Course Title	Advanced Database Systems				
Course Code	ACSC384				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	3rd (Fall)				
Teacher's Name	Dr Christos Markides				
ECTS	6	Lectures / week	2	Laboratories/week	2
Course Purpose	The course considers the concepts of modern database systems. Teaches the theory and application of advanced database systems, the supporting mechanisms of the DBMS, and the underlying theory of the database transactions in terms of Atomicity, Consistency, Isolation, and Durability (ACID). Implements practical applications of modern database systems, including the Model-View-Controller (MVC) architecture. Discusses alternative database systems, such as distributed databases and introduces Big Data.				
Learning Outcomes	Upon successful completion of the course students will be able to: 1. Describe in detail the functions and role of DBMS as an interface between end users and database. 2. Define transactions and supporting mechanisms embedded in DBMS for working with them in concurrent computing environment, including recovery and security of databases. 3. Apply both in theory and practice the programmatic use of databases on the example of connecting applications to database system. 4. Examine the nature of object-oriented databases and their practical use. The students to have the ability to analyse the problem domain and make selection of respective relational or object-oriented database. 5. Describe and compare the basic models and mechanisms for development and use of distributed databases for supporting distributed applications, including Internet/Web applications. 6. Discuss alternative database systems, such as distributed databases, and introduce Big Data.				
Prerequisites	ACSC223		Co-requisites	None	
Course Content	• **Overview**: Types of Databases Database Applications, Database and DBMS Definitions, Data Models, Database Terminology, Relations, properties and keys, Entity Integrity, Referential Integrity and Constraints. • **DBMS Overview**: Structure, Functions, and Components, Components of Database Manager, Roles in the Database Environment, ANSI/SPARC Three-Level Architecture, Views, Advantages and Disadvantages of DBMSs. • **Database Analysis and Design**: Database System Development				

	Lifecycle, Database Planning, System Definition, Requirements Collection and Analysis, Database Design, Optimal Model Criteria and Success Factors, Phases of Database Design, Conceptual Model Steps, Logical Model Steps, Physical Database Design Steps, DBMS Evaluation Features, Application Design, Implementation, Testing, and Maintenance. • **Transactions and Concurrency Control**: Overview, Transaction Support, State Transition and State Transition Diagram, ACID, DBMS Transaction Subsystem, Transaction Support, Atomic Operations, Concurrency Control, Serializability, Schedules, Recovery, Concurrency Control Techniques (Locking, 2PL, Rollback), and Deadlocks (Prevention, Detection, and Recovery). • **Security and Administration** Transparencies: Database Security, Threats, Countermeasures, RAID, DBMSs and Web Security. • **Database Recovery**: Overview, Failures, Transaction Recovery, DBMS Recovery Facilities, Backup Mechanisms, Logging, Checkpointing, Recovery Techniques, Deferred Updates, Immediate Updates, Shadow Paging, and Recovery Issues (MySQL). • **Distributed DBMS**: Overview, Distributed Database, Distributed DBMS, Distributed Processing, Parallel DBMS, Advantages and Disadvantages, Types of DDBMS, Functions of DDBMS, MDBS and FDBMS, DDBMS Components, and Rules for DDBMS. • **Introducing Big Data**: Overview, Sources of Big Data, Definitions, Adoption of Big Data, Characteristics (3Vs, 4Vs), Data Processing Techniques, Processing Architectures, Technologies (Hadoop Framework, NoSQL), and Lifecycle.
Teaching Methodology	The course will combine theoretical aspects of modern database systems with extended practical work on the concepts of databases and DBMS. Delivery will be based on 2 period lecturing and 2 laboratory period. Laboratory work will mainly consist of introducing students to the practical and students are expected to complete the practical outside contact hours. Students are expected to find references from the library and on the Internet to complete their practical work.
Bibliography	<u>Textbooks:</u> • Thomas M. Connolly, Carolyn E. Begg, ***Database Systems: A Practical Approach to Design, Implementation, and Management***, 6th Edition, Addison-Wesley Publishing, 2015, ISBN: 978-0132943260. <u>References:</u> • R. Elmasri, S. B. Navathe, ***Fundamentals of Database Systems***, 7th Edition, Pearson, 2016, ISBN: 978-1292097619. • R. Ramakrishnan, J. Gehrke, ***Database Management Systems***, 3rd Edition, McGraw Hill, 2003, ISBN: 978-0071231510.
Assessment	Students are assessed on the theoretical aspects of the course through tests, and the final exam, while lab exercises cover the applied and hand-on aspects of the course. Coursework will comprise of two tests, a set of lab exercises, and three-hour closed book exam. The weights for each

	assessment component are: • Labs: 20% • Tests: 20% • Final Exam: 60%
Language	English