

COURSE OUTLINE

1. GENERAL

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|---|--|---------------------|----------------|
| SCHOOL | FACULTY OF ENGINEERING | | |
| DEPARTMENT | ENVIRONMENTAL ENGINEERING | | |
| LEVEL OF STUDIES | UNDERGRADUATE | | |
| COURSE CODE | E4ΥΠ | SEMESTER | 3 ^ο |
| COURSE TITLE | ATMOSPHERIC POLLUTION | | |
| TEACHING ACTIVITIES <i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i> | TEACHING HOURS PER WEEK | ECTS CREDITS | |
| Lectures (theory) | 2 | | |
| Exercises/problems | 1 | | |
| Laboratories | 3 | | |
| Total | 6 | 5 | |
| <i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i> | | | |
| COURSE TYPE <i>Background, General Knowledge, Scientific Area, Skill Development</i> | BACKGROUND | | |
| PREREQUISITES: | MATHEMATICS, ATMOSPHERIC CHEMISTRY | | |
| TEACHING & EXAMINATION LANGUAGE: | GREEK ENGLISH FOR ERASMUS STUDENTS | | |
| COURSE OFFERED TO ERASMUS STUDENTS: | YES | | |
| COURSE URL: | https://eclass.duth.gr/courses/TMC113/ (Lectures) https://eclass.duth.gr/courses/TMC105/ (Labs) | | |

2. LEARNING OUTCOMES

| | | | | | | | | | | | | |
|---|--|--------------------------------------|----------------|-----------------------------|-------------------------------------|--|------------------------|-----------------------|------------------------|--|-----------------|--|
| Learning Outcomes <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i> | | | | | | | | | | | | |
| <p>The goal of this course is the familiarization of the students with the atmospheric pollution problem and the physicochemical processes that take place in the atmosphere. After the completion of the course the students will be able to:</p> <ul style="list-style-type: none"> understand the role of the chemical compounds in the atmosphere estimate the effect of the radiation in the atmosphere understand the physicochemical properties of the aerosols and the ways of their introduction in the atmosphere understand the removal mechanisms of the atmospheric pollutants and the role of the acid rain take place in atmospheric pollutant measurements that originate from various emission sources (industry, vehicles etc.) analyze data from atmospheric emission sources and accomplish a complete environmental survey | | | | | | | | | | | | |
| General Skills <i>Name the desirable general skills upon successful completion of the module</i> | | | | | | | | | | | | |
| <table border="0"> <tr> <td><i>Search, analysis and synthesis of data and information,</i></td> <td><i>Project design and management</i></td> </tr> <tr> <td><i>ICT Use</i></td> <td><i>Equity and Inclusion</i></td> </tr> <tr> <td><i>Adaptation to new situations</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Decision making</i></td> <td><i>Sustainability</i></td> </tr> <tr> <td><i>Autonomous work</i></td> <td><i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Teamwork</i></td> <td></td> </tr> </table> | <i>Search, analysis and synthesis of data and information,</i> | <i>Project design and management</i> | <i>ICT Use</i> | <i>Equity and Inclusion</i> | <i>Adaptation to new situations</i> | <i>Respect for the natural environment</i> | <i>Decision making</i> | <i>Sustainability</i> | <i>Autonomous work</i> | <i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i> | <i>Teamwork</i> | |
| <i>Search, analysis and synthesis of data and information,</i> | <i>Project design and management</i> | | | | | | | | | | | |
| <i>ICT Use</i> | <i>Equity and Inclusion</i> | | | | | | | | | | | |
| <i>Adaptation to new situations</i> | <i>Respect for the natural environment</i> | | | | | | | | | | | |
| <i>Decision making</i> | <i>Sustainability</i> | | | | | | | | | | | |
| <i>Autonomous work</i> | <i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i> | | | | | | | | | | | |
| <i>Teamwork</i> | | | | | | | | | | | | |

| | |
|--|---|
| <i>Working in an international environment</i> | <i>Critical thinking</i> |
| <i>Working in an interdisciplinary environment</i> | <i>Promoting free, creative and inductive reasoning</i> |
| <i>Production of new research ideas</i> | |
| Adaptation to new situations | |
| Decision making | |
| Autonomous work | |
| Respect for the natural environment | |

3. COURSE CONTENT

1. Atmosphere: the layers of the atmosphere, wind circulation, pollutants transportation in the atmosphere, expressing the amount of a substance in the atmosphere
2. Chemical compounds in the atmosphere, atmospheric lifetime
3. Atmospheric radiation, radiation absorption by atmospheric gases, energy balance for Earth and atmosphere
4. Atmospheric aerosol, aerosol size distributions, aerosol chemical composition, water and atmospheric particles, formation of major inorganic compounds, elemental carbon, organic carbon, secondary organic carbon
5. Removal processes of pollutants, wet deposition of gas-phase pollutants, wet deposition of aerosols, acid rain
6. Atmospheric dispersion and diffusion

Laboratory courses:

EXERCISE 1: Number concentration measurements of atmospheric particles

EXERCISE 2: Differential Optical Absorption Spectroscopy

EXERCISE 3: Ambient sulfur dioxide measurements

EXERCISE 4: Ambient particulate sulfate and nitrate measurements

EXERCISE 5: PM_{2.5} filter sampling method and analysis with ionic chromatography

EXERCISE 6: Determination of pH in precipitation

4. LEARNING & TEACHING METHODS - EVALUATION

| | | |
|--|---|--------------------------|
| TEACHING METHOD <i>Face to face, Distance learning, etc.</i> | Face to face | |
| USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i> | Use of ICT in teaching and laboratory education, usage of board | |
| TEACHING ORGANIZATION <i>The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc. The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i> | Activity | Workload/semester |
| | Lectures | 40 |
| | Exercises/problems | 20 |
| | Laboratory exercises | 20 |
| | Laboratory reports | 30 |
| | Bibliographic research and analysis | 40 |
| | Total | 150 |
| STUDENT EVALUATION <i>Description of the evaluation process</i> | | |

Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others

Please indicate all relevant information about the course assessment and how students are informed

Formative

Laboratory exercises (30%)

Written exam, problem solving (70%)

5. SUGGESTED BIBLIOGRAPHY

1. «ΣΗΜΕΙΩΣΕΙΣ ΑΤΜΟΣΦΑΙΡΙΚΗΣ ΡΥΠΑΝΣΗΣ» Ευαγγελία Κωστανίδου, ΕΛΕΥΘΕΡΟ στο e- class.
2. «ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΑΤΜΟΣΦΑΙΡΙΚΗΣ ΡΥΠΑΝΣΗΣ» Ευαγγελία Κωστανίδου, ΕΛΕΥΘΕΡΟ στο e-class.
3. «CHEMISTRY OF THE UPPER AND LOWER ATMOSPHERE» B. Finlayson- Pitts and J. Pitts J. Academic Press 2000.
4. «ATMOSPHERIC CHEMISTRY AND PHYSICS» J. Seinfeld, S. Pandis. Wiley Interscience, Second Edition 2006 (Στην βιβλιοθήκη του ΔΠΘ με αριθμό καταχώρησης QC 879.6.S45 2006).

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

| | |
|---|---|
| Teacher (full name): | Evangelia Kostenidou |
| Contact details: | ekosteni@env.duth.gr |
| Supervisors: (1) | YES |
| Evaluation methods: (2) | Written examination with distance learning methods |
| Implementation Instructions: (3) | The exams will take place in zoom. All the students will be connected through their university account, otherwise they will not have access. During the examination the webcam and the microphone will be on. At the beginning of the examination each student will show their ID on the webcam for the verification of his/her identification. The examination will have a total duration of 3 hours. The exercises will be sent to the email account of each student, and they will be a combination of multiple-choice test and problem solving. The answers will be scanned (with a scanner or a camera) and they will be sent to an email account (that the professor will give in advance) before the end of the exams. |

(1) Please write YES or NO

(2) Note down the evaluation methods used by the teacher, e.g.

- *written assignment* or/and exercises
- written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(3) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises**: the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and **any other necessary information**.

b) in case of **oral examination with distance learning methods**: the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.