

## ***CS 4433: Introduction to Database Systems***

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**Required Course:** Elective

**Course Number:** CS 4433

**Course Name:** Introduction to Database Systems

**Credit Hours:** 3

**Lecture Hours:** 2.5

**Lab Hours:** 0

**Instructors:** Dr. Esra Akbas

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**Book Title(s):** Database systems; The Complete Book 2<sup>nd</sup> edition

**Book Author(s):** Hector Gracia-Molina, Jeff Ullman and Jennifer Widom

**Book Year(s):** 2008

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**Course Description:** An overview of database management systems, entity-relationship model, relational model, structural query language, relational algebra, relational database design with normalization theorems, XML; basic file organization and storage management; elementary e-commerce web application development; database systems and the Internet.

**Course Prerequisites:** CS 2133 (Computer Science II), Knowledge of Programming

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**Course Goals:** Upon successful completion of this course of study, the student will be familiar with:

- The basic principles of designing and implementing an application using relational database systems
- How a relational database application works for designing (the schema for), mapping and querying structured data
- The database language SQL
- Elementary e-commerce a web-based database system development

### **Student Outcomes:**

<b>Student Outcome</b>	<b>Course Outcome</b>
1	Describe, define and apply the major components of the relational database model to database design Learn and apply relational algebra and the Structured Query Language (SQL) for database definition and manipulation
2	

	<p>Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.</p> <p>Utilize a database modeling technique for a single entity class, a one-to-one (1:1) relationship between entity classes, a one-to-many (1:M) relationship between entity classes, a many-to-many (M:M) relationship between entity classes, and recursive relationships;</p> <p>Define, develop and process single entity, 1:1, 1:M, and M:M database tables;</p>
3	Write status reports for their project which are a proposal, status of the project during the semester and final complete project report
4	<p>Apply ethical computing concepts and practices to database design and implementation</p> <p>Learn and implement the principles and concepts of information integrity, security and confidentiality</p>
5	Complete a course project within a team.
6	<p>Install, configure, and interact with a relational database management system</p> <p>Develop an Elementary e-commerce web-based database system</p>

### Course Topics:

Knowledge Area	Total Hours of Coverage
Information Management (IM)	33
Information Assurance and Security (IAS)	2

KA	Knowledge Unit	Topics Covered	Hours
IM	Information Management Concepts	Information storage and retrieval (CT-1) Information capture and representation (CT-1) Searching and retrieving (CT-1) Analysis and indexing (CT-2) Reliability, security, scalability, efficiency (CT-2)	1
IM	Database Systems	File systems vs. DBMS Approaches to and evolution of DBMS (CT-2) Database architecture and data independence (CT-2)	2

		Core DBMS functions and system components (CT-2) DBMS user, designer, application developer, administrator (CT-1)	
IM	Data Modeling	Conceptual modeling – ER model (CT-2) Logical database design – Relational model, objectrelational model (CT-2)	5
IM	Relational Databases	Relational database design, schema design, mapping conceptual schema to relational schema, functional dependencies, superkeys and candidate keys, foreign keys, schema decomposition and refinement, loss-less join and dependency preservation, normal forms – 1NF, 2NF, 3NF, BCNF, multi-valued dependency and 4NF – entity and referential integrity	10
IM	Query Languages	Relational algebra SQL queries, constraints and triggers ODBC, JDBC Query processing strategies Query evaluation Query processing costs	10
IM	Indexing	Basic structure Indexes with SQL	1
IM	Physical Database Design	Memory hierarchy, file organization (heap files, clustered files, sorted files), tree-based indexing (B-tree, B+tree), hash-based indexing, I/O cost models for indexing, comparison of indexing techniques, indexes and performance tuning	3
IM	Transaction Processing	ACID properties, failure, and recovery, concurrency control, serializability, two phase locking protocols, deadlocks, logs and logging protocol	1
IAS	Foundational Concepts	Database security, access control via database views, integrity, audit	1
IAS	Security Policy and Governance	Backup and recovery	1