Computer Science Department
cs.salemstate.edu

ITE320 Information Management Systems **4 cr.**

Catalog description:

It is the role of the IT professional to develop, deploy, manage and integrate data and information systems to support the organization. At a fundamental level, Information Management Systems address these issues by providing mechanisms of storing, searching, updating, and retrieving information. Underlying all of these functionalities are the concepts of a file and file organization, upon which is built the concept of an information management system. This course presents the fundamental concepts of data organization architectures, database management system models and query languages, principles of data modeling, and techniques for managing a database environment. Contemporary distributed network-based data storage mechanisms are also discussed. Three lecture hours and three hours of scheduled laboratory per week.

Prerequisite: ITE105, ITE201

Course Narrative

The emphasis of this course is on a thorough understanding of file systems (file structure, file organization, and file access methods), data storage architecture, data organization and manipulation in different IT environments. Information derived from data is important to the management, productivity, and overall performance of an organization. Data must be efficiently and securely stored, organized, retrieved and managed to make it meaningful to the organization - a database and associated database management systems is the most effective way to solve this problem.

In this course data storage and management systems are investigated from the internal point of view (such as physical storage architecture), and the external point of view (such as choosing a database management system) for a particular set of requirements. Students will understand how to connect to the backend database using simple web applications.

Goals:

The purpose of this course is to develop students' understanding of databases and techniques for database query and management. Upon completion of the course, a student should be able to do the following:

G1: describe fundamental mechanisms (software and hardware) of data storage and data manipulation in IT environments using appropriate terminology;
G2: describe the fundamentals of database management systems (data organization architecture, data modeling, data access, data management, etc.);
G3: analyze the appropriateness of different methods of data storage organization in the context of

specific environments;

Course Objectives:

Upon successful completion of the course, a student will have demonstrated the ability to:

O1: apply correct technical terminology when analyzing requirements, describing issues, and designing solutions for data storage and data manipulation in an IT environment;
O2: identify the components of a database and explain methods and technologies that are used in designing, implementing, and maintaining a database;
O3: analyze the requirements of a specific IT environment and provide recommendations for the design of storage architecture for such an environment;
O4: demonstrate knowledge of standards and methods used in the creation of a database with specified characteristics;
O5: work collectively with users and IT personnel in analyzing problems and designing solutions that address customer needs;

Program Objective / Course Objective matrix (For ABET Accreditation Purposes)

(The following Matrix maps the Program Objectives for Information Technology Program outlined by Accreditation Board of Engineering Technology (ABET) with the Course Objectives. The check marks below the course objective represent that those course objectives accomplish specific program objectives set forth by ABET.)

Program Objective	O1	O2	O3	O4	O5	O6
PO-A: An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	✓			✓	✓	
PO-B: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.		✓	✓		✓	✓
PO-C: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	✓	✓	✓	✓	✓	✓
***PO-D:** An ability to function effectively on teams to accomplish a common goal.						
***PO-E:** An understanding of professional, ethical, legal, security and social issues and responsibilities.						
***PO-F:** An ability to communicate effectively with a range of audiences.						
***PO-G:** An ability to analyze the local and global impact of computing on individuals, organizations, and society.						
***PO-H:** Recognition of the need for and an ability to engage in continuing professional development.						
PO-I: An ability to use current techniques, skills, and tools necessary for computing practice.	✓	✓	✓	✓	✓	✓

Program Objective	O1	O2	O3	O4	O5	O6
PO-J: An ability to use and apply current technical concepts and practices in the core information technologies.			✓	✓		
PO-K: An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.			✓	✓	✓	
***PO-L:** An ability to effectively integrate IT-based solutions into the user environment.						
***PO-M:** An understanding of best practices and standards and their application.						
***PO-N:** An ability to assist in the creation of an effective project plan.						

Course Topics:

The column on the right hand side represents the Body of Knowledge and number of hours (in parenthesis) set forth by ABET accreditation board for accomplishing minimum required hours assigned for different categories. More information on this body of knowledge can be found in Appendix A "The IT Body of Knowledge" on Page 68 of the following document.
http://www.acm.org//education/curricula/IT2008%20Curriculum.pdf

- **Files and File Management Systems** **IM1 (2)**
  - What is a file (On-disk structures, internal formats, properties and characteristics)
  - File organization methods (record formats – byte-stream, random, variable, undefined)
  - File access methods (sequential, random, index-sequential)
  - Examples of different file systems (Unix, Windows, OpenVMS) and their use in different implementations
  - Data storage organization (from hard drives to networked storage architectures)
- **Fundamentals of Information Systems and Concepts** **IM1 (4)**
  - Information vs. data, data and meta-data
  - Databases Systems
  - Why Databases?
  - Introducing the Database
  - Why Database Design is Important
  - Problems with File System data processing
  - Difference between homogeneous, heterogeneous and federated distributed databases
  - Different types of Database Systems
    - Traditional Text-based database
    - Multimedia databases
    - Geographic information systems
    - Data warehouses and online analytical processing (OLAP) systems
    - Real-time and active database technology
  - Advantages of Databases vs File System

        - The database system environment
        - DBMS Functions
        - Managing the Database System: A Shift in Focus
    - Place of Database in overall computer architecture
        - In Operating Systems, IDE Tools, and Input/output Files

- **Database System Concepts and Architecture** **IM3(4)**
    - Database Design
        - The information Systems
        - History of Database evolution
        - The System Development Life Sycle
            - Planning, Analysis, Detailed Systems Design, Implementation, and Maintenance
        - Conceptual Design
        - DBMS Software Selection
        - Logical Design
        - Physical Design
        - Database Design Strategies
        - Centralized vs. Decentralized Design
        - Object-oriented vs. relational Database
    - The Relational Database Model
        - A Logical View of Data
        - Keys
        - Integrity Rules
        - Relational Algebra
        - The Data Dictionary and the System Catalog
        - Relationships within the Relational Database
        - Data Redundancy Revisited
        - Indexes
        - Cod's Relational Database Rules

- **Data Modeling** **IM3(2), IM4(6)**
    - The Importance of Data Models
    - Data Model Basic Building Blocks
    - Business Rules
    - The Evolution of Data Models
        - Hierarchical and Network Models
        - Relational Model
        - The Entity Relationship Model (ER diagram)
        - The Object-Oriented (OO) Model
        - Object/Relational and XML
        - Emerging Data Models: Big Data and NoSQL
    - Degrees of Data Models
        - The External Model
        - The Conceptual Model
        - The Internal Model
        - The Physical Model
    - Entity Relationship (ER) Modeling

        - The Entity Relationship Model (ERM)
        - Developing an ER Diagram
        - Database Design Challenges: Conflicting Goals
    - Advanced Data Modeling
        - The Extended Entity Relationship Model (EER Model)
        - Entity Clustering
        - Entity Integrity: Selecting Primary Keys
        - Design Cases: Learning Flexible Database Design
    - Normalization of Database Tables
        - The Need for Normalization
        - The Normalization Process
        - Improving the Design
        - Surrogate Key Considerations
    - Normal forms (what is that, how are they used, and examples)

- **Database Query Languages** **IM2 (8)**
    - Introduction to Structured Query Languages(SQL)
        - Introduction to SQL
        - Data Definition Commands
            - The Database Model
            - Creating the Database
            - The Database Schema
            - Creating Table Structure, Data types, Constraints, SQL Indexes
        - Data Manipulation Commands
            - Select, Insert, update, and delete
        - Defining and operating Queries
            - Selecting Rows with Conditional Restrictions
            - Arithmetic Operators: The rule of Precedence
            - Logical Operators: AND , OR, and NOT
            - Special Operators
        - Joining Database Tables

- **Managing the Database Environments** **IM5 (3), WS2(1)**
    - The Evolution of Database Administration
    - The Database Environments' Human Component
        - The DBA's Managerial Role
        - The DBA's Technical Role
        - The DBA's Role in the Cloud
    - Database Security
        - Security Policies
        - Security Vulnerabilities
    - Database Administrative Tools
        - The Data Dictionary
        - CASE Tools
    - Developing a Database Administration Strategy
    - The DBA at Work: Using Oracle for Database Administration
        - Oracle Database Administration Tools

        - Ensuring that the RDBMS Starts Automatically
        - Creating Table spaces and Data files
        - Managing Users and Establishing Security
        - Customizing the database Initiation Parameters
    - Data backup and recovery (methods, tools, and administrative protocols)
    - Database and Web Connectivity
        - ODBC, JDBC and XML in the implementation of an n-tier database architecture
        - Web Services and the role of SOAP
    - Other Topics
        - Describe n-tier database architecture.
        - Homogeneous, heterogeneous and federated distributed databases
        - Replication as it pertains to distributed databases

- **Special purpose databases** **IM6(1)**

    - Special purpose databases:
        - Text databases
        - Multimedia databases
        - Temporal databases
        - Spatial databases
        - Mobile databases
        - Scientific databases

Student Experiences:

Laboratory exercises
Weekly labs consist of hands-on exercises that include:

- Students will use pre-built simple LAMP architecture for project
- Apps- MySQL Workbench, Oracle PHP Admin and more.
- Analyzing and comparing data storage architectures and databases, preparing assessment reports
- Extensive data retrieval practice projects, in multiple retrieval contexts / languages
- Design of structures in at least one current database management system in order to address specific information retrieval requirements
- Analyzing models of database management systems in the context of specific IT environments, preparing comparative assessment reports

Projects
The outcomes of several labs will be combined into the starting point for two or more extensive projects, the lab-work serving as scaffolding for building up solutions to relatively complex problems. All lab/project reports must conform to guidelines announced in class. Projects will be assessed and graded against the Project Implementation rubric.

Quizzes, Tests and Examinations
There will be four quizzes (each covering a major topic), a midterm, and a cumulative final. Quizzes and exams will include multiple choice and problem solving tasks.

Final Grade
Final grade will be determined on the basis of the following approximate weights:

Grading Categories	Weights (%)
Laboratory exercises	20
Projects	20
Quizzes	20
Midterm exam	20
Final exam	20
Total	100

Student Experiences by Course Outcome (Objective) matrix:

	Labs	Projects	Quizzes	Midterm exam	Final Exam
CO1	✓		✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5		✓			

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