Course Title: CIS-278 Database Systems

Prerequisites: CIS-265 (Advanced Programming Concepts) or CIS-266 (Visual Basic)

Credits/Hours: 3 Credits 3 Lecture / 1 Lab

Gen’l Ed. Course: No

Course Description:

Database systems is an introduction to the design and implementation of a database system. Topics considered include database architecture; the Entity-Relationship model; the relational model of data; normalization theory; data definition languages and query facilities; physical database design; data integrity and security; programming language interfaces; database administration and control; and current trends in database systems. Students use a DBMS to develop an actual database.

Student Learning Outcomes: Upon completion of the course, the student will:

1. Be able to describe the components of a database system and the relationships between them.
2. Understand the major models of data and the role that each plays in the development process.
3. Know how to do the conceptual design of a database using the Entity-Relationship model of data.
4. Be able to use normalization theory to determine the quality of the design of a relational database.
5. Know how to use structured query language to create, modify, and query a relational database.
6. Understand the various schemes for the physical organization of a database.
7. Know the functions and goals of database administration.

Student Learning Outcomes Assessment Measurement:

Each of the above listed student learning outcomes will be assessed by: (1) written assignments and/or quizzes; (2) written examinations and a comprehensive final exam.

Course Grade: see the grading policy for the course.
Course Content:

1. **Introduction to Database Systems**
   - Data, information, and metadata
   - Limitations of traditional file processing systems
   - Components of the database environment
   - Accessing a database
   - Data dictionary and repository
   - Pros and cons of the database approach
   - Personal, workgroup, departmental, and enterprise databases

2. **Database Architecture**
   - ANSI/SPARC three schema architecture
   - Logical and physical data independence

3. **The Database Development Process**
   - Overview of the database development life cycle
   - Rapid application development methods – prototyping
   - Survey of data models
   - Fact-gathering techniques
   - Management of the development project

4. **Conceptual Database Design: The Entity-Relationship Model**
   - Entity types, attributes, and relationship types
   - Modeling the business rules of the organization
   - Entity-Relationship diagram and model notation
   - Conceptual design using the E/R model

5. **The Enhanced Entity-Relationship Model**
   - Representing supertypes and subtypes
   - Representing specialization and generalization
   - Specifying constraints in supertype/subtype relationships
   - Defining supertype/subtype hierarchies
   - Entity clustering

   **Project Part I: Conceptual Database Design**

6. **Logical Database Design: The Relational Data Model**
   - Fundamental terminology and concepts
   - Modeling with relations
   - Transforming a conceptual data model into the relational data model
   - Relational integrity constraints
7. **Relational Database Design: Normalization Theory**
   - Modification anomalies
   - Functional dependencies
   - Normal forms and the normalization process
   - Boyce-Codd normal form
   - Fourth normal form – multi-valued dependencies

   **Project Part II: Transforming the E/R Model into the Relational Model**

8. **Relational Database: Introduction to SQL**
   - The SQL environment - data definition, manipulation, and control languages
   - Relational operations
   - Schema and table definition
   - Inserting, updating, and deleting data
   - Single table queries
   - Base tables and user views

9. **Advanced SQL: Queries Involving Multiple Tables**
   - Sub-queries
   - join operations
   - Data manipulation using relational algebra
   - Embedded SQL

   **Project Part III: Implementing and Processing a Relational Database**

10. **Physical Database Design: Organization and Access**
    - Fundamental terminology and concepts
    - File organization and access strategies
    - Indexing techniques and B+ trees
    - Denormalization

11. **Database Administration and Control**
    - Database administration functions and goals
    - Database integrity, security, backup and recovery
    - Controlling concurrent access

12. **Additional Topics and Current Trends in Database Systems**
    - Data warehousing
    - Distributed database
    - Object-Oriented data modeling and databases

Rev: 8/2012