**CMPS 3420 Database Systems**

**Catalog Description**

**CMPS 3420 Database Systems (4)**

Basic issues in data modeling, database application software design and implementation. File organizations, relational model, relational database management systems, and query languages are addressed in detail. Two-tier architecture, three-tier architecture and development tools are covered. Each week lecture meets for 150 minutes and lab meets for 150 minutes. Prerequisite: CMPS 2020 and CMPS 2950.

**Prerequisites by Topic**

Programming skills in one of main programming languages, data structures and algorithm (CMPS 2020). The set theory, set operations, and first-order logic of CMPS 2950 are required.

**Units and Contact Time**

4 semester units. 3 units lecture (150 minutes), 1 unit lab (150 minutes).

**Type**

Required for CS

**Required Textbook**

Fundamentals of Database Systems, 6th Ed.by Elmasri & Navathe, published by Addison Wesley ISBN 978-0-13-608620-8

**Recommended Textbook and Other Supplemental Materials**

* Oracle 8/9/10, The complete reference (reference)
* Any Oracle SQL and Oracle PL/SQL will be useful.
* Any books on Microsoft Studio will will be helpful
* Any book on C# and ASP will be good.

 **Coordinator(s)**

Huaqing Wang

**Student Learning Outcomes**

ACM/IEEE Body of Knowledge Topics:

* *Information models and systems (IM1):*History and motivation for information systems; information storage and retrieval; information management applications; information capture and representation; analysis and indexing; search, retrieval, linking, navigation; integrity, scalability, efficiency, and effectiveness
* *Database systems(IM2):* History and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence
* *Data modeling (IM3):* Data modeling; conceptual models; object-oriented model; relational data model
* *Relational databases (IM4 & IM6):* Mapping conceptual schema to a relational schema; Entity and referential integrity; Relational algebra and relational calculusl; Functional dependency and Normal forms.
* *Database query languages (IM5):* Overview of database languages; SQL; 4th-generation environments; database connectivities (JDBC, ODBC) **†** ; stored procedures **†**

 **†***Graphics user-interface design & programming (HC5 & HC6):* client-server and three-tire architectures design and implementation **.**

**ABET Outcome Coverage**

3b. An ability to analyze a problem, and identify and deﬁne the computing requirements and

speciﬁcations appropriate to its solution.

3c. An ability to design, implement and evaluate a computer-based system, process, component,

or program to meet desired needs.

3f. An ability to communicate eﬀectively with a range of audiences.

3h. Recognition of the need for and an ability to engage in continuing professional development.

3i. An ability to use current techniques, skills, and tools necessary for computing practice.

3j. An ability to apply mathematical foundations, algorithmic principles, and computer science

theory in the modeling and design of computer-based systems in a way that demonstrates

comprehension of the tradeoﬀs involved in design choices.

3k. An ability to apply design and development principles in the construction of software systems

of varying complexity.

**Lecture Topics and Rough Schedule**

Chapter 7 Data Modeling using Entity-Relationship 9ER) Model

Chapter 8 The Enhanced Entity-Relationship (EER) Model

Chapter 10 Practical Database Design Methodology and Use of UML Diagrams

Chapter 1 Databases and Database Users,

Chapter 2 Database System Concepts and Architectures

Chapter 3 The relational Data Model and Relational Database Constraints

Chapter 9 Translate ER/EER Database to Relational Database

Chapter 6 Relational tuple and domain relational calculus

Chapter 4 Basic SQL

Chapter 5 More SQL: Complex Queries, Triggers, Views, and Schema Modification

Chapter 15 Basics of Functional Dependencies and Normalizations for Relational Databases

Materials Added : Case Studies

1. Oracle: Interactive SQL, Embedded SQL, Oracle PL/SQL, and Stored Procedures and triggers

(Reference to chapters 3 and 4)

 2. Graphic User Interface, JDBC, C# (students learn C# or Java before and during class by themselves).

Week 1, 2, 3:

* Lectures discuss Chapter 7, 8 and 10.
* Students will form a team or work individually to identity a business or organization that as a need for information system software.
* Each individual or team will present the business/organization, and sub-area which needs information system.
* Team/individual will work on concept database design, and document the targeted database and conceptual database design or Entity-Relational Database.

Week 4, 5:

* Lecture on chapter 1 and 2. Database system and database management systems, their components and functionalities.
* Team/individual presents their conceptual database (Entity-Relationship Model) to class, and class will give suggestions.

Week 6, 7, 8, 9, 10:

* Lectures chapters 3, 9, 6, 4, and 5 on relational model, three theoretical query languages (relational algebra (RA, tuple-calculus (TRC) and domain- calculus(DRC), and conversion from conceptual databases to logical (relational) databases. Design and implementation of queries in RA, TRC and DRC.
* Students will convert their E-R databases to relational database, design queries and answer the queries in RA, DRC, TRC and document all the works.

Week 11, 12:

* Lecture on SQL language, Oracle SQL/Plus, PL/SQL, Java Database Connectivity (JDBC), and Open Database connectivity (ODBC).
* Student will convert their logical database (relational) database to physical database (on Oracle DBMS). Convert theoretical queries in to SQL queries, Create views and stored procedures, triggers and etc.

Week 13:

* Chapter 15. Lecture on relational normal forms: its definitions and problems of un-normalized relations.
* Students check their relations against normal form, and make changes to their relations.

Week 14:

* Lecture on Graphical User Information (GUI) design and implementation, GUI components and layout, event and event handling.
* Students design one or two GUI interfaces in the language they choose as final phase of this course, and present the final project to the class.

Week 15:

 - Class project presentations and written report due

**Design Content Description**

 Each individual or team will work on a database system for designed for a business/organization. The design will be divided into the following phases:

* Information collection and conceptual database design ( Entity-relational Model will be used)
* Logical database design (Relational Model will be used)
* Physical database resign (Oracle database management system will be used)
* Graphical User Interface (GUI) will be design and implemented ( choose any IDE and language)
* Three oral presentations and one written report with coding are required.

**Prepared By**

Huaqing Wang on [date]

**Approval**

Approved by CEE/CS Department on [date]
Effective [term]