



CS 321 FILES AND DATABASES

IES Abroad Madrid

DESCRIPTION:

Topics covered in this course include the reasons for using a database, the components of a database system, the purpose of database management systems (DBMS), the elements of a database, and the functions of a database application. The objectives of this course are mainly to gain knowledge about information systems and databases, which includes acquiring knowledge in the data model as a design tool to create a database. The process of designing/using the relational model is learned, and practical experience using data language (SQL) to create, develop and manipulate a database is acquired. In addition, management and use of the database technology using commercial Database Management Systems (DBMSs) are learned.

CREDITS: 4 credits

CONTACT HOURS: 60 hours

LANGUAGE OF INSTRUCTION: English

PREREQUISITES: Data structures and Programming principles

ADDITIONAL COST: None

METHOD OF PRESENTATION:

This course is presented in modules; each module discusses a topic in database management systems designing rules and principles. Labs, Assignments, and in-class activities will be used as teaching and learning tools.

REQUIRED WORK AND FORM OF ASSESSMENT:

- Final exam - 30%
- Midterm exam - 20%
- Quizzes & In-Class Activities - 20%
- Assignments - 20%
- Attendance and Participation - 10%

Course Element

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems.

Introduction to Database design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises.

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical database

Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.

SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity All JNTU World Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies. **Transaction Management:** Transactions, Transaction Concept, A Simple Transaction Model, Storage

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Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity
Transaction Isolation Levels, Implementation of Isolation Levels.

Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes. Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

LEARNING OUTCOMES:

By the end of the course, students will be able to:

1. Create conceptual models of relational databases based on requirement specification documents;
2. Translate a conceptual model to the relational model;
3. Create, modify and query relational databases using the SQL language;
4. Apply normalization techniques to reduce data redundancy and improve data integrity;
5. Create computer programs which store, modify and query data stored in databases;
6. Set up indexes and use other techniques to improve the performance of databases;
7. Explain principles of good database systems and apply protection mechanisms.
8. Present and discuss the course content orally and in writing with proficiency appropriate to the course level.

ATTENDANCE POLICY:

As a member of our class community, you are expected to be present and on time every day. Attending class has an impact on your learning and academic success. For this reason, attendance is **mandatory for all IES Madrid classes**, including course-related excursions. Absences will only be excused in cases of documented medical or family emergencies. Any assessed work, including exams, tests, and presentations, will be rescheduled if the absence is justified; otherwise, it will be graded as 0. You are allowed a maximum of 1 unexcused absence for once-a-week courses and 2 unexcused absences for twice-a-week courses. Each additional absence will deduct 5 points from your final grade. **Accumulating 7 or more absences in twice-a-week courses, or 4 or more in once-a-week courses, may lead to a failing grade.** Students arriving more than 11 minutes after the scheduled start time will be marked as 'late.' Three 'late' arrivals will be counted as 1 absence. Any student arriving 30 minutes or more after the scheduled start time will be marked as 'absent.' For more information, please refer to the full [Attendance and Punctuality Policy](#) document.

ASSIGNMENT, QUIZZES, AND CLASS ACTIVITIES SUBMISSION POLICY:

- All class activities and quizzes must be submitted during the class session. Late submissions will receive a grade of zero.
- Assignments must be submitted before the specified deadline. Late submissions will incur the following penalties:
 - 10% penalty for submissions within 24 hours of the deadline.
 - 20% penalty for submissions within 48 hours of the deadline.
 - 30% penalty for submissions within 72 hours of the deadline.
 - Assignments submitted more than 3 days after the deadline will receive a grade of zero.

CONTENT:

Modules	Content	Assignment
Module1	Chapter 1&2- Introduction to Databases	● Reading Chapter 2
Module2	Relational Model and Schema	● Class Activity ● Assignment1: design Relational Schema for Art Gallery database (case study) - Apply Primary Key, Super Key, and Foreign Key.
Module3	Data Modeling Using the Entity–Relationship (ER) Model	● Class Activity ● Assignment2: Case Study (Pharmacies Group database)
Module4	Enhanced Entity–Relationship (ER) Model	● Class Activity ● Assignment3: apply EER Model

Module5	SQL- Basics • Data Definition Language (DDL) • Data Manipulation Language (DML)	• Lab1: Design DB using SQL instructions, add data to the DB using SQL code, and apply key constraints. Lab2: Display, and Manipulating database
Module6	Midterm Project: Analysis and Discussion workshop	
Midterm Exam	On-paper	Project submission
Module7	The Relational Algebra and Relational Calculus	• Assignment4- relational Algebra
Module6	More Complex SQL data insertion and retrieving	• Class Activity. • Lab3: more complex query on DB with aggregate functions, nested queries.
Module7	SQL nested query, join (inner, left, right, full), and Trigger	• Lab4: Triggers • Assignment5- Case study, apply JOIN and PROJECT.
Module8	Basics of Functional Dependencies and Normalization for Relational Databases	• Final Project Publication • Class activity • Assignment6: Functional Dependencies and Normalization (case study)
Module 9	Introduction to Transactions Process	• Exercises
Module10	Workshop and discussion for course project	Student present their initial analysis for the project statement

Modules	Topic	Duties
Exam	On-Paper Exam & Course Project	Final Project submission (real life case project) examples: • Dentist Clinic Database • E-Commerce store • Metro-line ticketing

COURSE-RELATED TRIPS:

- None

REQUIRED READINGS:

- Course lecture notes.
- Selected chapters from the course textbook.

REQUIRED TOOLS AND TECHNOLOGY:

- **MySQL workbench**, there are several free SQL server management tools. Feel free to choose the one that best fits your computer's specifications. For example, you may consider using [SQLWorkbench](#) or [SQL server](#).

Please, be aware that it's impossible for the teachers to provide technical support for the installation in your own computer of the required tools or other related issues

RECOMMENDED READINGS:

- Fundamentals of Database Systems, by Ramez Elmasri and Shamkant Navathe, 7th Edition (**Course Textbook**).
- "Database System and Concepts", Fifth Edition McGraw-Hill (optional).