Course Description

Course Description: This course includes advanced concept of database system. The main topics covered are advanced concept of relational data model, Extended E-R model, new database management technologies, query optimization, NoSQL database and big data processing techniques.

Course Objectives: At the end of the course students should be able to know new developments in database technology, interpret and explain the impact of emerging database standards, evaluate the contribution of database theory to practical implementations of database management systems. Also, students should be able to develop more advanced application using MapReduce and Hadoop.

Units and Unit Content

1. Enhanced Entity Relationship Model and Relational Model
teaching hours: 8 hrs
Entity Relationship Model Revised; Subclasses, Superclasses and Inheritance; Specialization and Generalization; Constraints and characteristics of specialization and Generalization; Union Types; Aggregation; Relational Model Revised; Converting ER and EER Model to Relational Model; SQL and Advanced Features; Concepts of File Structures, Hashing, and Indexing

2. Object and Object Relational Databases
teaching hours: 10 hrs
Object Database Concepts; Object Database Extensions to SQL; The ODMG Object Model and the Object Definition Language ODL; Object Database Conceptual Design; Object Query Language OQL; Language Binding in the ODMG Standard

3. Query Processing and Optimization
teaching hours: 7 hrs
Concept of Query Processing; Query Trees and Heuristics for Query Optimization; Choice of Query Execution Plans; Cost-Based Optimization

4. Distributed Databases, NOSQL Systems, and BigData
teaching hours: 12 hrs
Distributed Database Concepts and Advantages; Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design; Types of Distributed Database Systems; Distributed Database Architectures

Introduction to NOSQL Systems; The CAP Theorem; Document-based, Key-value Stores, Column-based, and Graph-based Systems; BigData; MapReduce; Hadoop

5. Advanced Database Models, Systems, and Applications
teaching hours: 8 hrs
Active Database Concepts and Triggers; Temporal Database Concepts; Spatial Database Concepts; Multimedia Database Concepts; Deductive Database Concepts; Introduction to Information Retrieval and Web Search

Lab and Practical works

Students should implement different concepts of database system studied in each unit of the course during lab time and should submit a mini project at the end the course.