## Course Outline

**Faculty of Computing and Information Technology**

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| Title | **Database System** |
| **Code** | CS-243 |
| **Instructor Name** |  |
| **Credit Hours** | 4  ***Theory/week:***  Weight 3 Cr. Hrs.  Contact Hours 3 Hrs.  Lectures: 2  Duration 1.5 Hrs.  ***Lab/week:***  Weight 1 Cr. Hrs.  Contact Hours 1.5 Hrs.  Labs. 1  Duration 1 Hrs. |
| **Prerequisite** | Introduction to Computing |
| **Prerequisite Skill/Knowledge/Understanding** | * Students have concepts of computer science. * Students have used Office Suite. * Concepts of programming language are essential for developing Project. |
| **Category** | Computer Science (Core) |
| **Course Goals** | * To provide students a good understanding of the principles of database Analysis, Design and Modeling techniques especially for creation of relational databases * To have a fairly good practice in conceptual modeling using entity-relationship diagrams * To learn how queries in SQL can be written correctly and efficiently * To learn about transaction processing in database management systems * Applying the concepts learned in the course to develop a real world application |
| **Statement of Course Need** | * Analysts and decision-makers in today's dynamic business environment depend on the benefits of information to effectively support their decision-making process. This course provides the knowledge and skills for analysts, developers and database developers to design and build a functioning database application that assembles and consolidates enterprise data for information analysis. |
| **Learning Outcomes** | * Understand the need and motivation for database Systems. * Will be able to implement a logically designed Database using commercially available DB tools i.e. SQL Server/ Oracle. * Decide what database task to use for a given problem/data set * Implement and evaluate database solutions * Good concepts of modeling techniques (ERD) * Students will capable of designing and implementing real time solutions of database related problems * Students will be aware of some Advance topics of database. |
| **Syllabus** | **Topics**: Traditional File Based Systems; Database Approach; Roles in Database Environment; History of Database Management Systems; Advantages and Disadvantages of DBMS; ANSI-SPARC Architecture; Data Manipulation Language (DML); Data Models; Functions of DBMS; Components of DBMS; Multi-User DBMS Architectures; History of Relational Model; Terminologies; Relational Data Structures, Mathematical Relation, Database Relations, Relational Keys, Representing Relational, Database Schemas; Relational Integrity; Relational Algebra; Introduction to SQL; Data Manipulation; Integrity enhancement Feature; Data Definition: Create a Database, Creating Tables, Altering Table, Dropping Table, Creating Index, Removing Index; Views: Creating Views, Removing views, Restrictions on Views, Updating Views, Advantages and Disadvantages, View Materialization; Transactions; Access Control; Information Systems Life Cycle; Database Application Life Cycle; Database Planning; System Definition; Requirements Collection & Analysis; Database Design; DBMS Selection; Implementation; Testing; Data Administration & Database Administration; Entity Types; Relationship Types; Attributes; Strong & weak Entity Types; Attributes on Relationships; Structural Constrains; Problems with ER Models; Specialization/Generalization For EERD; Constraints on Specialization/Generalization; Insertion Anomalies, Deletion Anomalies, Update Anomalies; Functional Dependency; Process of Normalization; First Normal Form; Second Normal Form; Review of Normalization (1NF-BCNF); Introduction and overview of Database Design Methodology; Conceptual Database Design Methodology; Logical Database Design Methodology; Comparisons of Logical and Physical Database Design; Overview of Physical Database Design; Physical Database Design Methodology: Database Security; Counter Measures; Client Server Architecture and their advantages; Centralized and Distributed Databases; Advance Topics. |
| **Text Book/s** | 1. Thomas Connally \* Carolyn Begg “Database Systems”, 3rd Ed., ISBN 0-515-13038-9 |
| **Reference Books/Material** | 1. Fred Mc Fadden, Jeffry A Hoffer, and Merry Prescot “Modern Database Management”, 5th Ed., Wesley Logman, 2001. ISBN 0-201-47432-8 2. C. J. DATES “Database Management Systems”8th Ed. 2001. ISBN 0-901-543432-8 |
| **Instructional Aids/Resources** | * Windows Environment * Oracle 10g client & Server / SQL Server * Erwin * Multimedia in Class Rooms as well as in Labs * Photocopy Facility for Handouts/Case Studies |
| **Assessment Criteria** | |  |  |  |  | | --- | --- | --- | --- | | **Sessional 25%** | **Mid 25%** | **Final 50%** | **Total 100%** | | Quizzes 05 | Paper: 25 | Paper 50 |  | | Project 10 |  |  |  | | Assignment and Presentations 05 |  |  |  | |
| **Recommendations** | Project is the compulsory part of this Course.  Marks division for sectional or project may vary on the basis of complexity of project or available time for project execution and documentation. |

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| **Framework** |  |  |  |  |
| **Week** | **Lecture** | Topic | Source (Book-Chapter No. Section No.) | Recommendations for Learning Activities  (Mention Assignments, Test, Quizzes, Practical, Case Study, Projects, Lab Work or Reading Assignments) |
| 1 | 1 | Database Approach:   * Data, Processing & Information * The Role of Data in Business * Meta Data& MetaMeta Data * The Database * Evaluation of Database * Types of Files * Traditional File Processing Systems * Limitations * Database Approach * Advantages & Disadvantages * Components of the DBMS Environment | Text A-Ch1  Text B-Ch1 | * Distribution of Course Outline * Discuss its objective * Prerequisite Test |
| 2 | Types of Database  Centralized Database   * Personal Computer Database * Client/Server database * Distributed Database   + Homogeneous Distributed Database   + Heterogeneous Distributed Database * Teleprocessing | Text A-Ch1  Text B-Ch1 |  |
| 2 | 3 | Database System Models:   * Concept and Evaluation Of Database Model * Flat file Model * Hierarchical model * Network Model * Relational Model * Object Relational Model * Object Based data Model | Text A –Ch2  Text B –Ch1  Handouts |  |
| 4 | ANSI-SPARC Architecture:   * External Level * Conceptual Level * Internal Level | Text A –Ch2  Hands outs | Assignment |
| 5 | Overview of Information Engineering Methodology Database Application Life Cycle Planning  System Definition:   * Users Views   Requirements Collection & Analysis:   * Centralized Approach * View Integration Approach | Text A –Ch9  Hands outs | Quiz  **Project Announced** |
| 3 | 6 | Database Design:   * Approaches to Database Design * Data Modeling * Phases of Database Design   DBMS Selection  Implementation Testing Data Administration & Database Administration:   * Data Administration * Database Administration * Comparison | Text A –Ch9 |  |
| 4  5  6 | 7 | Fact Finding Techniques  Database Analysis   * Uses of Fact-Finding Techniques * What Facts are collected? * Fact Finding Techniques   + Examining Documentation   + Interviewing   + Observation   + Research   + Questionnaires   A worked Example | Text A –Ch10 | Quiz |
| 8 | Database Design:  Logical Design  Conceptual Database Design   * Introduction to Entity-Relational model   Entity Types  Relationship Types:   * Degree of Relationship Type * Recursive Relationship | Text A –Ch10  Text B-Ch5 & 6 | Assignment |
| 9 | Attributes:   * Simple & Composite Attributes * Single Valued & Multi-Valued Attributes * Derived Attributes * Keys  Strong & Weak Entity TypesAttributes on Relationships Structural Constrains:   * One-to-One Relationships * One-to-Many Relationships * Many-to-Many Relationships * Cardinality and Participation Constrain | Text A –Ch 11 |  |
| 10 | Specialization/Generalization For EERD:   * Super Classes & Sub Classes * Super Class / Sub Class Relationships * Attributes Inheritance * Specialization Process * Generalization Process * Constraints on Specialization/Generalization * Aggregation * Composition | Text A –Ch11 | Quiz  Ist Deliverable |
| 11 | Logical Database Design  Normalization   * Purpose of Normalization * Data Redundancy & Update Anomalies: * Insertion Anomalies * Deletion Anomalies * Update Anomalies   **Process of Normalization**  First Normal Form  Second Normal Form:   * Full Functional Dependency | Text A –Ch13  Text B-Ch7 | Assignment |
| 12 | Third Normal Form:  Transitive Dependency  Boyce-Codd Normal Form  Forth Normal Form   * Multi-valued Dependency   Fifth Normal Form (5 NF)   * Lossless-Join Dependency | Text A –Ch13  Text B-Ch7 | Quiz  Case Study |
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| 7  8 | 13 | Introduction to SQL:   * Objective of SQL * History of SQL * Importance & Environment of SQL   Categories of SQL Commands   * DML * DDL * DCL   Data Definition:   * Create a Database * Creating Tables * Altering Table * Dropping Table | Text A –Ch6  Handouts |  |
| 14 | **Views:**   * Creating Views * Removing views * Restrictions on Views * Updating Views * Advantages and Disadvantages * View Materialization * How the ISO transaction model works. * How to use the GRANT and REVOKE statements as a level of security. | Text A –Ch6 |  |
| 15 | **Data Integrity**  Types of Data integrity   * Entity Integrity * Domain Integrity * Referential Integrity * User-defined Integrity   Constraints   * PRIMARY KEY Constraint * UNIQUE Constraint * IDENTITY Property * DEFAULT Definition * FOREIGN Key Constraint * CHECK Constraint * NOT NULL Constraint   Rules | Text A –Ch6  Handouts |  |
|  | 16 | **Data Manipulation:**  Understanding the SELECT command Format   * The SELECT Clause * The FROM Clause * The WHERE Clause   + Relational Operators   + Logical Operators   + Wildcard Characters * Understanding the NULL values and Expressions * ORDER BY Clause | Text A –Ch5 | Quiz |
| 9 | 17 | Aggregate Functions in SQL  * The GROUP BY Clause * The HAVING Clause | Text A –Ch5 | Submission of ER Model of Final Project |
| 18 | **Querying from Multiple Tables**   * Sub Query * Types of Sub Query * Nested Sub query   + Single row sub query   + Multiple row sub query * Correlated Subquery * Parameters Queries | Text A –Ch5 |  |
| 10 | 19 | Multi Table QueriesJoinsTypes of Joins  * Inner join * Outer Join   + Left outer join * Right outer join   EISTS and NOT EXITS  Combining Results Tables(UNION, INTERSECCTION, EXCEPT) |  |  |
| 11 | 20 | **Changing the Content of Tables using Action Queries**   * The INSERT table Statement * The DELETE table Statement * The UPDATE table Statement   Append Action Query |  |  |
| 21 | **Physical database Design**  File organization and storage structure  Basic concepts  Unorderd File  Ordered File  Hash Files`   * Hash Functions | Text B –Ch6 | Case Study for Final project given |
| 12 | 22 | Indexes  * Types of Indexes * Indexed sequential Files * Secondary indexes * Multilevel indexes * B+ trees * Clustered, Non Clustered Indexes | Text B –Ch6 | Submission of Normalized tables of the Final Project |
| 23 | Database Security:   * Threats   Counter Measures:   * Authorization * Views * Backup and Recovery * Integrity * Encryption * RAID | Text A –Ch19 |  |
| 13 | 24 | **Transaction Management**   * The Concept of Transaction * Transaction and Scheduling * Concurrent Execution of Transactions * Serialzability * Lock-Based Concurrency Control   Deadlocks | Text A –Ch19 Text B-Ch12 |  |
| 25 | * Incremental Log with Deferred Updates * Incremental Log with immediate Updates   Concurrency Control |  |  |
| 14 | 26 | * Deadlock detection * Deadlock prevention * Timestamping |  | Quiz |
| 27, 28 | Data Warehousing Concepts | Text A –Ch31  Ref Material |  |
| 29, 30 | Data Mining Concepts | Text A –Ch34  Ref Material | Final Submission of the Final project with Documentation |
| 16 | 31 | Project Presentation |  |  |
| 32 | Revision |  |  |