**Course Outline**

<table>
<tr><td>Title</td><td>Database System</td></tr>
<tr><td>Code</td><td>IT-3701</td></tr>
<tr><td>Credit Hours</td><td>3<br>Theory/week:<br>Weight: 3 Cr. Hrs.<br>Contact Hours: 3 Hrs.<br>Lectures: 2<br>Duration: 1.5 Hrs.<br>Lab/week:<br>Weight: 1 Cr. Hr.<br>Contact Hours: 3 Hrs.<br>Labs: 1<br>Duration: 3 Hrs.</td></tr>
<tr><td>Prerequisite</td><td>None</td></tr>
<tr><td>Prerequisite Skill/Knowledge/Understanding</td><td>• Strong grip on business processes<br>• Familiarization and practical experience of relation algebra and set operations.</td></tr>
<tr><td>Required Study Hours</td><td>
<table>
<tr><th>TEACHING, LEARNING + ASSESSMENT ACTIVITIES</th><th>STUDY HOURS</th></tr>
<tr><td>32 x 1.5 hr lectures</td><td>48</td></tr>
<tr><td>Lab activity 16 x 3 hr</td><td>48</td></tr>
<tr><td>Regular student’s Centered learning</td><td>48</td></tr>
<tr><td>Net Surfing</td><td>36</td></tr>
<tr><td>In course Assignment(s) + Quiz /Test + Project (practical or writing)</td><td>6+14 + 20 = 40</td></tr>
<tr><td>Preparation term examination + Project Schema viva</td><td>20</td></tr>
<tr><td>Term examination + final project viva / Presentation</td><td>10</td></tr>
<tr><td>Total</td><td>250</td></tr>
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<tr><td>Follow Up</td><td>Database Administration</td></tr>
<tr><td>Program Name</td><td>Bachelor of Science in Computer Science (BS-CS)</td></tr>
<tr><td>Category</td><td>Core</td></tr>
<tr><td>Aims and Objectives</td><td>• To understand the basic concepts of Database<br>• To discuss the advantages of database system over conventional file system<br>• To make a logical and analytical Comparison of Different Data Models<br>• To provide strong dimensions, strengths and future prospects of Database Systems.<br>• To design and implementation of Database Modeling<br>• To Transform ERD (Entity Relationship Diagram) into relations<br>• To develop Good Skills in SQL (Structured Query Language)<br>• To discuss Advantages of Distributed database over Centralized Database<br>• To Familiarize with future databases</td></tr>
<tr><td>Learning Outcomes</td><td>• Students will be able to understand the Database System environment<br>• Students will be able to Design and Implement a Relational database for real life problems<br>• Students will be Expertise in writing SQL queries<br>• Students will have Good concepts of modeling techniques (ERD)<br>• Students will be able to suggest a Centralized Distributed system according to organizational needs<br>• Students will be able to design and implement solutions for the small business organizations</td></tr>
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<tr><td>Syllabus</td><td>Topics: File Systems and Databases: Introduction, A File system Critique, Database Systems, Database Models. Introduction to RDBMS: Logical view of Data; Entities and Attributes, Tables and their Characteristics, Keys; Integrity Rules. Relational Algebra: Relational Database Operators, System Catalog. Entity Relationship (E-R) Modeling: Basic Modeling Concepts, Data Models, The Entity Relationship (E-R) Model. Normalization of Database Tables: Objectives, Forms, Normalization and Database Design, Denormalization, Structured Query Language (SQL): Introduction, DDL Commands, DML Commands, DCL Commands, Complex Queries and SQL Functions, Procedural SQL; Triggers, Stored procedures. Database Design: The System Development Life Cycle (SDLC), The Database Life Cycle (DBLC), Database Design Strategies, Transaction Management and Concurrency Control: Introduction, Transaction Properties and Types, Concurrency Control Issues, Database Recovery Management. DDBMS: Evolution, Components, Distributed processing and distributed databases, Distributed database transparency features. Distributed database design, Data fragmentation, Data replication, Data allocation, Client-server versus DDBMS, C.J. Date’s 12 commandments for distributed databases.</td></tr>
<tr><td>Text Books</td><td>• Carlos Coronel, Steve Morris, “Database Systems” Design, Implementation, Management, 13th Edition” ISBN: 978-1-337-62790-0<br>• Jason Price “Oracle Database 11g SQL” McGraw Hill<br>• Introduction to Orcale9i: SQL – Student Guide by Oracle Press</td></tr>
<tr><td>Reference Material</td><td>A. Jeffrey Hoffer, “Modern Database Management ” Design, Implementation, Management, 11th Edition”<br>B. Thomas Connolly, “Database Systems: A Practical Approach to Design, Implementation and Management (6th Ed.)”<br>C. Elmasri, “Fundamentals of Database Systems: (7th Ed.)”<br>D. C. J. DATES “Database Management Systems” (8th Ed.)”</td></tr>
<tr><td>Instructional Aids/Resources</td><td>• Windows Environment<br>• Oracle 11 client & Server / SQL Server<br>• Multimedia in Class Rooms as well as in Labs<br>• Photocopy Facility for Handouts/Case Studies</td></tr>
<tr><td>Assessment Criteria</td><td>
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<tr><th>Sessional 25%</th><th></th><th>Mid 35%</th><th></th><th>Final 40%</th><th></th><th>Total 100%</th></tr>
<tr><td>Quizzes</td><td>12</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assignments</td><td>05</td><td>Paper</td><td>35</td><td>Paper</td><td>40</td><td></td></tr>
<tr><td>Home works</td><td>03</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Project + Presentation</td><td>05</td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>Recommendations</td><td>Project is the compulsory part of this course.</td></tr>
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| Week | Lec. | Topic | Source<br>Book-Chapter No. (Sections / Pages) | Recommendations for Learning Activities<br>(Quizzes, Assignments, Homework, Case Study, Projects, Lab Work) |
|---|---|---|---|---|
| 1 | 1 | **Introduction**<br>• Introducing Data, Information, Database;<br>• File Processing System and its Disadvantages<br>• Database Systems and its Advantages<br>• Types of Databases | TB: Ch1 (1.1 to 1.6)<br>RB-A: Ch1 (p2 to p27)<br>RB-B: Ch1 (1.1 to 1.6)<br>RB-C: Ch1 (1.1 to 1.6) | Books Readings |
| | 2 | **Database Architecture and Components**<br>• Three Level Architecture<br>• Data Independence and its types<br>• Components of Database Environment<br>• Database Languages<br>• Functions of DBMS | TB: Ch1 (1.7)<br>RB-B: Ch2 (2.1, 2.4)<br>RB-C: Ch2 (2.2, 2.4) | Books Readings RB-B: Ch2 (2.1)<br>Homework<br>Project Title and Group Formation |
| 2 | 3 | **Relational Algebra**<br>• Operators of relational algebra<br>**Structured Query Language (SQL):**<br>• Introduction<br>• SELECT statement<br>• Arithmetic operators<br>• Relational and Logical operators | TB: Ch3 (3.4), Ch7 (7.1 to 7.4)<br>RB-B: Ch2 (2.2)<br>RB-C: Ch2 (2.3), Ch8 (8.1 to 8.3)<br>Oracle Press: Ch1 (1.1 to 1.13)<br>Oracle Press: Ch1 (2.3 to 2.5) | Quiz#1<br>Submission of one Page Proposal for Term Project |
| | 4 | **Database Development and Data Modeling:**<br>• Database Development Process<br>• Database Life Cycle<br>• Basic Building Blocks of Data Models (Entities, Attributes, Relationship, Constraints) | TB: Ch2 (2.1 to 2.4) | Books Readings<br>Homework<br>Project Title and Group Formation |
| 3 | 5 | **The Evolution of Data Models (Logical Data Models)**<br>• Hierarchical Data Model<br>• Network Data Model<br>• Relational Data Model<br>• Relational Keys | TB: Ch2 (2.5), Ch3 (3.1, 3.2)<br>RB-B: Ch2 (2.3), Ch4 (4.1 to 4.4)<br>RB-C: Ch2 (2.1), Ch5 (5.1, 5.2) | Quiz#2<br>Books Readings |
| | 6 | **SELECT Statement**<br>• Special operators (BETWEEN, IN, LIKE, IS NULL)<br>• Use of DISTINCT<br>• Column Alias<br>• ORDER BY clause<br>• Substitution variables (&, &&)<br>**SQL Functions:**<br>• Single row functions<br>  ○ Character functions | Oracle Press: Ch1 (1.14 to 1.25)<br>Oracle Press: Ch2 (2.6 to 2.25) | Lab Exercises |
| 4 | 7 | • Integrity Constraints / Rules<br>• Entity Integrity, Referential Integrity<br>• Data Dictionary | TB: Ch3(3.3)<br>RB-A: Ch4 (p160 to p163)<br>RB-B: Ch4(4.3)<br>RB-C: Ch5(5.1, 5.2) | |

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| | 8 | **SQL Functions:**<br>• Single row functions<br>  ○ Character functions<br>  ○ Number functions<br>• Date functions<br>• Type conversion functions<br>• NVL, NVL2, NULLIF<br>• Decode function<br>• CASE expression | Oracle Press: Ch3 (3.2 to 3.39) | |
| **5** | 9 | **Entity Relationship (E-R) Modeling:**<br>• Introduction<br>• Basic Constructs and Notations<br>• Types of Attributes<br>• Degree of Relationship<br>• Connectivity / Cardinality of a Relationship | TB: Ch4 (4.1, 4.2)<br>RB-A: Ch2 (p56 to p78)<br>RB-B: Ch12 (12.1 to 12.3)<br>RB-C: Ch12 (3.1 to 3.3) | Assignment |
| | 10 | **Entity Relationship (E-R) Model:**<br>• Relationship Strength (Existence Dependency)<br>• Relationship Participation<br>• Modeling Multivalued Attribute(s)<br>• Composite Entities<br>**SQL:**<br>• Multi-row (group) functions<br>• Group by clause<br>• Having clause | TB: (4.2, 4.3)<br>RB-A: Ch2 (p57 to p90)<br>RB-B: Ch12 (12.4, 12.5)<br>RB-C: Ch12 (3.4, 3.5)<br>Oracle Press: Ch5 | **Lab:** To Practice the SQL Data Management Commands, Complex queries. |
| **6** | 11 | • Developing ER diagram – Examples<br>**Enhanced Entity Relationship (E-R) Model:**,<br>• Entity Super types and subtypes<br>• Comparison of E-R Modeling Symbols. | TB: Ch5 (5.1)<br>RB-A: Ch2(p114 to p128)<br>RB-B: Ch13 (13.1 to 13.3)<br>RB-C: Ch12 (4.1 to 4.3) | Case Studies<br>Tiny College (TB)<br>Pine Valley Furniture Company (Text-A) |
| | 12 | **SQL Joins**<br>• Cartesian Join<br>• Inner or Equi Join<br>• Outer Join (Left, Right, Full) | Oracle Press: Ch4 | Submission of Preliminary Report of Term Project<br>Preparation for Next class Pre Mid Test |
| **7** | 13 | **Transform E-R Diagram into Database Structure:** General Rules Governing Relationships Among Tables | TB: Ch9 (9.6)<br>RB-A: Ch4 (p165 to p178) | Pre Mid Test |
| | 14 | • Non-Equi Join<br>• Self Join<br>• **Subqueries** | Oracle Press: Ch4, Ch6 | Submission of E-R Model of Final Project |
| **8** | 15 | Creating Database Tables<br>Managing Table and Column Level Constraints | Oracle Press: Ch9, Ch10 | |
| | 16 | Revision | | |
| **MID TERM** | | | | |

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| **9** | 17 | **Normalization of Database Tables:**<br>N**e**ed for Normalization, Functional dependencies, Armstrong axioms, Conversion to First Normal Form | TB: Ch6 (6.1 to 6.3)<br>RB-A: Ch4(p178 to p184)<br>RB-B: Ch14 (14.1 to 14.6)<br>RB-C: Ch14 (14.1 to 14.3) | N.A. |
| | 18 | **Normalization:**<br>Conversion to Second and Third Normal Forms. Examples | TB: Ch6 (6.3 to 6.5)<br>RB-A: Ch4(p185 to p187)<br>RB-B: Ch14 (14.7 to 14.9)<br>RB-C: Ch14 (14.4) | Submission of Revised E-R Model of Final Project |
| **10** | 19 | **Normalization and Database Design:** Higher Level Normal Forms, BCNF, 4NF, 5NF | TB: Ch6 (6.6, 6.7)<br>RB-A: Ch4 (p187 to p192)<br>RB-B: Ch15<br>RB-C: Ch14 (14.5 to 14.8) | Assignment |
| | 20 | **SQL – Data Manipulation:**<br>Insert, Update and Delete operations | Oracle Press: Ch8 | **Lab:** To Practice, Complex Queries, SQL Function, and listing issues. |
| **11** | 21 | **Database Design:**<br>• Top-down vs. Bottom-up approach<br>• Phases of database design (Conceptual, Logical, Physical) | TB: Ch6 (6.8), Chp9<br>RB-A: Ch5<br>RB-B: Ch10 | |
| | 22 | **Database Objects:** Virtual Tables (Views), Indexes, Sequence, Synonyms | Oracle Press: Ch11, Ch12 | |
| **12** | 23 | **Transaction Management:**<br>What is a Transaction; Evaluating Transaction Results, Transaction Properties, Transaction Management with SQL, Buffer Management, Recovery Management | TB: Ch10 (10.1, 10.7)<br>RB-B: Ch22 (22.1, 22.3)<br>RB-C: Ch20 | Quiz |
| | 24 | **Controlling User Rights & Access (DCL):**<br>Role, Privileges, Grant, Revoke | Oracle Press: Ch13 | |
| **13** | 25 | **Concurrency Control:** Lost Updates, Un-committed Data, Inconsistent Retrievals, Dirty Data | TB: Ch10 (10.2, 10.3)<br>RB-B: Ch22 (22.2, 22.5)<br>RB-C: Ch21 | Final Project front end submission |
| | 26 | **Concurrency Control with locking Methods:** Lock Granularity, Lock Types, Two-Phase Locking, Deadlocks, Time Stamping Methods | TB: Ch10 (10.4, 10.5)<br>RB-B: Ch22 (22.2, 22.5)<br>RB-C: Ch21 | N.A |
| **14** | 27 | **Procedural SQL:**<br>Basics of PL/SQL | | |
| | 28 | **Distributed Databases:**<br>Introduction, Types of distributed databases, Advantages & Disadvantages, Components of DDBMS | TB: Ch12<br>RB-B: Ch24 (24.1 to 24.5)<br>RB-C: Ch23 (23.1,23.2) | Final Submission of the Final project with Documentation |
| **15** | 29 | Stored Procedures, Triggers | | |
| | 30 | Big Data and NoSQL | TB –Ch14 (14.1 to 14.5) | |
| **16** | 31 | Data Quality and Integration | RB A- Ch 10 | |
| | 32 | Future Trends, Revision. | | Preparation for Pre Final Test |