NORTHWESTERN CONNECTICUT COMMUNITY COLLEGE

COURSE SYLLABUS

Course Title: Database Development I **Course #:** CSC* 233

Course Description: 4 Credits. Course covers the concepts of data organization for designing databases and creating business computer systems. Data schemes and structures, querying, searching, updating and editing, indexing, sorting, screen formatting, and linking files will be emphasized. Students will develop queries using standard SQL.

Pre-requisite/Co-requisite: CSC* 104.

Goals: Students are expected to

- develop algorithmic skills and design solutions to solve common business problems
- develop data modeling skills to create database solutions from designs
- develop testing skills to insure the accuracy of solutions
- develop SQL skills to manipulate data
- increase communication skills to produce documentation to accompany database projects.

Outcomes: Upon successful completion of this course students will be able to:

1) Identify and explain the basic components of a database system
   a) Describe the common uses of database systems
   b) Explain the characteristics of file based systems
   c) Explain the problems of the file based approach
   d) Explain the terms database and database management system
   e) Identify the functions and major components of a DBMS
   f) Identify personnel involved in the DBMS environment
   g) Explain the history of the development of DBMS's
   h) Identify the advantages and disadvantages of DBMS's
   i) Explain the purpose and origin of the three level architecture
   j) Explain external, conceptual and internal levels
   k) Explain external/conceptual and internal/conceptual mappings
   l) Explain the meaning of logical and physical data independence
   m) Explain the distinction between DDL and DML
   n) Identify the classification of data models
   o) Explain the purpose and importance of conceptual modeling
   p) Explain the typical services a DBMS should supply
   q) Explain the function and importance of the system catalog
   r) Distinguish between different architecture tiers
   s) Explain the meaning of client server architecture
   t) Explain the function of an application server
   u) Describe middleware and provide examples
   v) Explain the use of Transaction Processing Monitors
   w) Explain the purpose and technology standards of a Web service
   x) Explain the difference between a distributed DBMS and distributed processing
   y) Describe the architecture of a data warehouse
   z) Describe the software components of a DBMS

2) Demonstrate a thorough understanding of the relational model
   a) Explain the origins of the relational model
   b) Explain the terminology of the relational model
   c) Explain how tables are used to represent data
   d) Demonstrate the connection between mathematical relations and relations in the relational model
   e) Identify candidate, primary, alternate and foreign keys
   f) Explain entity integrity and referential integrity
   g) Explain the meaning of relational completeness

3) Use relational algebra and relational calculus in the development of queries
   a) Demonstrate the formation of queries in relational algebra
   b) Demonstrate the formation of queries in tuple relational calculus
   c) Demonstrate the formation of queries in domain relational calculus

4) Demonstrate understanding and usage of Structured Query Language
   a) Explain the categories of relational Data Manipulation Languages
   b) Explain the purpose and importance of SQL
   c) Explain the history and development of SQL
   d) Create SQL statements
   e) Retrieve data using the SELECT statement
   f) Build SQL statements using
      i) WHERE
      ii) ORDER BY
      iii) aggregates
      iv) GROUP BY
      v) subqueries
      vi) joins
   g) Perform database updates using
      i) UNION
      ii) INTERSECT
      iii) DELETE
   h) Explain the data types supported by the SQL standard
   i) Explain the purpose of the integrity enhancement feature of SQL
   j) Define integrity constraints using
      i) required data
      ii) domain constraints
      iii) entity integrity
      iv) referential integrity
      v) general constraints

5) Demonstrate the usage of views in managing data
   a) Explain the purpose of views
   b) Demonstrate how to create and delete views using SQL
   c) Demonstrate how to perform operations on views
   d) Explain when views are updateable
   e) Explain the advantages and disadvantages of views
   f) Explain how to use the GRANT and REVOVE statements as a level of security

6) Demonstrate using Structured Query Language beyond simple data retrieval
   a) Demonstrate how to use the SQL Programming language
   b) Demonstrate how to use SQL cursors
   c) Demonstrate how to create stored procedures
   d) Demonstrate how to create triggers
   e) Explain how to use triggers to enforce integrity constraints
   f) Explain the advantages and disadvantages of triggers

g) Explain how to use recursive queries

7) Demonstrate an understanding of Query By Example
   a) Explain the main features of QBE
   b) Explain the types of queries provided in Microsoft Access
   c) Demonstrate how to build queries using QBE

8) Demonstrate an understanding of database development
   a) Explain the main components of an information system
   b) Explain the main stages of the database system development lifecycle
   c) Explain the main phases of database design
      i) conceptual
      ii) logical
      iii) physical
   d) Describe the types of criteria used to evaluate a DBMS
   e) Evaluate and select a DBMS
   f) Explain the benefits of CASE tools
   g) Explain when fact finding techniques are used in the database system development lifecycle
   h) Explain the type of facts collected and documentation produced in each stage of the database system development lifecycle
   i) Describe the most commonly used fact finding techniques
   j) Explain how to use each fact finding technique
   k) Demonstrate how to use Entity Relationship modeling in database design
   l) Explain the basic concepts associated with the ER model
      i) entities
      ii) relationships
      iii) attributes
   m) Demonstrate diagrammatic techniques for displaying an ER model using UML
   n) Identify and resolve connection traps
   o) Explain the limitation of ER modeling and the requirements to represent more complex applications using additional modeling concepts

   p) Demonstrate and explain the most useful additional modeling concepts
      i) specialization/generalization
      ii) aggregation
      iii) composition

9) Demonstrate an understanding of normalization
   a) Explain the purpose of normalization
   b) Demonstrate how normalization is used when designing a relational database
   c) Explain the problems associated with redundant data
   d) Explain the concept of functional dependencies
   e) Explain the characteristics of functional dependencies used in normalization
   f) Identify functional dependencies for a relation
   g) Identify the most commonly used normal forms
   h) Identify the problems associated with relations that break the rules of normal forms
   i) Explain how inference rules identify a set of all functional dependencies for a relation
   j) Explain the use of Armstrong's axioms
   k) Explain the use of normal forms beyond Third Normal Form
   l) Identify a BCNF
   m) Explain the concept of multi-valued dependencies
   n) Explain the concept of join dependency and 5NF

10) Demonstrate an understanding of database design
   a) Describe the purpose of design methodology
   b) Explain the three main phases of database design

    i) conceptual
    ii) logical
    iii) physical
c) Demonstrate how to decompose the scope of a design into specific views of the enterprise
d) Demonstrate hoe to use ER modeling to build a logical conceptual model
e) Demonstrate how to document the process of conceptual database design
f) Demonstrate how to derive a set of relations from a conceptual data model
g) Demonstrate how to use normalization to validate relations
h) Demonstrate how to insure accuracy in a logical data model
i) Demonstrate how to merge logical data models
j) Explain the purpose of physical database design
k) Explain how to map the logical database design to a physical database design
l) Explain how to design base relations
m) Explain how to design general constraints
n) Explain when to use secondary indexes to improve performance
o) Demonstrate how to estimate the size of a database
p) Explain how to design user views
q) Explain how to design security mechanisms