	VIETNAM NATIONAL UNIVERSITY OF HO CHI MINH CITY UNIVERSITY OF NATURAL SCIENCES **FACULTY OF INFORMATION TECHNOLOGY**

COURSE SYLLABUS

Course Code: TH201

Title: Database Design

Credits: 4

Workload: Lecture hours: **3** periods * **15** weeks = **45** periods
Laboratory hours: **2** periods * **15** weeks = **30** periods

Prerequisites: TH107 – Introduction to Database Systems

Course Objectives:

Design theory for relational database design is presented. Different problems at which the designer is faced during the design process are discussed: the synthesis and decomposition approaches used in conceptual design, analysis and comparison of the database schema resulting from these two approaches, graphical representation of the conceptual database schema, methods for selecting a particular internal database schema based on the concepts of access paths graph and embedded join of relations in an access paths graph. Finally, a project based on real-life problems is done in group of 2 students; it must cover all the steps of the design process and is implemented with a relational database management system.

Main Text: N/A

References:

- *Bases de données – Les systèmes et leurs langages*
  G. Gardarin - Eyrolles, 1994.
- *Une approche de conception d'une Base de données cohérentes et complètes*
  Dong Thi Bich Thuy._ Genève: Le Concept Moderne, 1986.
- *Fundamentals of database systems*
  Ramez Elmasri, Shamkant B. Navathe - Addison Wesley - 4th edition, 2003.

Course Outline:

Chapter 1 : Phases in database system design (4 lecture periods)

1. Introduction
   1. Objectives in database system design
   2. Problems for designer
   3. Input and output in designing process
2. Life cycle of a database system
   1. 7 stages in the cycle
   2. Phases in database system design
3. Requirement analysis phase
   1. Objectives

    2. Methods
4. Conceptual design phase
    1. Objectives
    2. Methods
5. Logic design phase
    1. Objectives
    2. Methods
6. Physical design phase
    1. Objectives
    2. Methods

Chapter 2 : Relational data model and data dependencies (7 lecture periods + 3 lab periods)

1. Relational data model: review of basic concepts
2. Functional Dependencies
    1. Definitions
    2. Closure of a set of functional dependencies
    3. Armstrong axioms
    4. Covers and Minimum Covers
    5. Properties of Functional Dependencies
    6. Key definition with the notion of FD
3. Multi-valued Dependencies
    1. Definition
    2. Inference rule set
    3. Dependency basis
    4. Potential Multi-valued Dependencies in Q

Chapter 3 : Conceptual design phase (8 lecture periods + 5 lab periods)

1. Main objectives
    1. Motivation
    2. Functional Dependency Checking Mechanisms
    3. Objectives of conceptual design
2. Normal Forms
    1. First Normal Form (1NF)
    2. Second Normal Form (2NF)
    3. Third Normal Form (3NF)
    4. Boyce-Codd-Kent Normal Form (BCNF) and its limitations
    5. Fourth Normal Form and its limitations
    6. Normal Form of database scheme
3. Database Scheme Equivalence
    1. Principles to evaluate the equivalence of database scheme
    2. Functional Dependency Preservation Property
    3. Information Preservation Property
    4. Complete Representation of Database
4. Two approaches to database system design
    1. Decomposition approach
    2. Synthesis approach
    3. Analysis of results of the two approaches

Chapter 4 : Logical design phase(8 lecture periods + 5 lab periods)

1. Objectives of this phase
2. Graphical representation of the conceptual database schema
    1. Some basic concepts in graph theory
    2. Access path graph (APG)
    3. Relational graph (RG)
    4. Embedded joined in APG and RG
3. An algorithm for converting a database scheme into a relational graph
    1. Objectives of the algorithm
    2. The algorithm
    3. Reverse conversion: from relational graph to database schema
4. Some special cases:
    1. Case 1
    2. Case 2
    3. Case 3
5. Logical design process

Chapter 5 : Physical design phase (3 lecture periods + 2 lab periods)

1. Onjectives of this phase
2. Node transformations
    1. Fragmentation (horizontal/vertical fragment)
    2. Merged Nodes
    3. Inverted Nodes
3. Edge transformations
    1. Redundant access paths
    2. Access path implementations
4. Implementation in Relational DBMSs

Grading Final exam : 70%

Assignments and final project: 30%