

**UNIVERSITY OF WISCONSIN**  
**Bachelor of Science in Applied Computing**  
**APC 410 Section 01: Database Management 2**  
**(Semester/Year)**

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**COURSE DESCRIPTION:** This course covers architecture and use-cases of non-relational (NoSQL) based on four types of databases including document, Graph, Key-value, and wide column store. Topics include: data types, create/update/delete data, query, cursors, indexing, dynamic schema design, scalability (scale-out) over scale-up of RDBMS, analysis of massive unstructured and semi-structured data and data security.

**MODE OF DELIVERY:** Online

**COURSE OBJECTIVES:** At the end of this course, students will be able to:

- Develop knowledge of key features of each of four types of NoSQL databases (key-value, document, column-family, and graph databases).
- Leverage basic and advanced query features in MongoDB database for creating and querying document databases.
- Leverage basic and advanced query features in Apache Cassandra database for creating and querying column-family databases.
- Develop knowledge of basic and essential concepts in relational database administration and security.

**TEXTBOOKS:**

**Required Textbooks:**

- Pramod J. Sadalage and Martin Fowler. *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*. Addison-Wesley. 1<sup>st</sup> ed. ISBN-10: 0321826620 | ISBN-13: 978-0321826626
- David Hows, Pepter Membrey, Eelco Plugge, and Tim Hawkins. *The Definitive Guide to MongoDB: A Complete Guide to Dealing with Big Data using MongoDB*. APRESS. 3<sup>rd</sup> ed. ISBN: 978-1-4842-1183-054999

### **Optional Textbook:**

- Russell Bradberry and Eric Lubow. Practical Cassandra: A Developer's Approach. Addison-Wesley. 1st ed. ISBN-10: 032193394X | ISBN-13: 9780321933942

### **COURSE OUTLINE:**

- I) Introduction to NoSQL Databases
  - a. Motivation of using NoSQL Databases
  - b. Different Types of NoSQL Databases
  - c. Data Models of NoSQL Databases
  
- II) Key-Value Databases
  - a. Definition of a Key-Value Database
  - b. Popular Key-Value Databases
  - c. Key Features of a Key-Value database
  - d. Suitable and Unsuitable Use Cases of Key-Value Databases
  
- III) Document Databases
  - a. Definition of a Document Database
  - b. Key Features of a Document Database
  - c. Suitable and Unsuitable Use Cases of Document Databases
  
- IV) MongoDB Database
  - a. Key Features of MongoDB
  - b. JSON Data Format
  - c. Keys and Indexes
  - d. Data Models
  - e. Manipulating Data in MongoDB
  - f. Querying Data in MongoDB
  - g. Advanced Queries in MongoDB
  
- V) Column-Family Databases
  - a. Definition and Basic Structure of a Column-Family Database
  - b. Key Technical Features of a Column-Family Database
  - c. Suitable and Unsuitable Use Cases of Column-Family Databases
  
- VI) Apache Cassandra Database
  - a. Basic Features of Apache Cassandra
  - b. Cassandra Data Model
  - c. Cassandra Query Language (CQL)

1. Partition Keys and Clustering Columns
2. Data Definition and Manipulation Commands (CREATE, INSERT, UPDATE, DELETE, and BATCH)
3. Querying Data Using SELECT Statement

VII) Graph Databases

- a. Definition of a Graph Database
- b. An Example Graph Structure
- c. Key Features of a Graph Database
- d. Cypher Query Language in Neo4J Graph Database
- e. Suitable and Unsuitable Use Cases of Graph Databases

VIII) Database Administration and Security

- a. Need and Role of a Database in an Organization
- b. Evolution of Database Administration
- c. Human Component of a Database Environment
- d. Managerial Role and Technical Role of a DBA
- e. Database Security Basics, including Security Goals, Security Policies, Security Vulnerabilities, and Security Measures

**GENERAL TEACHING PROCEDURE/METHODOLOGY:**

Audio Lectures, Lesson Discussions, Assignments, and Labs

**EVALUATION PROCEDURES TO BE USED:**

Assignments, Labs, Quizzes, and Final Exam

**COURSE GRADING:** Grades will be assessed using a variety of methods:

Assignment	Points
Lesson Discussions: 14 @ 0.2 point	2.8
Assignments: 6 @ 4 points	24
Labs: 6 @ 5 points	30
Quizzes: 14 @ 1 point	14
Finals Exam	29.2
<b>Total Points</b>	<b>100</b>

**FINAL EXAM: YES**

**GRADE SCALE:**

Final grades will be assigned according to the following scale:

A: score  $\geq 90$ ,

B:  $80 \leq \text{score} < 90$ ,

C:  $70 \leq \text{score} < 80$

D:  $60 \leq \text{score} < 70$ ,

F: score  $< 60$

Depending on the overall performance of the class, the instructor may use lower cutoff points for some of the letter grades.

**WORKLOAD:**

Students should expect to spend 40 hours reading the required readings, 60 hours going through the online course materials (audio lectures, lesson discussions, and quizzes) and 50 hours completing the assignments and labs for a total of 150 hours.