COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_INF760**	**SEMESTER**	**7**
COURSE TITLE	**Data Management Systems**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	
Seminars / Practice exercises	1	
Laboratory	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	4	5

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Specialised.
PREREQUISITE COURSES:	No. Students are advised to have already attended the courses: Data Bases, Introduction to Distributed Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.ece.uop.gr/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

- *Guidelines for writing Learning Outcomes*

The course is focused on advanced issues of relational databases (DBs), understanding distributed DBs, getting familiar with NoSQL DBs and introducing to the management of large-scale data (big data).

Keywords: Relational DBs, DB design, SQL, DB programming, SQL/PSM, distributed DB, NoSQL DB, CAP theorem, big data, big data management, big data technologies.

Learning Outcomes

Upon successful completion of the course, student will be able to:

At the knowledge level:

- Design relational DBs at an advanced level.
- Use SQL language to implement advanced applications.
- Program DBs using popular standards such as SQL / PSM (Persisted Stored Modules), SQL / CLI (Call Level Interface) and JDVC (JAVA Data Base Connectivity).
- Know the basic principles, types and architectures and the most popular data management techniques of the distributed DBs.
- Understand NoSQL DBs, their categories, the most important data management techniques of each category and the most important commercial systems of each category.
- get acquainted with the concept and management of big data and the main relevant technologies

At the skill level:

- Use the relational DBs at an advanced level.
- Use efficient standards and products such as PL / SQL and JDVC for DB programming.
- Use distributed data management systems in order to achieve maximum performance and error recovery.
- Use NoSQL data management systems.
- Use, at an introductory level, the most modern big data management systems such as Hadoop / Reduce, Spark, Yarn.

At the level of abilities:

- Be able to design and implement complex applications in relational DBs.
- Solve complex problems that require the combination and interface of programming languages (procedural or object-oriented ones) with relational DBs.
- Evaluate the various data management problems and, according to their requirements, use relational or/and NoSQL DBs.
- Propose cost-effective solutions for managing large-scale data using the appropriate technologies effectively.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team Work
- Working in an international environment
- Production of free, creative and inductive thinking
- Production of new research ideas

(3) SYLLABUS

The course is developed in the following 13 lectures:

1. Advanced design issues of relational DBs. Extended ER model, logical and physical DB design.

2. Advanced SQL use. Complex queries, data integrity constraints implementation, triggers.
3. DB programming. Combined use of procedural and/or object oriented languages with SQL (e.g. PL/SQL, JDVC).
4. Use of specific relational Data Base Management System. Design and implementation of a complex DB application.
5. Distributed DBs. Distributed data management, data fragmentation, replication management, concurrency, fault recovery.
6. NoSQL DBs. CAP theorem. Key-value NoSQL systems. Column-based NoSQL systems. Main characteristics, properties, functionality.
7. NoSQL DBs. Document based NoSQL systems. Main characteristics, properties, functionality.
8. NoSQL DBs. Graph based NoSQL systems. Main characteristics, properties, functionality.
9. Use of specific NoSQL system for implementing a non complex application.
10. Big Data management. Definitions, charcteristics, applications, processing requirments, review of relative distributed technologies.
11. Hadoop Ecosystem and MapReduce programming model. HDFS architecture and functionality, Yarn, MapReduce architecture, Hadoop/ MapReduce installation.
12. SPARK Ecosystem. SPARK architecture, RDDs and Dataframes.
13. Use of Hadoop/ MapReduce and SPARK systems. Demonstration of simple big data management application.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in class and in the laboratory. Distance learning support via e-Class system.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Supporting the learning process through the e-Class platform (for notification of the course regulations, for distribution of slides, laboratory exercises, supplementary material, announcements, links, bibliography, etc.). • During the lectures of the theoretical part, a projector and presentations in electronic form are used, which are also posted on the eclass from the beginning of the semester. • During the lectures, a computer is used to write and execute code. • Use of specialized software integrated development environment (such as relational DB, NoSQL DB, Hadoop/MapReduce, SPARK).

TEACHING METHODS

The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	***Semester workload***
Theory Lectures	26
Seminars / Practice exercises	13
Laboratory Exercises	13
Preparation of laboratory exercises	13
Projects preparation	25
Independent study of lectures and bibliography	35
Course Total	***125 hours (5 ECTS)***

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

A. Written final exam that includes:

- Solve exercises
- Multiple choice questions
- Short answer questions

B. Preparation of laboratory exercises and project.

Remarks:

- The final grade results from the weighting of the theory and work grades with coefficients determined at the beginning of the semester and announced to the students via e-class. Indicatively it will be about 60% - 40%
- Laboratory exercises and assignments will be submitted electronically and students will be asked to take an oral exam on them.
- The exam material and the evaluation process are communicated to the students in the lecture hall and in the e-class.

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- Βασίλειος Τ. Ταμπακάς, Εισαγωγή στις Βάσεις Δεδομένων, έκδοση 2η, 2017, ISBN: 978-960-9427-66-1, Εκδόσεις Γκότση.
- Elmasri Ramez, Navathe Shamkant, Θεμελιώδεις αρχές συστημάτων βάσεων δεδομένων, Έκδοση 7η, αναθεωρημένη, 2016, ISBN: 978-960-531-343-2, Εκδόσεις Δίαυλος.
- Sourav Mazumder, Robin Singh Bhadoria, Ganesh Chandra Deka (eds), Distributed Computing in Big Data Analytics, Springer, 2018.
- Shashank Tiwari, PROFESSIONAL NoSQL, John Wiley & Sons, Inc. 2011.

- *Related academic journals:*

- ACM Journal of Information Management
- ACM/IMS Transactions on Data Science
- IEEE Transactions on Big Data