

DATABASES

1. Thông tin về học phần (General Information)

Tên học phần (Course name): Databases

Mã học phần (Course code): INT1313

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Lecture room: Projector, microphone and speaker, air conditioner, Chalkboard or Whiteboard.

- Laboratory: Computer with Internet connection and Database Management System, Projector, microphone and speaker, air conditioner, Chalkboard or Whiteboard.

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 0h
- Bài tập lớn (Projects): 9h
- Thực hành (Lab): 4h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Address: Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course aims to provide learners with important knowledge about database systems, including:

- basic concepts necessary for a good understanding of database models, systems, and languages,
- the relational data model, the SQL standard, and the formal relational languages,
- the operations of the relational algebra and introduces the relational calculus,
- conceptual database modeling and database design,
- the normalization theory: the formalisms, theories, and algorithms developed for relational database design by normalization.

Kỹ năng (Skills):

The aim of this course is to equip learners with skills in:

- analyzing the data and data organization needs of organizations;
- applying the Entity-Relationship (E-R) Model for building information systems' data models;
- transforming an E-R diagram into a relational model, and use normalization to create a relational database schema;
- formulating queries in relational algebra by using projection, selection, product, and join operations;
- using SQL for database creation, manipulation, and control.

Thái độ, Chuyên cần (Attitude):

Learners are required to attend the classes and complete assignments/projects.

3. Tóm tắt nội dung học phần (Description)

This course introduces the fundamental concepts necessary for designing, using, and implementing database systems and database applications to learners. The course emphasizes on database modeling and design, the SQL language and normal forms. Besides, computer laboratory exercises and mini-projects based training are parts of the course to help students improving real-world database manipulation skills.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1 Databases and database users

- 1.1 Introduction
- 1.2 An example
- 1.3 Characteristics of the database approach
- 1.4 Actors on the Scene
- 1.5 Workers behind the Scene
- 1.6 Advantages of using the DBMS Approach
- 1.7 A brief history of database applications
- 1.8 When not to use a DBMS

Chapter 2 Database system concepts and architecture

- 2.1 Data models, schemas, and instances
- 2.2 Three-schema architecture and data independence
- 2.3 Database languages and interfaces
- 2.4 Database system environments
- 2.5 Centralized and client/server architectures for DBMSs
- 2.6 Classification of database management systems

Chapter 3 Relational data model and relational database constraints

- 3.1 Relational model concepts
- 3.2 Relational model constraints and relational database schemas
- 3.3 Update operations, transactions, and dealing with constraint violations

Chapter 4 Basic SQL

- 4.1 SQL data definition and data types
- 4.2 Specifying constraints in SQL
- 4.3 Basic retrieval queries in SQL
- 4.4 INSERT, DELETE, and UPDATE statements in SQL
- 4.5 Additional features of SQL

Chapter 5 More SQL: complex queries, triggers, views, and schema modification

- 5.1 More complex sql retrieval queries
- 5.2 Specifying constraints as assertions and actions as triggers
- 5.3 Views (virtual tables) in SQL
- 5.4 Schema change statements in SQL

Chapter 6 Relational algebra and relational calculus

6.1 Unary relational operations: SELECT and PROJECT

6.2 Relational algebra operations from set theory

6.3 Binary relational operations: JOIN and DIVISION

6.4 Additional relational operations

6.5 Examples of queries in relational algebra

6.6 Tuple relational calculus

6.7 Domain relational calculus

Chapter 7 Data modeling using the entity-relationship (ER) model

7.1 Using high-level conceptual data models for database design

7.2 A sample database application

7.3 Entity types, entity sets, attributes, and keys

7.4 Relationship types, relationship sets, roles, and structural constraints

7.5 Weak entity types

7.6 ER diagrams, naming conventions, and design issues

7.7 Example of other notation: uml class diagrams

7.8 Relationship types of degree higher than two

Chapter 8 Enhanced entity-relationship (EER) model

8.1 Subclasses, superclasses, and inheritance

8.2 Specialization and generalization

8.3 Constraints and characteristics of specialization and generalization hierarchies

8.4 Modeling of UNION types using categories

8.5 A example: EER schema, design choices, and formal definitions

8.6 Example of other notation: representing specialization and generalization in UML

class diagrams

Chapter 9 Relational database design by ER and EER-to-relational mapping

9.1 Relational database design using ER-to-relational mapping

9.2 Mapping EER model constructs to relations

Chapter 10 Basics of functional dependencies and normalization for relational Databases

10.1 Informal design guidelines for relational schemas

10.2 Functional dependencies

10.3 Normal forms based on primary keys

10.4 General definitions of second and third normal forms

10.5 Boyce-Codd normal form

Chapter 11 Relational database design algorithms and further dependencies

11.1 Further topics in functional dependencies: inference rules, equivalence, and minimal cover

11.2 Properties of relational decompositions

11.3 Algorithms for relational database schema design

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1]. Ramez Elmasri and Shamkant B. Navathe “Fundamentals of Database Systems”, Fourth Edition. Pearson Addison Wesley, 2004.

5.2. Học liệu tham khảo (Optional Textbooks)

[2] Hector Garcia-Molina, Jeffrey D. Ullman, Jenifer Widom. “Database Systems: The complete book”, Pearson Prentice Hall, Upper Saddle River, NJ 07458.

[3]. Abraham Silberschatz, Henry Korth, Sudarshan S. Database system concepts. 7th Edition. New York: McGraw-Hill, 2019.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exams	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

Phạm Văn Cường

**Giảng viên biên soạn
(Lecturer)**

Nguyễn Văn Tới