COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering
ACADEMIC UNIT	Mechanical Engineering
LEVEL OF STUDIES	*Undergraduate (towards 5-year Diploma Degree)*

COURSE CODE	ΟΠ0801	**SEMESTER**	8th
COURSE TITLE	Data Science for Supply Chain Management		

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	3	3
Laboratory Exercises	2	3
	5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	• Specialized general knowledge, • Skills development.
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=18458&lang=en

(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 aim of the course is to prepare and equip future scientists and executives in the field of Supply Chain Management with the necessary skills of the interdisciplinary field of Data Science. The course will introduce the broad scientific field of Machine Learning which is a key area of Artificial Intelligence. Emphasis will be placed on developing intelligent applications utilizing Big Data Analytics techniques for better decision-making on practical supply chain issues.

Indicatively, Machine Learning algorithms, methods and models (supervised and unsupervised learning) for big data analysis will be presented, such as: regression methods, classification methods, artificial neural networks, support vector machines, deep learning models, clustering algorithms, dimensionality reduction techniques. The application of these will focus on solving practical supply chain issues, including time series analysis for demand forecasting, inventory management, various optimization problems.

The Anaconda distribution will be used with emphasis on the use of the Python programming language, which has a lot of features and is particularly efficient for applications in the field of Data Science. The source code will be written in interactive development environments (IDEs), mainly JupyterLab and

Spyder. For the implementation of practical applications, we will make use of key indicative open-source Python packages (libraries) such as Google OR-Tools, H2O, Matplotlib, NumPy, pandas, scikit-learn, SciPy, Seaborn, statsmodels.

Key Cloud Services for code repository management platforms and web-based interactive development environments, such as GitHub and Google Colaboratory (Colab) respectively, will be presented.

The programming language R will be presented and compared to Python, with emphasis on their applications in the field of Data Science, for modelling and decision-making in supply chain issues.

Upon successful completion of the course, students are expected to:
- Understand the basic programming principles with Python.
- Write source code in interactive development environments (IDEs).
- Use basic data manipulation, analysis and visualization Python packages (libraries).
- Use basic Python packages (libraries) related to Machine Learning.
- Have an understanding of the basic principles of Data Science and its potential.
- Understand and become familiar with Machine Learning algorithms, methods and models (supervised and unsupervised learning).
- Draw conclusions and estimates from big data analysis for better decision-making.
- Be familiar with analyzing case studies and solving real-world problems with emphasis on supply chain management problems.

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*
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.
- Adapting to new situations.
- Decision-making.
- Working independently.
- Project planning and management.
- Criticism and self-criticism.
- Production of free, creative and inductive.

(3) SYLLABUS

- Presentation of the basic principles of Data Science with a focus on Supply Chain Management,
- Presentation of Anaconda distribution with creation and management of virtual environments,
- Introduction to Python Programming Language,
- Data Types and Structures,
- Control Structures,
- File Handling (Input and Output),
- Define and Call Functions,
- Packages (libraries) for Data Manipulation, Analysis, and Visualization,
- Packages (libraries) for Machine Learning,
- Presentation of Supervised and Unsupervised learning,
- Presentation of Machine Learning algorithms, methods and models, such as:
    - Regression Methods,
    - Classification Methods,
    - Artificial Neural Networks,
    - Support Vector Machines,

- − Deep Learning Models,
- − Clustering Algorithms,
- − Dimensionality Reduction Techniques.
- Practical applications in time series analysis for demand forecasting,
- Practical applications in inventory management,
- Practical applications in various optimization problems,
- Presentation of cloud services (GitHub and Google Colab),
- Presentation and comparison of R programming language versus Python on Data Science in supply chain issues.

(4) TEACHING and LEARNING METHODS - EVALUATION

| DELIVERY
Face-to-face, Distance learning, etc.	Face-to-face teaching in a computer lab (for the theoretical and laboratory part of the course).
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students.	Use of ICT in teaching (delivery of lectures with writing and analysis of source code, web-based learning process support), in laboratory training (familiarization with the Anaconda distribution, practice in interactive development environments JupyterLab and Spyder) and in communication with students (advisory guidance and the option of electronic homework submission).

| **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**
	Lectures	70
	Laboratory Exercises	30
	Independent Study	50
	Course Total (25 hours of workload per credit)	***150***

| **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. | I. Computer Lab-Based Final Exam (70%)
II. Assignments (30%)

Specifically-defined evaluation criteria are given at the beginning of the semester. |
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(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:
- Deitel, H. M., & Deitel, P. J. (2021). Εισαγωγή στην Python για τις Επιστήμες Υπολογιστών και Δεδομένων. Εκδότης: Χ. ΓΚΙΟΥΡΔΑ ΣΙΑ ΕΕ. ISBN: 9789605127442.
- FAWCETT, T., & PROVOST, F. (2019). Η ΕΠΙΣΤΗΜΗ ΤΩΝ ΔΕΔΟΜΕΝΩΝ ΓΙΑ ΕΠΙΧΕΙΡΗΣΕΙΣ. Εκδότης: ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ. ISBN: 9789604619917.

- Hillier, F. S., Lieberman, G. J., & Διαμαντίδης, Α. (Επιστ. Επιμέλεια) (2021). Εισαγωγή Στην Επιχειρησιακή Έρευνα (11η Έκδοση). Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε. ISBN: 9789604189168.
- MATTHES, E. (2020). Η ΓΛΩΣΣΑ ΠΡΟΓΡΑΜΜΑΤΙΣΜΟΥ PYTHON. Εκδότης: ΕΚΔΟΣΕΙΣ ΔΙΣΙΓΜΑ ΙΚΕ. ISBN: 9786182020036.
- Muddana, A. L., & Vinayakam, S. (2024). Python for Data Science. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-52473-8
- Sunil, C., Ανδρουτσόπουλος, Κ., & Μαντάς, Μ. (Επιστ. επιμέλεια). (2020). Διοίκηση Εφοδιαστικής Αλυσίδας, 7η Έκδοση. Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε. ISBN: 9789604188758.
- Βλαχάβας, Ι., Κεφαλάς, Π., Βασιλειάδης, Ν., Κόκκορας, Φ., & Σακελλαρίου, Η. (2020). ΤΕΧΝΗΤΗ ΝΟΗΜΟΣΥΝΗ - 4η ΕΚΔΟΣΗ. Εκδότης: ΕΤΑΙΡΕΙΑ ΑΞΙΟΠΟΙΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΠΕΡΙΟΥΣΙΑΣ ΠΑΝΕΠΙΣΤΗΜΙΟΥ ΜΑΚΕΔΟΝΙΑΣ. ISBN: 9786185196448.
- ΔΙΑΜΑΝΤΑΡΑΣ, Κ., & ΜΠΟΤΣΗΣ, Δ. (2019). ΜΗΧΑΝΙΚΗ ΜΑΘΗΣΗ. Εκδότης: ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ. ISBN: 9789604619955.

Related academic journals:
- Big Data Mining and Analytics, IEEE
- Big Data Research, Elsevier
- Computers & Industrial Engineering, Elsevier
- Data Mining and Knowledge Discovery, Springer
- Data Science and Engineering, Springer
- European Journal of Operational Research, Elsevier
- Expert Systems with Applications, Elsevier
- IEEE Transactions on Knowledge and Data Engineering, IEEE
- International Journal of Data Science and Analytics, Springer
- International Journal of Production Economics, Elsevier
- International Journal of Production Research, Taylor & Francis
- Management Science, INFORMS
- Operational Research, Springer