COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MINERAL RESOURCES ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	MRE405	SEMESTER	4
COURSE TITLE	TRANSPORT PHENOMENA		

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	4
Labs	1	1
Total	4	5
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, specialised general knowledge, skills development*	Required, *general background*
PREREQUISITE COURSES:	MRE303
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uowm.gr/courses/MRE137/

(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 designed to provide to students

- an introductory and general view of transport phenomena as they appear in several physicochemical processes
- a good grasping of the basic equations that describe momentum, mass and heat transport in different media and an appreciation of their similarity to solve simple problems
- the ability to appreciate the ubiquity of these phenomena within a large range of environmental and industrial processes and their simultaneous occurrence
- a good grasp of the application of mathematical methods used to set up and solve the basic conservation laws of mass, energy, momentum and angular momentum at microscopic, macroscopic level and molecular level and the ability to distinguish between those for application to a particular technological problem
- a good knowledge of basic computational tools such as EXCEL and Mathematica as applied to solve simple problems of transport phenomena

❖ the ability to search and extract specific articles from the relevant scientific literature

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 interdisciplinary environment
Criticism and self-criticism
Production of new Research ideas
Production of free, creative and inductive thinking
Showing social, professional and ethical responsibility

(3) SYLLABUS

- Introduction
- Mechanisms of molecular transport
- Viscosity and concept of momentum flux (Newton's law)
- The concept of convective momentum transport
- Thermal conductivity and meaning of the heat flux (Fourier's law)
- Free and forced convective heat transport
- Diffusion and the concept of mass flux (Fick's law)
- The concept of the molecular mass flux
- Convective mass and molecular transport
- Introduction to conservation laws at a microscopic level
- Simple mass, energy and momentum balances in differential elements (shell balances) and derivation of concentration, temperature and velocity profiles in one dimension
- Forms of the diffusion equation
- Generalized equations of continuity, motion and energy (equations of change) for mixtures

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, Distance learning, Lectures, Computational EXCEL Lab, Tutorials
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	E-Class, electronic communication, video demonstrations, intermediate exams via e-Class tools
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	36
Computational Lab	24
Tutorials	24
Self-study	16
Course total	***100***

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.*	Final exam (40%, minimum required grade =4/10), Multiple choice intermediate exam (20%), Homework (20%), Computational Lab (20%)

(5) SUGGESTED BIBLIOGRAPHY

- Suggested bibliography:

1. Unit Operations of Chemical Engineering (Έκδοση: 7/2005), by McCabe et al, Κωδικό στον Εύδοξο: 22708928, ISBN: 9780071247108. Εκδότης: Επίκεντρο Α.Ε.

2. Βασικές Διεργασίες Χημικής Μηχανικής, 7η Έκδοση, by McCabe-Smith-Harriott, Κωδικό στον Εύδοξο: 50655948, ISBN: 978-960-418-566-5, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

3. Εισαγωγή στα Φαινόμενα Μεταφοράς, 2η Έκδοση, by Bird R. Byron, Stewart E. Warren, Lightfoot N. Edwin, Klingenberg J. Danilel, Ευστάθιος Κικκινίδης (επιμέλεια), Κωδικό στον Εύδοξο: 59415132, ISBN: 978-960-418-752-2, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

4. ΜΕΤΑΦΟΡΑ ΜΑΖΑΣ ΣΕ ΠΕΡΙΒΑΛΛΟΝΤΙΚΕΣ ΔΙΕΡΓΑΣΙΕΣ, by Ασσαέλ Μ., Κακοσίμος Κ., Αντωνιάδης Κ., Παναγιωτόπουλος Κ., Κωδικό στον Εύδοξο: 32998761, ISBN: 978-960-418-426-2, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

5. MASS TRANSFER OPERATIONS, by TREYBAL, Κωδικό στον Εύδοξο: 50659376, ISBN: 9780070666153, Εκδότης: Επίκεντρο Α.Ε.

6. INTRODUCTION TO CHEMICAL PROCESSES: PRINCIPLES, ANALYSIS, SYNTHESIS, by MURPHY, Κωδικός Βιβλίου στον Εύδοξο: 50659377, ISBN: 9780071254298, Εκδότης: Επίκεντρο Α.Ε.

- *Related academic journals::*

1. *Computer Aided Chemical Engineering, Elsevier*
2. *Journal of Membrane Science, Elsevier*
3. *International Journal of Heat and Mass Transfer, Elsevier*
4. *International Journal of Thermal Sciences, Elsevier*
5. *Computers & Mathematics with Applications, Elsevier*
6. *Journal of Contaminant Hydrology, Elsevier*
7. *Advances in Water Resources, Elsevier*
8. *Water Science and Technology, International Water Association*
9. *Heat and Mass Transfer, Springer*
10. *Water, Air, & Soil Pollution, Springer*
11. *Environmental Science and Pollution Research, Springer*
12. *Heat Transfer Engineering, Taylor & Francis*
14. *Journal of Environmental Chemical Engineering*
15. *Journal of Sustainable Metallurgy*