primary Key, Foreign Key, Unique Key, NOT NULL, or Business Constraints*, explicitly map their exact placement within the provided tables, and formally document the architectural justification for each selection. Furthermore, students must conduct a risk analysis by detailing the specific data anomalies, logical corruption, or system failures that would occur if those constraints were omitted, demonstrating their understanding of defensive database design.

Real-Life DBMS Explorer [10 Marks] :
 Students will observe any real-world application such as ATM systems, hospital software, e-commerce websites, library systems, or food delivery apps and identify how **databases** are used for storing, retrieving, and managing information. Students must prepare a short report explaining entities, relationships, and possible SQL operations involved in the system. Students need to upload the observation report and supporting screenshots/images on the GMIU portal.

4	PL/SQL Programming Concepts and Database Application Development Theory Topics : Introduction to PL/SQL : Overview of PL/SQL, Features and Advantages of PL/SQL, SQL vs PL/SQL, PL/SQL Block Structure : Structure of PL/SQL Block (Declaration, Execution, Exception), Writing and Executing Simple PL/SQL Programs, Variables and Data Types : Declaration and Initialization of Variables, Constants and Scope of Variables, Control Structures : Conditional Statements, Looping Statements. Practical: 52. Write a simple PL/SQL block to display "Hello World" using DBMS_OUTPUT.PUT_LINE 53. Create a PL/SQL block with all three sections 54. Implement PL/SQL programs using IF STATEMENT	18	20%
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1. IF statement to check whether a number is **odd or even**
 2. IF statement to check Whether a number is **positive or negative**
 3. IF statement to find **Greater of two numbers**.
 4. IF statement to check whether a number is **divisible by 5**
 5. IF statement to check whether a student is **pass or fail based on marks**
 6. IF statement to check whether a character is a **vowel or consonant**.
57. Implement PL/SQL programs using WHILE LOOP.
1. Implementation of PL/SQL program using WHILE loop to print numbers from **1 to N**.
 2. Implementation of PL/SQL program using WHILE loop to print **odd and even numbers up to N**.
 3. Implementation of PL/SQL program using WHILE loop to calculate the **sum of first N natural numbers**.
 4. Implementation of PL/SQL program using WHILE loop to find the **factorial of a number**.
 5. Implementation of PL/SQL program using WHILE loop to generate the **Fibonacci series**.
58. Implement PL/SQL programs using CASE STATEMENT.
1. CASE statement to display **grade based on marks**.
 2. CASE statement to show **month name from number (1-12)**.
 3. CASE statement to perform **basic arithmetic operations (+, -, *, /)**.
 4. CASE statement to display **salary category (low, medium, high)**.
 5. CASE statement to display **traffic light signals (red, yellow, green)**.
59. Implement PL/SQL programs using LOOP STATEMENT.
1. LOOP statement to print numbers from 1 to 10.
 2. LOOP statement to print Factorial number.
 3. LOOP statement to calculate the sum of digits of a number.
 4. LOOP statement to reverse a given number.
 5. LOOP statement to print even numbers between 1 and N.
60. Implement PL/SQL program to perform ant * pattern.

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61. Create a program using a BASIC LOOP with an EXIT WHEN condition to process data until a specific threshold is met.

Evaluation Method :

Sr. No.	Evaluation Methods	SEE	CCE
1.	PL/SQL Puzzle Debugger : Students will rearrange the code into a correct PL/SQL block structure and verify the execution flow.	20	
2	Metadata Master Builder : Students will create a data dictionary for a selected system by defining table names, field names, data types, constraints, and descriptions.		05
3	Participation in PAHEL Project Exhibition : Students are required to participate in PAHEL (Mini TechManjari), work closely with their faculty mentor, prepare a quality project, and effectively represent it during the project exhibition.		05
Total		20	10

Examination Style :

PL/SQL Puzzle Debugger [20 Marks] :

The faculty will provide students with a repository of intentionally jumbled, fragmented PL/SQL code snippets—including mixed variables, conditional blocks, loop iterations, and exception handlers—cluttered out of operational sequence. Inside the examination, **students must write the final compiled code** by systematically assembling and rearranging these disjointed lines into a syntactically correct, line-by-line **PL/SQL Block Structure**. Students are not required to author new logic from scratch; instead, they must demonstrate structural and procedural debugging skills by accurately mapping the components into their mandatory logical sequence: nesting variables within the **Declaration** section, orchestrating data flow and loops inside the **Execution** (BEGIN-END) block, and routing error handling into the designated **Exception** sector.



	Metadata Master Builder [05 Marks] : Students will design a data dictionary for any selected database system such as a college management system, banking system, or inventory system. They must define table names, attribute names, data types, constraints, and descriptions for each field. This activity improves understanding of metadata and database documentation practices. Students need to upload the completed data dictionary document in PDF on the GMIU Web portal. Participation in PAHEL Project Exhibition [05 Marks] : Students are instructed to actively participate in PAHEL (Mini TechManjari) under the guidance of their assigned faculty mentor. Each team must prepare and present their project professionally, demonstrating its objectives, implementation, features, and outcomes. Students should regularly discuss their progress with their mentor, complete the project as per the given timeline, and confidently represent their work during the exhibition.										
5	Advanced Database Management and Administration Theory Topics : Database Administration : Role of Database Administrator (DBA), User Management, Create User, Delete User, Privileges and Security, Data Control Language (DCL) : GRANT, REVOKE, Types of Privileges, Roles, Transaction Control Language (TCL) : COMMIT, SAVEPOINT, Data Concurrency and Locking : Introduction to Data Concurrency, Problems of Concurrency (Dirty Read, Lost Update, etc.), Introduction to Locking, Types of Locks (Shared Lock, Exclusive Lock), Lock Table Statements, Database Backup and Recovery : Need for Backup, Types of Backup, Recovery Techniques, Introduction to Transactions – ACID properties Practical : 62. Creating and Managing Users (CREATE and DELETE USER) 63. Implementing Security using GRANT and REVOKE 64. Managing Roles and Combined Privileges 65. Managing Transactions using COMMIT and ROLLBACK 66. Implementing Partial Rollbacks using SAVEPOINT 67. Database Export/Backup Generation 68. Database Restoration and Recovery Evaluation Method : <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Real-Time Project Forge : Faculty will provide a project problem statement. Students will</td><td>20</td><td></td></tr> </tbody> </table>	Sr. No.	Evaluation Methods	SEE	CCE	1.	Real-Time Project Forge : Faculty will provide a project problem statement. Students will	20		18	20%
Sr. No.	Evaluation Methods	SEE	CCE								
1.	Real-Time Project Forge : Faculty will provide a project problem statement. Students will	20									



	analyze requirements, design and implement the solution, test the project, and present the final outcome		
2	Smart Startup Schema Builder : Students think like entrepreneurs and design a complete database structure for a startup idea.		10
Total		20	10

Examination Style :

Real-Time Project Forge [20 Marks] :
Faculty will provide the project problem statement, explain the expected outcomes, guide students on applying unit concepts, monitor project progress, and evaluate students based on implementation, understanding, creativity, documentation, and viva performance, while students have to work on a real-world project related to the unit concepts by analyzing requirements, designing and implementing the solution, demonstrating the working project, explaining the concepts and tools used.

Smart Startup Schema Builder [10 Marks] :
Students will imagine a startup idea such as an online learning platform, food delivery application, travel booking system, or fitness app and design the database requirements for the business. They must identify entities, relationships, user data flow, and required database operations. Students need to upload a mini project report, ER Diagram, and presentation slides on the GMIU Web portal.

Suggested Specification:

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	10%	20%	10%	10%	40%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table



Course Outcome:

After learning the course the students should be able to:	
CO1	Understand the fundamental concepts of data, information, DBMS, and SQL commands for creating, manipulating, and retrieving data from databases.
CO2	Explain database architecture, DBA responsibilities, database security, and apply SQL clauses, joins, and functions for efficient query processing.
CO3	Apply database constraints, set operations, normalization techniques, and functional dependency concepts to design efficient relational databases.
CO4	Develop and execute PL/SQL programs using variables, block structures, conditional statements, and looping constructs for database programming.
CO5	Implement knowledge of transaction management, concurrency control, database security, backup, recovery, and user privilege management in DBMS.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students.

A minimum of 20–30% of the course content shall be suggested to deliver through Flipped Learning, where students study digital learning resources before the classroom session. Classroom time shall be utilized for discussion, problem-solving, practical applications, and higher-order learning activities.

Students shall be encouraged to use AI-powered learning platforms, simulation software, virtual laboratories, digital libraries, research databases, online certification courses, NPTEL, SWAYAM, MOOCs, and other technology-enabled learning resources to strengthen conceptual understanding and practical competence.

Continuous assessment shall be conducted through Active Learning Assignments (ALAs), quizzes, skill demonstrations, presentations, practical exercises, projects, case studies, innovation activities, peer assessment, reflective learning, and industry-oriented tasks instead of relying primarily on conventional written assignments.

Reference Books:

- [1] Database Concepts (10th Edition), David M. Kroenke, David J. Auer, Pearson Education, 2023
- [2] Database Systems: Design, Implementation, & Management (14th Edition), Carlos Coronel, Steven Morris, Cengage Learning, Inc.
- [3] Database System Concepts (7th Edition), Abraham (Avi) Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill Education
- [4] Database Systems: Design, Implementation, & Management (14th Edition), Peter Rob, Carlos Coronel, Cengage Learning
- [5] Oracle SQL and PL/SQL (3rd Edition), Timothy S. O'Leary, Linda L. O'Leary, McGraw-Hill Education



Suggested Assessment Guidelines :**Module 1: Introduction to Database Systems and Basic SQL :**

Program Implementation Task (20 Marks):		
Criteria	Description	Marks
Accuracy of Selected Records	Correctly identify which records satisfy all the given conditions in the mystery criteria.	5
Correct Use of SQL Operators	Apply correctly Arithmetic, Relational, IN, BETWEEN, EXISTS, ANY, ALL operators in their reasoning.	5
Logical Tracing of Table	Step-by-step evaluation showing which records survive each condition.	5
Query Writing Skills	Writes a SELECT query logically representing the conditions.	5
Total		20

Module 2: Database System Architecture and Advance SQL Query :

Program Implementation Task (20 Marks):		
Criteria	Description	Marks
Concept Understanding	Evaluates students' understanding of DBMS concepts, architecture, joins, functions, and database operations.	5
Query/Problem Solving	Measures students' ability to analyze problems and apply suitable SQL clauses, joins, and functions logically.	5
Practical Execution	Assesses correct execution of database tasks, query processing, and output generation.	5
Explanation	Evaluates explanation skills, documentation quality, and understanding of performed activities.	5
Total		20

Module 3: Constraints and Normalization :

Program Implementation Task (20 Marks):		
Criteria	Description	Marks
Selection of Constraints	Selects at least three appropriate constraints from the available options and identifies their types correctly.	5
Placement Mapping	Correctly assigns each constraint to the appropriate table and column(s), showing understanding of table relationships.	5
Risk Analysis	Explains data anomalies, logical corruption, or system failures that could occur if constraints are missing.	5
Clarity	Presentation of work is organized and systematic.	5
Total		20



Module 4 : PL/SQL Programming Concepts and Database Application Development :

Program Implementation Task (20 Marks):		
Criteria	Description	Marks
Variable Declaration Placement	All variables are correctly placed in the Declaration section, with proper initialization where needed.	5
Execution Block Assembly	Logical flow of loops, conditional statements, and operations correctly assembled in the BEGIN-END block.	5
Exception Handling Placement	All error handling statements correctly routed to the Exception section.	5
Sequence & Structural Logic	Overall line-by-line PL/SQL structure demonstrates correct procedural flow and nesting.	5
Total		20

Module 5 : Advanced Database Management and Administration

Program Implementation Task (20 Marks):		
Criteria	Description	Marks
Database Design & Constraints	Correctly identify entities, relationships, apply constraints, and justify placement.	5
SQL Operations	Execute correct DDL, DML, and DQL operations.	5
PL/SQL Block Structure	Properly implement variables, loops, conditionals, and exception handling in structured blocks.	5
Set Operations & Normalization	Apply set operations correctly and demonstrate normalized database structure.	5
Total		20

