



# C-ID Descriptor

## Introduction to Database Management Systems

### Descriptor Details

- **Descriptor Title:** Introduction to Database Management Systems
- **C-ID Number:** 180
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### General Description

This course addresses database management, both on-premises and cloud-based, along with different approaches for storing data. In the course, students define, develop, operate, and scale both Structured Query Language (SQL) and noSQL data storage solutions and basic related applications. This course considers strategic, operational, and ethical factors that should be balanced during the design of a storage solution. Students will apply principles using a common Relational Database Management System and SQL to create and fill tables, and to retrieve and manipulate data. Object-based APIs and noSQL solutions will be covered. Topics include automated backups, transaction logs, restoration, and retention.

### Prerequisites

None

### Corequisites

None

## **Advisories**

Business Information Systems/Computer Information Systems (C-ID ITIS 120 or C-ID BUS 140)

## **Content**

1. Introduction to Databases
  - a. Databases and Database Users
  - b. Database Systems Concepts and Architecture
  - c. Data Management Strategy, Regulatory Compliance, and related Data Ethics
2. Conceptual Data Modeling and Database Design
  - a. Data Modeling Using the Entity Relationship (ER) Model
3. The Relational Data Model and Structured Query Language (SQL)
  - a. The Relational Data Model and Relational Database Constraints
  - b. Basic SQL
  - c. More SQL: Complex Queries, Triggers, Views, and Schema Modification
  - d. Relational Database Design
4. Database Programming Techniques
  - a. Introduction to SQL Programming Techniques
  - b. Web Database Programming
5. Database Objects
  - a. Object and Object-Relational Databases
  - b. Object-based Application Programming Interfaces (APIs)
  - c. XML: Extensible Markup Language
6. Database Design Theory and Normalization
  - a. Basics of Functional Dependencies and Normalization for Relational Databases
7. File Structures, Hashing, Indexing, and Physical Database Design
  - a. Disc Storage, Basic File Structures, Hashing, and Modern Storage Architectures
  - b. Indexing Structures for Files and Physical Database Design
8. Query Processing and Optimization
  - a. Strategies for Query Processing
  - b. Query Optimization

9. Transaction Processing, Concurrency Control, and Recovering
  - a. Introduction to Transaction Processing concepts and theory
  - b. Concurrency control techniques
  - c. Database recovery techniques
10. Distributed databases, NoSQL systems, cloud computing, and Big Data
  - a. Distributed database concepts
  - b. NoSQL databases, and Big Data storage systems and technologies
11. Advanced database models, systems, and applications
  - a. Introduction to information retrieval and web search
  - b. Data Mining concepts
  - c. Overview of Data Warehousing and Online Analytical Processing (OLAP)
12. Database Administration
  - a. User privileges
  - b. Performance tuning
13. Business continuity
  - a. Disaster recovery
  - b. Database security
  - c. Information assurance
  - d. Data encryption

### **Lab Activities**

No information provided

### **Objectives**

*At the conclusion of this course, the student should be able to:*

1. Define the role of databases, database management systems, and related ethics and risks in a dynamic global regulatory environment.
2. Understand basic database structure.
3. Design a relational database so that it is at least in 3rd Normal Form.
4. Implement a relational database design using a common database management system, including the principles of data type selection and indexing.
5. Use the data definition, data manipulation, and data control language components of Structured Query Language (SQL) in the context of one widely

used implementation of the language.

6. Describe the role of databases and database management systems in the context of enterprise systems, including various cloud-based implementation models.
7. Describe the key principles of data security and identify data security risk and violations in data management system design.
8. Describe the fundamentals of Online Transaction Processing (OLTP) and Online Analytic Processing (OLAP), and how they relate to business intelligence, data warehousing, and data mining.
9. Demonstrate the basics of monitoring, managing, backing up, restoring, and securing database instances.
10. Describe business continuity considerations related to database management.

### **Evaluation Methods**

Evaluation will include applied hands-on projects and a combination of examinations, presentations, discussions, or problem-solving assignments.

### **Textbooks**

- Elmasri, R. & Navathe, S., *Fundamentals of Database Systems*, Pearson
- Kroenke, D. M. & Auer, D., *Database Concepts*, Pearson