CHEMISTRY
Course Code: M 104
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Simona Varvara, PhD
Laboratory/seminar tutor: Roxana Bostan, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	5

COURSE AIMS:
The course attempts to develop the capacity for knowledge and understanding of the basic concepts specific to chemistry and their application in the environmental engineering.

ENTRY REQUIREMENTS: -

COURSE CONTENTS:
1. Introduction to chemistry. Fundamentals of chemistry.
2-3. Atomic models. Atomic structure. Relations between the atomic structure and periodic table of elements. Periodicity law
4-6. Chemical bonds: Ionic bonds. Covalent bonds. Coordinative bonds. Metallic bonds.
7. Solutions. Solution's concentrations (percentage, molar, normal etc.). Problems
8-9. Arrhenius law. Acids. Bases. Protolithic equilibrium of water. pH and pOH of solutions.
10. Salts hydrolysis.
11-12. Basics of precipitation, redox and complex formation reactions.
13-14. Chemical analysis. Qualitative analysis. Identification of cations and anions from solutions

LAB WORKS AND SEMINARS:
1. Safety rules in the chemistry lab. Regulation in the chemistry laboratory. Operations, equipment and utensils used in the chemistry lab
2. Solutions. Expression of concentration of solutions. Problems.
3. Laboratory solution preparation – practical work
4. Titrated solution. Determination of the solution's factor
5. Determination of the solution pH
6. Practical determination of soil quality (pH, content of N, P, K, moisture etc.)
7. Qualitative chemical analysis. Methods for detecting cations and anions.
8. Assessment of the laboratory knowledges

TEACHING METHODS:
Lecture, conversation, exemplification, practical laboratory work.

LEARNING OUTCOMES:
1 Explaining the mechanisms, processes and effects of anthropogenic or natural origin which determine and influence the environmental pollution
- Defining the basic concepts needed to apply scientific theories and methodology environment.
- Using scientific knowledge base in defining and explaining specific concepts and environmental engineering
- Application of scientific knowledge to define and explain the specific concepts and environmental engineering
- Qualitative and quantitative analysis of natural phenomena and technological processes to prevent and reduce environmental impact.
2. Identification and compliance with professional ethics and deontology, taking responsibility for decisions and risks
3. Identify roles and responsibilities in a multidisciplinary team and application the techniques and effective work relationships within the team

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
A one-hour written examination (60% of the final grade). The examination of the practical abilities acquired in the laboratory (40% of the final grade).
The course is given as a combination of lectures, lab works and seminars. There is a 100% attendance requirement for lab works and seminars.

RECOMMENDED READING:

- A. J. Fletcher, Chemistry for Chemical Engineers, Ventus Publishing ApS, 2012, ISBN: 978-87-403-0249-3
- R. Elsair, Fundamentals of Chemistry, Ventus Publishing ApS, 2012, ISBN 978-87-403-0105-2
- M. L. Ungureşan, D. M. Gligor, General chemistry, Editura Galaxia, Gutenberg, Cluj-Napoca, 2012, ISBN 978-973-141-448-5

TECHNICAL MECHANICS
Course Code: M 110
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Dorin Victor, PhD
Seminar tutor: Popa Dorin Victor, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Summer	Grade	4

COURSE AIM:
The course presents a unified conception about the concepts related to elements of rigid solid mechanics that studies the balance and movement of bodies, based on some simplifying assumptions, namely: the bodies are considered rigid without the possibility of deformation; by their properties, these bodies represent the ideal mechanical models;

COURSE CONTENTS:
1. Introductory elements of technical mechanics. Rigid solid mechanics;
2. Statics of material point
3. Free material point. Material point subjected to bonds
4. Statics of rigid solid
5. Forces couples
6. Ideal bonds of rigid solid
7. Kinematics of material point
8. Kinematics of rigid solid
9. Dynamics
10. Dynamics of material point
11. Dynamics of rigid solid

TEACHING METHODS:
Lecture, conversation, exemplification.

LEARNING OUTCOMES
- Understanding and knowing the technical mechanics that presents the mechanics general framework, the main concepts and notions this discipline is based on;
- Understanding and knowing the Statics witch representing the mechanics part that deals with the study of equivalent strength systems and with the balance conditions;
- Understanding and knowing the Kinematics witch is the part of theoretical mechanics that studies the movement of material systems without considering the system's forces and masses;
- Understanding and knowing the Dynamics witch is the part of mechanics that studies the movement of material systems taking into account the forces;

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 70%, Verification during the semester- 30%.

RECOMMENDED READING:

- Valcovici, V.,Balan,St.,R.Voinea.,-*Mecanica Teoretica*
- Ripianu,A.,Popescu,P.,Balan,B., - *Mecanica Tehnica*, Didactic and Pedagogic Publishing House, Bucharest, 1984;
- Olariu, V.,Sima,P.,Achiriloaie,V.,- *Mecanica Tehnica*,E.T.Brasov.1989;
- Bauşic,V., Horbaniuc,D., Palihovici,V., Leon,D., Bejinariu,V. *Rezistenţa materialelor*, vol. I, Rotaprint I.P. Iaşi, 1978
- Buzdugan, Gh. *Rezistenţa materialelor*, Didactic and Pedagogic Publishing House, Bucharest, 1984
- Buzdugan, Gh., et. al., *Rezistenţa materialelor.Aplicaţii*, Romanian Academy Publishing House, Bucharest, 1991
- Popa D., *Mecanica Tehnica,* Seria Didactica, Universitatea „1 Decembrie 1918 ", Alba Iulia, 2010

ENVIRONMENTAL CHEMISTRY
Course code: M112
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Maria, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Summer	Grade	4

COURSE AIMS:
Students will learn to understand specific concepts in the field of environmental chemistry.

COURSE CONTENTS:
1. Fundamentals of Environmental Chemistry
2. Pollution types and sources.
3. Environmental cycles of elements (oxygen, carbon, nitrogen, sulfur) and water.
4. Atmospheric chemistry and Air pollution
5. Soil Chemistry and Pollution
6. Aquatic chemistry and Water pollution

TEACHING METHODS:
Lecture, Discussions, Exemplification

LEARNING OUTCOMES:
- Familiarize students with the various divisions of the environment
- Explain the gaseous components of the environment and the chemistry responsible for the observed variation, processes such as; ozone depletion, greenhouse effect, global warming.
- Understanding of the organic and inorganic chemical processes controlling the chemical composition of the aquatic environment and the fate of pollutants in the aquatic environment.
- Familiarize students with the main constituents of soils and the way they are formed. Introduce some important characteristics of soils, their classification and the various ways in which soils are polluted.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 60%, Verification during the semester (project, practical activities) - 40%.

RECOMMENDED READING:

- Popa, M, Bostan, R. Varvara, S., Environmental *Chemistry – practical activities*, Alba Iulia, 2008;
- Manahan, Stanley E. *Environmental Chemistry,* Boca Raton: CRC Press LLC, 2000

ATMOSPHERIC PHYSICS
Course Code: M113
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Mihai Teopent Corcheș, PhD
Seminar tutor: Mihai Teopent Corcheș, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	28	2	Summer	Grade	3

COURSE AIMS:
The overall objective of the course:
-Developing scientific thinking, acquiring the skills needed to observe environmental phenomena and to solve specific problems correctly;
Specific objectives:
- Acquiring the skills needed to effectively use information sources, developing individual study skills and teamwork skills;

ENTRY REQUIREMENTS:
- Physics

COURSE CONTENTS:
The course covers the following main topics:
-Atmospheric composition;
-Static atmosphere;
-Thermodynamic processes in the atmosphere;
-Solar thermal radiation and Earth-atmosphere system;
-Sun and solar constant;
-Short wavelength radiation in the atmosphere;
-Earth and atmospheric radiation. Radiation balance;
-The transport of heat into the atmosphere;
-The thermal regime of the atmosphere;
-The water cycle in the Earth-atmosphere system;
-Air movement;
-The hydrodynamic cycle;
-Liquid precipitation
-Snow
-Evapotranspiration;
The seminar covers the following main topics:
-Components of the atmosphere;
-Water vapor in the atmosphere;
-Atmospheric pressure - atmospheric pressure measuring instruments. Air pressure variation with altitude;
-Atmospheric humidity. Determining relative humidity of the atmosphere. Methods and instruments for measuring relative humidity and precipitation;
-Air movement. Methods and instruments for measuring wind speed and direction;
-Air temperature. Tools to determine and record the air temperature;
-Solar radiation. Methods and instruments for measuring solar radiation.

TEACHING METHODS:
Lecture, conversation, exemplification.

LEARNING OUTCOMES:
Professional Skills
Knowing and appropriate using the specific concepts of this domain;
Explaining, modeling and interpreting the physical phenomena and processes that occur in the atmosphere;
Knowing the experimental methods used to study Atmospheric physics

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
A two-hour written examination (75% of the final grade)
Carrying out practical work. (25% of the final grade)

RECOMMENDED READING:

- Devendraa Siingh, A.K. Singh, R.P. Patel, Rajesh Singh, R.P. Sin 2009, *Thunderstorms, lightning, sprites and magnetospheric whistler-mode radio waves*
- Ayşegül YILMAZ, 2006, *Atmosphere Physics*;
- *Abdel Hannachi, 2012, Climate Variability - Some Aspects, Challenges and Prospects*

ANALYTICAL CHEMISTRY AND INSTRUMENTAL ANALYSIS

Course Code: M 203

Type of course: compulsory

Language of instruction: English tutoring available for Erasmus students

Name of lecturer: Simona Varvara, PhD

Laboratory tutor: Roxana Bostan, PhD

Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	5

COURSE AIMS:

- Acquiring and understanding the basics of analytical chemistry and instrumental analysis in order to apply them in environmental issues.
- Developing the students' scientific thinking and cognitive skills in order to find correct solution to specific problems related to environmental engineering.

ENTRY REQUIREMENTS:

Chemistry, Physics

COURSE CONTENTS:

1 Introduction to analytical chemistry.
2. Overview of titrimetry. Acid–Base titration curves. Quantitative and qualitative applications
3. Titrations based on oxidation-reduction reactions. Redox titration curves. Redox indicators. Quantitative applications to the analysis of the environmental samples
4. Precipitation Titrations. Titration curve. Types of indicators. Quantitative applications.
5. Titrations based on complexation Reactions. Complexon. Complexometric titration curves. Quantitative applications to the analysis of the environmental samples
6. Gravimetric analysis. Applications to the analysis of the environmental samples
7. Overview of spectroscopic methods of analysis
8-9.Ultraviolet-Visible Spectrophotometry (UV-VIS) – principles, instrumentation, applications to the analysis of the environmental samples.
10-11. Atomic Absorption Spectroscopy (AAS)– principles, instrumentation, applications to the analysis of the environmental samples
12. Emission Absorption Spectroscopy (EAS) - principles, instrumentation, applications to the analysis of the environmental samples.
13. X-ray spectrometry - principle, instrumentation, applications to the analysis of the environmental samples.
14. Basics on chromatographic methods. Practical applications.

LAB WORKS:

1. Safety rules in the laboratory. Rules in the chemistry laboratory. Processing results of chemical analysis
2. Acid-base titrimetry: standardization of NaOH. Determination of acetic acid by titration.
3. Titrations based on complexation reactions. Determination of Mg^{2+} and of the water hardness.
4. Titrations based on redox reactions. Standardization of $KMnO_4$. Determination of Cu^{2+} from by iodometry.
5. Spectrophotometric determination of iron from liquid samples (UV-VIS absorption spectrum, the calibration curve method).
6. Quantitative chemical analysis by X-ray spectrometry. Determination of the heavy metals from wastewaters.
7. Assessment of the laboratory knowledges

TEACHING METHODS:

Lecture, conversation, exemplification, practical laboratory work.

LEARNING OUTCOMES:

1. Characterization and interpretation of environmental factors by analysing physico-chemical and biotic characteristics.
   - Description of environmental factors and their interaction with natural phenomena and man-made that affect the quality
   - Interpretation of the mechanisms by which natural and anthropogenic factors leads to environmental deterioration
   - Configuring methodologies that enable completion of a full investigation process environmental samples
   - Using appropriate methods of analysis to characterize the environmental factors.
2. Identification and compliance with professional ethics and deontology, taking responsibility for decisions and risks

3. Identify roles and responsibilities in a multidisciplinary team and application the techniques and effective work relationships within the team

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

A one-hour written examination (60% of the final grade).
The examination of the practical abilities acquired in the laboratory (40% of the final grade).
The course is given as a combination of lectures and lab works. There is a 100% attendance requirement for lab works.

RECOMMENDED READING:

- D. Harvey, Modern Analytical Chemistry. The Mc Graw-Hill Companies, Inc., 2001.
- S. Petrozzi, Practical Instrumental Analysis: Methods, Quality Assurance and Laboratory Management, Wiley, 2012
- D. A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, 2006

MATERIALS STRENGTH
Course Code: M 204
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Dorin Victor, PhD
Seminar tutor: Popa Dorin Victor, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	4

COURSE AIM:
The course presents a unified conception about the deformable solid mechanics problems. It should be taken into account that, under the action of forces, the bodies deform according to certain rules. The Materials Strength course studies the efforts (internal forces) occurring in elements, and their deformations under the action of external forces, taking into account the physical and mechanical properties of bodies;

COURSE CONTENTS:
1. Deformable solid mechanics. Concepts of materials strength. The subject of materials strength;
2. Effort, stress, displacement;
3. Centric stretching and compression. Definition; examples;
4. Shearing elements. The shearing of the section-reduced parts;
5. Elements needed for bending;
6. Straight bars torsion;
7. Straight bars buckling;
8. Compound stresses;
9. Flat surfaces geometric features;

TEACHING METHODS:
Lecture, conversation, exemplification.

LEARNING OUTCOMES
- Understanding and knowing the introductory elements of deformable solid mechanics, strength of materials concepts, object resistance of materials, effort, stress, displacement, centric stretching and compression, shearing elements, the shearing of the section-reduced parts required for bending, straight bars torsion and buckling, compound stresses, flat surfaces geometric features;
- applying the resistance coefficient method and monitoring the seepage of dams detour;

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 70%, Verification during the semester- 30%.

RECOMMENDED READING:

- Bauşic,V., Horbaniuc,D., Palihovici,V., Leon,D., Bejinariu,V., *Rezistenţa materialelor*, vol. I, Rotaprint Publishing House, I.P. Iaşi, 1978
- Buzdugan, Gh. *Rezistenţa materialelor*, Didactic and Pedagogic Publishing House, Bucharest, 1984
- Buzdugan, Gh. et. al., *Rezistenţa materialelor. Aplicaţii*, Romanian Academy Publishing House, Bucharest, 1991
- Comandar, C., Amariei, N. *Rezistenţa materialelor*, Cermi Publishing House, Iaşi, 1998
- Silaghi – Perju,D., *Rezistenţa materialelor*, Politehnica Publishing House,2004
- Valcovici, V.,Balan,St.,R.Voinea.,-*Mecanica Teoretica*
- Popa D., *Rezistenta Materialelor,* Seria Didactica, Universitatea „1 Decembrie 1918 ”, Alba Iulia, 2010

FLUID MECHANICS
Course Code: M 205
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ildiko Tulbure, PhD
Seminar tutor: Ildiko Tulbure, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	5

COURSE AIMS:

General aim:

- Knowing and understanding of basic concepts, theories and methods of Fluid Mechanics, their correct usage for describing environmental pollution processes as well as environmental protection ones.

Specific aims:

- Delivering theoretical and methodological basic notions related to Fluid Mechanics;
- Students customisation to the specific terminology and expressions of Fluid Mechanics;
- Presenting general notions related to laminar and turbulent flows;
- Explaining modelling methods of dynamic fluid systems.
- Understanding basic notions related to Fluid Mechanics, which will be used for describing specific phenomena regarding environmental pollution and environmental protection

ENTRY REQUIREMENTS:

Physics, Mathematics, Mechanics

COURSE CONTENTS:

- Introduction, goals and objectives of this course;
- Physical properties of fluids;
- Fluid Statics;
- Fluid kinematics;
- Ideal fluid dynamics;
- Principle of linear momentum and of angular momentum;
- Real fluid dynamics;
- Basics of urbulent flows;
- Pipe flows without pressure losses;
- Pipe flows with pressure losses;
- Mass and heat transfer in fluids;
- Characteristic numbers used for analysing fluid-dynamic processes
- Fluid-dynamic models used for describing environmental pollution phenomena
- Conclusions related to the relevance of fluid mechanics in environmental engineering

TEACHING METHODS:

Giving lectures, presenting real case studies, explaining industrial processes based on fluids, conversation, exemplification.

LEARNING OUTCOMES:

- usage of basic fluid mechanics notions in solving environmental pollution problems;
- gaining basic notions for further analysing and recess the environmental pollution and protection field;
- good expertise retrieval and systematic knowledge on the basis of deeper insights within the study of environmental pollution and protection subjects.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Oral examination – 60%; continuous assessment by preparing reports and delivering results of practical work in the laboratory – 30%; implication in solving problems during seminars – 10 %

RECOMMENDED READING:

- Tulbure, I.: *Mecanica fluidelor*. Didactica, University ”1 Decembrie 1918” Alba Iulia, 2014
- **Dan Gh. Ionescu: *Introducere în mecanica fluidelor*. Tehnică Publishing House. Bucharest, 2004.**

- Tulbure, I.: *Mecanica fluidelor – Lecture.* Institute for Applied Mechanics of the Clausthal Universito of Technology, Germany, 2003
- Jischa, M., F.: *Konvektiver Impuls-, Wärme- und Stoffaustausch.* Vieweg. Braunschweig, Germany, 1982.
- Irimie, I., I.: *Mecanica fluidelor şi maşini hidraulice*. Curs. Litografia Universităţii din Petroşani, 2000.
- Resiga, R.: *Mecanica fluidelor*, Curs, Litografia Universitatii Politehnice Timisoaara, 2003.
- Becker, E.: *Technische Strömungslehre (Mecanica fluidelor tehnică)*. Teubner, Stuttgart, 2005.

TRANSFER PHENOMENA AND UNIT OPERATIONS
Course Code: M 209
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ildiko Tulbure, PhD
Seminar tutor: Ildiko Tulbure, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	5

COURSE AIMS:
General aim:

- Knowing and understanding of basic concepts, theories and methods related to the analysis of transfer phenomena and unit operations as well as their correct usage for describing specific processes regarding environmental pollution and environmental protection.

Specific aims:

- Conveyance of theoretical and methodological basic notions related to tranfer phenomena and unit operations;
- Students customisation to the specific terminology used in mass and heat transfer phenomena and unit operations;
- Acquisition of basic notions used for understanding of specific aspects approached in future courses as well as in the future professional life.
- Presenting general calculation methods of processes related to impulse, mass and heat transfer in pipe flows and in plane flows;
- Presenting some thermodynamic systems used in environmental engineering;
- Understanding the usage way of transfer phenomena used in describing processes in environmental engineering.
- Gaining the competencies to successfully solve a complexe problem regarding impulse, heat or mass transfer in air and liquid flows in pipeline networks.

ENTRY REQUIREMENTS:
Physics, Mathematics, Chemistry, Fluid Mechanics

COURSE CONTENTS:

- Introduction, goals and objectives of this course;
- Transfer phenomena and unit operations – their analysis and application;
- Momentum transfer;
- Energy transfer;
- Mass transfer;
- Operations of momentum transfer;
- Operations of energy transfer;
- Operations of mass transfer;
- Similitude theory and dimensional analysis;
- Examples;
- Conclusions and applications in treating specific environmental pollution issues and environmental engineering matters.

TEACHING METHODS:
Giving lectures, presenting real case studies, explaining industrial processes based on momentum, energy and mass transfer, conversation, exemplification.

LEARNING OUTCOMES:

- explaining basic natural or anthropic mechanisms, processes and effects which are determing and influencing the environmental pollution;
- handling and solutioning specific environmental problems for assuring a sustainable development;
- characterising the state of environmental factors by analysing the characteristic physical, chemical and biotical parameters.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Oral examination – 60%; continuous assessment by preparing reports and delivering results of practical work in the laboratory – 20%; implication in solving problems during seminars – 20 %

RECOMMENDED READING:

- Tulbure, I., 2015: *Fenomene de transfer si operatii unitare*, lecture slides, Univ. "1 Decembrie 1918", Alba Iulia
- Vitan, F., 2007: *Fenomene de transfer*. Curs on-line pentru studenti.
- Otten. E W., 2003: *Repetitorium Experimentalphysik*. Springer, Berlin/Heidelberg
- Gavrila, L., 2000: *Fenomene de transfer*. Editura Alma Matter. Bacau
- Jischa, M., F., 1982: *Konvektiver Impuls-, Wärme- und Stoffaustausch (Schimb convectiv de impuls, caldura si materie)*. Editura Vieweg, Wiesbaden
- Haase, R., 1963: *Thermodynamik der irreversiblen Prozesse (Termodinamica proceselor ireversibile)*. Editura D. Steinkopff. Darmstadt.
- Tulbure, I., 2014: *Mecanica fluidelor*, note de curs, Univ. "1 Decembrie 1918", Alba Iulia
- Prigogine, I., Stengers; I. 1990: *Dialog mit der Natur*, Editura Piper, München
- Leca, A; Mladin, E., 1998 - *Transfer de căldură şi masa. O abordare inginerească*, Editura Tehnică, Bucureşti
- Lucas, K., 2007: *Thermodynamik: Die Grundgesetze der Energie- und Stoffumwandlungen,* Springer, Berlin

HYDRAULICS
Course Code: M 213
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ildiko Tulbure, PhD
Seminar tutor: Ildiko Tulbure, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	42	4	I	Grade	4

COURSE AIMS:
General aim:

- Knowing and understanding of basic concepts, theories and methods of Hydraulics, their correct usage for describing specific processes regarding pipe flows, water pipeline networks as well as regarding water pollution and installations for water protection.

Specific aims:

- Delivering theoretical and methodological basic notions related to hydraulic systems and water pipeline networks;
- Students customisation to the specific terminology used in Hydraulics;
- Presenting general calculation and modelling methods of laminar and turbulent pipe flows in hydraulic systems;
- Presenting some hydraulic systems used in environmental engineering;
- Understanding the usage way and the operating method of pipeline networks and of hydraulic systems;
- Gaining the competencies to apply hydraulic notions into the practice for solving concrete problems related to water pollution;
- Gaining the competencies to successfully solve a complexe problem regarding liquid flow in pipeline networks and cleaning polluted water.

ENTRY REQUIREMENTS:
Physics, Mathematics, Fluid Mechanics

COURSE CONTENTS:

- Introduction, goals and objectives of this course;
- Physical properties of liquids;
- Pressure variation in liquid flow;
- Ideal liquid flow, without pressure losses;
- Pressure losses in pipeline networks;
- Real liquid flow, with pressure losses;
- Laminar pipe flow with pressure losses ;
- Pipe flows without and with pressure losses;
- Turbulent pipe flow with pressure losses;
- Diagram of Nikuradse for laminar and turbulent pipeline flows;
- Steady-state flow in pipeline networks;
- Types of pipeline networks;
- Main principles for designing pipeline networks
- Conclusions regarding the relevance of hydraulics in environmental engineering

TEACHING METHODS:
Giving lectures, presenting real case studies, explaining industrial processes based on fluids, conversation, exemplification.

LEARNING OUTCOMES:

- usage of basic hydraulic notions in solving environmental pollution problems;
- gaining basic notions for further analysing and designing pipeline networks;
- good expertise retrieval and systematic knowledge on the basis of deeper insights within the study of environmental pollution and protection subjects.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Oral examination – 60%; continuous assessment by preparing reports and delivering results of practical work in the laboratory – 25%; implication in solving problems during seminars – 15 %

RECOMMENDED READING:

- Tulbure, I.: *Hydraulics*, Lecture slides, UAB, 2016
- Tulbure, I.: *Mecanica fluidelor*. Didactica, University ”1 Decembrie 1918” Alba Iulia, 2014
- Cioc, D., *Hidraulica,* Editura Didactică şi Pedagogică, Bucureşti 1983
- Iamandi, C., ş.a., *Hidraulica instalaţiilor,* Editura Tehnică, Bucureşti 2002
- Jischa, M., F.: *Konvektiver Impuls-, Wärme- und Stoffaustausch.* Vieweg. Braunschweig, Germany, 1982.
- Irimie, I., I.: *Mecanica fluidelor şi maşini hidraulice*. Curs. Litografia Universităţii din Petroşani, 2000.
- Kiselev, P.G., *Îndrumar pentru calcule hidraulice,* Editura Tehnică, Bucureşti 1988
- Becker, E.: *Technische Strömungslehre*. Teubner, Stuttgart, 2005.

THERMODYNAMICS AND TRANSFER PHENOMENA
Course Code: M 214
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ildiko Tulbure, PhD
Seminar tutor: Ildiko Tulbure, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	42	4	Summer	Grade	4

COURSE AIMS:
General aim:

- Knowing and understanding of basic concepts, theories and methods of Thermodynamics, their correct usage for describing specific processes regarding heat transfer in liquid flows and pipeline networks as well as regarding heat transfer in environmental pollution and in specific installations for environmental protection.

Specific aims:

- Delivering theoretical and methodological basic notions related to thermodynamic systems used for heat transfer;
- Students customisation to the specific terminology used in Thermodynamics;
- Presenting general calculation methods of processes related to heat transfer in pipe flows and in plane flows;
- Presenting some thermodynamic systems used in environmental engineering;
- Understanding the usage way of thermodynamic systems for heat transfer;
- Gaining the competencies to apply thermodynamic notions into the practice for solving concrete problems related to environmental protection;
- Gaining the competencies to successfully solve a complexe problem regarding heat transfer in air and liquid flows in pipeline networks.

ENTRY REQUIREMENTS:
Physics, Mathematics, Fluid Mechanics

COURSE CONTENTS:

- Introduction, goals and objectives of this course;
- Thermodynamic states and processes, thermodynamic state parameters;
- Thermodynamic systems;
- Real gas, perfect gas;
- First law of thermodynamics;
- Perfect gas state transformation;
- Second law of thermodynamics;
- Exergy and anergy. Entropy. Entropy law. Entropic charts;
- Fuels combustion;
- Steams and humid air;
- **Cyclic processes**. Carnot cycle. Motor cycle. Generator cycle. Examples of theoretical thermodynamic cycles and their materialisation;
- Mass transfer. Examples;
- Heat transfer. Examples;
- Conclusions and applications in modelling of environmental pollution and in environmental engineering

TEACHING METHODS:
Giving lectures, presenting real case studies, explaining industrial processes based on heat transfer, conversation, exemplification.

LEARNING OUTCOMES:

- usage of basic thermodynamic notions in solving environmental pollution problems;
- gaining basic notions for further analysing and designing thermodynamic processes;
- good expertise retrieval and systematic knowledge on the basis of deeper insights within the study of environmental pollution and protection subjects.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Oral examination – 60%; continuous assessment by preparing reports and delivering results of practical work in the laboratory – 20%; implication in solving problems during seminars – 20 %

RECOMMENDED READING:

- Tulbure, I., 2016: *Thermodyamics and transfer phenomena*, Lecture slides, UAB.
- Ionel, I., 2003: *Introducere în termotehnică*, curs pe suport CD şi în web, Ed. Politehnica, Timişoara.
- Jădăneanţ, M., Ionel, I. ş.a.,2001: *Termotehnică şi maşini termice în experimente*, Ed. Politehnica, Timişoara
- Popa, B., Mercea, V., 1982: *Termotehnică,* Editura Tehnica, Bucuresti
- Jischa, M., F., 1982: *Konvektiver Impuls-, Wärme- und Stoffaustausch (Schimb convectiv de impuls, caldura si materie)*. Editura Vieweg, Wiesbaden
- Leca, A; Mladin, E., 1998 - *Transfer de căldură şi masa. O abordare inginerească*, Editura Tehnică, Bucureşti
- G. Cerbe , H.-J. Hoffmann, 2002*:* Einführung in die Thermodynamik: Von den Grundlagen zur technischen Anwendung, Ed. Hanser, Bonn
- Lucas, K., 2007: *Thermodynamik: Die Grundgesetze der Energie- und Stoffumwandlungen,* Springer, Berlin

TOPOGRAPHY
Course Code: M 215
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ioan IENCIU, PhD
Seminar tutor: George Voicu, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	6	Summer	Grade	4

COURSE AIMS:
The program has established the structure of a course of general surveying and cadastre endpoints of course referring to the proper preparation of a plan topographical and thematic plans in areas such as agriculture, construction, etc., which are documents always preceded by surveying and geodetic, and finally the preparation of topographic maps or plans. Also on the work they are drawn topographical cadastral documentation underlying the development of environmental plans and risk plans.

ENTRY REQUIREMENTS:

COURSE CONTENTS:
Course contents:
1. The aim of the course. Earth's shape and size. Systems and axes. Measurement units.
2. Benchmarking, extension of alignments and angle measurement - methods
3. Direct and indirect measurement of distances - equipment
4. Indirect measurement distances
5. topographic triangulation networks - general
6. Guidelines and calculating the coordinates
7. Traverse, erasure, reporting points
8. Getting altimetry and compiling profiles
9. Introduction to the land registry and cadastral legislation
10. Cadastre general administrative demarcation of territories
11. Categories of use and the numbering of cadastral
12. Land Registry
13. Specialty cadastre
14. Cadastral documentation

Laboratory contents:
1. Getting the topography safety
2. Units. The materialization of topographic points
3. Apparatus terrain
4. Measurement of horizontal and vertical angles
5. Measuring Distances
6. Calculation orientation, side, and coordinates
7. Poligonaţia, raising details planimetric and altimetry
8. Drawing up topographical plans and profiles
9. Calculation surfaces
10. The delimitation of administrative territories
11. cadastral plans, cadastral categories of use and the numbering
12. Acts property
13. Cadastre specialty
14. Supporting laboratory work

TEACHING METHODS:
Instruction is a combination of lectures, conversation and theoretical and practical examples

LEARNING OUTCOMES:
C6. Introduction of best technologies in implementing environmental strategies and plans in accordance with the law

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Exam at least 2 test subjects - oral / written examination and Partial test (60% of the final grade)
Test of the lab - practical (40% of the final grade)

RECOMMENDED READING:

- *Deaconescu, C. - Topografie şi desen tehnic, Editura Didactică Pedagogică, Bucureşti, 1979;*
- *Dima, N . ş.a. - Topografie minieră, Editura Corvin , Deva, 1996;*
- *Dima, N. ş.a. – Topografie generală şi elemente de topografie minieră, Editura Universitas, Petroşani, 2005;*
- *I. Ienciu, L. Oprea, M. M. Tudoraşcu - Topografie şi cadastru, Editura Risoprint, Cluj-Napoca, 2014 ;*
- *Leu, I.N. ş.a - Topografie şi Cadastru, Editura Universul, Bucureşti, 2000;*
- *Mihăilă, M., ş.a. - Cadastru general şi publicitatea imobiliară, Editura Ceres, Bucureşti, 1995;*
- *Olaru, Gh., ş.a. - Cadastru funciar, Editura Ceres, Bucureşti, 1978;*
- *Oprea, L.; Tudoraşcu, M. – Cadastru general, Seria Didactica, Universitatea "1 Decembrie 1918" Alba Iulia, 2013;*
- *Oprea, L. - Cadastru – Îndrumător de proiect şi practică cadastrală, Editura Aeternitas, Alba Iulia, 2009;*
- *Pădure, I., Tudoraşcu, M., Oprea, L. - Cadastru funciar: in memoriam, Editura Risoprint, Cluj-Napoca, 2009;*
- *Pădure, I.; Kovacs L. - Topografie Generală, Editura Risoprint, Cluj Napoca, 2005;*
- *Russu, A. - Topografie cu elemente de geodezie şi fotogrammetrie, Editura Agrosilvică, Bucureşti, 1968.*

INFO-GRAPHICS
Course Code: M 301
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ioan IENCIU, PhD
Seminar tutor: George Voicu, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	4

COURSE AIMS:
• The general objective of discipline is the implementation of a routine regarding computer-aided graphics. In order, to cover all topics, we chose to work with complementary themes applied to deepen the topics treated in the course.

ENTRY REQUIREMENTS:
-

COURSE CONTENTS:
1. General concepts of graphical data processing;
2. Raster and vector images;
3. Surfer - software;
4. Vextractor - software;
5. AutoCAD - General remarks;
6. AutoCAD - Creating and editing objects;
7. AutoCAD - dimensioning objects;
8. AutoCAD - the georeferencing of raster topographic plans;
9. AutoCAD - „Topograph" application;
10. AutoCAD - „TopoLT" application;
11. AutoCAD - „Sirot" application;
12. AutoCAD - drafting and plotting plans and maps.

Laboratory contents:
1. Notion of Safety in laboratory;
2. Vextractor – software: raster management, vectorization raster data, Export data;
3. Surfer – software: Graphic Mode Achieving Work, 2D models, 3D models, exporting data;
4. AutoCAD: Overview, settings, Import data, management work, creating layers objects, properties of objects, toolbars, drawing plans, georeferencing raster image, plotting works.
5. AutoCAD - „Topograph" application; AutoCAD - „TopoLT" application; AutoCAD - „Sirot" application;

Test of the lab.

TEACHING METHODS:
Instruction is a combination of lectures, conversation and theoretical and practical examples

LEARNING OUTCOMES:
C5. Using TIC in environmental engineering problems

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Colloquy at least 2 test subjects - written examination (60% of the final grade)
Test of the lab - practical (40% of the final grade)

RECOMMENDED READING:

- Ienciu, I.; Oprea, L. - Prelucrarea automată a datelor analitice şi grafice din topografie şi cadastru, Editura Aeternitas, Alba-Iulia, 2009;
- Ienciu, I.; Oprea, L. – Infografică pentru topografie şi cadastru, Seria Didactica, Universitatea „1 Decembrie 1918", Alba-Iulia, 2009;
- Ienciu, I. - Exploatarea programelor topografice, Seria Didactica, Universitatea „1 Decembrie 1918", Alba-Iulia, 2006;
- Ienciu, I. - Optimizarea reţelelor geodezice în cadastru, Editura Risoprint, Cluj-Napoca, 2006;
- Ienciu, I.; Rîşteiu, M.; Wainberg, D. - Suport informatic de digitizare a datelor din topografie şi cadastru, Editura Aeternitas, Alba Iulia, 2003;
- *** - Manualul inginerului geodez, Volumul II, Editura tehnică Bucureşti, 1985;

- *** - Manualul inginerului geodez, Volumul III, Editura tehnică Bucureşti, 1985;
- *** - Surfer, Help;
- *** - Vextractor, Help;
- *** - AutoCAD, Help;
- Aplicaţia TopoLT, Help;
- *** - Aplicaţia Topograph, Help.

GIS APPLIED IN ENVIRONMENTAL ENGINEERING
Course Code: M 303
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Tudor Borşan, PhD Eng
Seminar tutor: Tudor Borşan, PhD Eng
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	2 hour of lecture per week / 2 hour of seminar per week	Autumn	Grade	4

COURSE AIMS:
- Knowing, understanding and a correct using of fundamental ideas concerning concepts specific to GIS.

ENTRY REQUIREMENTS:
Cartography; Geomorphology; CAD techniques.

COURSE CONTENTS:
The course covers the following main topics:
- Introduction and theoretical issues in GIS;
- Areas of GIS applicability;
- GIS components;
- GIS functions;
- Spatial data structures. Internal representation of vector layers. Internal encoding of a raster;
- Databases;
- Spatial data acquisition;
- Data conversions. Data import. Import from other GIS software. Import from CAD software;
- Data structures. Designing a database for attribute data;
- Acquiring and integrating data;
- Attribute and spatial queries;
- Building surface models;
- Exploratory data analysis;
- Maps and digital cartography. Thematic mapping techniques.

The seminar covers the following main topics:
- Preparation of a GIS project;
- GIS products;
- Arc Gis Desktop's modules;
- **C**onversion of analog cartographic products;
- Building new shapefile;
- Building new geodatabase;
- Map rectification, georeferencing and digitizing;
- The digitizing process. Digitizing regimes;
- Using symbols and creating annotations in GIS;
- Integrating and manipulating attribute data;
- Attribute and spatial queries;
- Building surface models;
- Spatial analysis;
- Thematic mapping techniques.

TEACHING METHODS:
Conversation, exemplification.

LEARNING OUTCOMES:
- Using GIS enhances students' ability to think critcally about analyzing data.
- Using GIS promotes students' ability to use numbers and numeric skills, and to use tools that facilitate processing and transferreing information.;
- This technology enables students to visualize spatial patterns, linkages, and relationships. GIS is used not only in geography courses, but in environmental studies, earth science, history, mathematics, chemistry, biology, language arts,and other subjects.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

- A two-hour written examination (75% of the final grade)
- Carrying out practical work. (25% of the final grade)

RECOMMENDED READING:

- GIS by ESRI – Michael Minami, Using Arc Map, Enviromental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100, USA;
- GIS by ESRI – ***, Editing in Arc Map, Enviromental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100, USA;
- GIS by ESRI – Aleta Vienneau, Using Arc Catalog, Enviromental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100, USA;
- Wheatley,D., Gillings, M., Spatial Technology and Archaeology – The Archaeological Applications of GIS, 2002.

TECHNOLOGIES FOR ENVIRONMENTAL PROTECTION
Course Code: M 308
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Ildiko Tulbure, PhD
Seminar tutor: Ildiko Tulbure, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	6

COURSE AIMS:
General aim

- Knowing, understanding and correct usage of diverse basic notions, concepts and methods related to environmental engineering as well as clarifying the necessity of considering ecological aspects when different economic activities are planned to be carried out, so that their environmental impact should be as small as possible.

Specific aims:

- Presenting the theoretical and methodological basic notions related to environmental engineering;
- Students customisation to the specific environmental engineering terminology;
- Presenting general notions related to plants and devices used for environmental protection;
- Explaining designing methods of different plants used for environmental protection;
- Understanding basic notions related to environmental engineering.

ENTRY REQUIREMENTS:
Physics, Chemistry, General Ecology and Environmental Protection, Analysis and Synthesis of Technological Processes

COURSE CONTENTS:

- Introduction, goals and objectives of this course;
- Basics regarding environmental pollution and protection;
- General notions regarding technologies for environmental protection;
- Basics notions and concepts related to technologies for environmental protection;
- Crisis of ecosphere health status;
- Ecological toxicity;
- Ecological risk assessment;
- Technologies for air protection;
- Technologies for water protection;
- Technologies for soil protection;
- Biotechnologies for air, water and soil protection;
- The concept of sustainable development and its operationalisation;
- Waste management and recycling;
- Conclusions related to ecology relevance.

TEACHING METHODS:
Giving lectures, presenting and debating real case studies, conversation, exemplification of concrete situations regarding technologies for environmental protection.

LEARNING OUTCOMES:

- usage of basic knowledge regarding technologies for environmental protection in solving concrete pollution problems;
- gaining basic notions for further analysing and recess the environmental pollution and installations for environmental protection;
- good expertise retrieval and systematic knowledge on the basis of deeper insights within the study of environmental engineering subjects.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Oral examination – 40%; project work – 40%; - continuous assessment by preparing reports and delivering results of practical work in the laboratory – 20%

RECOMMENDED READING:

- Tulbure, I.: *Technologies for Environmental Protection*, Lecture slides, UAB, 2015
- Banu, A., Radovici, O.,M.: *Elemente de Ingineria si Protectia Mediului*. Editura Tehnica, Bucurresti, 2007
- Tulbure, I., 2013: *Technikbewertung (Technology Assessment)*, Lecture, Clausthal University of Technology, Germany
- Bank, M.: *Basiswissen Umwelttechnik*, 5th Edition, Editura Vogel, Würzburg, 2006
- Tulbure, I., 1997: *Zustandsbeschreibung und Dynamik umweltrelevanter Systeme*. UT Clausthal; Ed. Papierflieger, Germany, CUTEC+series, Nr. 25
- Banse, G., Nelson, G. L., Parodi, O., 2011: *Sustainable Development - The Cultural Perspective*, Edition Sigma, Berlin, Germany
- Jischa, M. F., 2005: *Herausforderung Zukunft (Future Challenge)*. Editura Spektrum Akademischer Varlag, Heidelberg, Berlin
- Negulescu, M. s.a.: *Protecţia mediului înconjurător*. Editura Tehnică, Bucureşti, 1995
- Club of Rome: http://www.clubofrome.org

WASTEWATER TREATMENT AND RECOVERY I

Course Code: M 311

Type of course: compulsory

Language of instruction: English tutoring available for Erasmus students

Name of lecturer: Simona Varvara, PhD

Seminar tutor: Roxana Bostan, PhD

Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Summer	Grade	4

COURSE AIMS:

- Developing the ability of the students to capitalize the practical knowledge of chemistry, biotechnology, biology and engineering and to apply them in the technological practice and control.
- Acquiring basic knowledge on urban wastewaters and on the mechanical and biological methods used for their treatment.

ENTRY REQUIREMENTS:

Chemistry, Analytical Chemistry and Instrumental Analysis, Mechanics, Hydraulics

COURSE CONTENTS:

1. Basic concepts on water pollution. The sources of water pollution.
2-3. Wastewaters. Types of wastewater. Wastewater quality indicators.
4. Physical, chemical and bacteriological properties of the wastewater.
5. Legislation. Council Directive 91/271/EEC concerning urban wastewater treatment
6. Basics principles of urban wastewater treatment. Urban wastewater pretreatment methods
7-8. Physical processes involved in the urban wastewater treatment. Mechanical urban wastewater treatment
9. Equipment used in the mechanical step of urban wastewater treatment.
10-12. Biological treatment of urban wastewater
13-14. Equipment used in the biological step of urban wastewater treatment

LAB WORKS:

1. Laboratory safety rules. Water management - principles and European regulations. Categories and water quality technical conditions - types of indicators and methods of determination. Collecting, preserving and transporting water samples to determine quality indicators
2. Determination of the main characteristics of water quality. Determination of pH, conductivity, hardness and the content of materials in suspension.
3. Determination of urban wastewater's chemical oxygen demand, CBO5 and CCO-Cr.
4. Determination of urban wastewater's turbidity and fix residue.
5. Determination of toxic metal ions from urban wastewaters by X-ray spectrometry.
6. Visit to wastewater treatment plant in Alba Iulia.
7. Assessment of the laboratory knowledge

TEACHING METHODS:

Lecture, conversation, exemplification, laboratory work.

LEARNING OUTCOMES:

1. Management and resolution of specific environmental issues for sustainable development
   - Description and application of concepts, theories and practical methods/technologies for determining environmental quality status
   - Qualitative and quantitative evaluation of natural phenomena and human activities affecting the quality of the environment
   - Identifying the best technical and technological solutions to implement professional projects of environmental engineering
2. Introducing the best technologies in the implementation of environmental strategies and plans in accordance with the law
   - Identification of accurate information about the best technologies available in the field
   - Identification and implementation of technical solutions to solve problems related to environmental engineering
   - Developing process analysis and technological projects in order to reduce environmental impact.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

A one-hour written examination (60% of the final grade). The examination of the practical abilities acquired in the laboratory (40% of the final grade).

The course is given as a combination of lectures, lab works and seminars. There is a 100% attendance requirement for lab works and seminars.

RECOMMENDED READING:

- M. von Sperling, Basic Principles of Wastewater Treatment, volumes 1-4, IWA Publishing House, London 2007
- D. Fatta-Kassinos, D. D. Dionysiou, K. Kümmerer (editors), Advanced Treatment Technologies for Urban Wastewater Reuse (The Handbook of Environmental Chemistry), Springer, 2016, ISBN-13: 978-3319238852

HYDRO-TECHNICAL DESIGNS OF CONSTRUCTIONS AND FACILITIES

Course Code: M 313
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Dorin Victor, PhD
Seminar tutor: Popa Dorin Victor, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	I	Grade	4

COURSE AIM:
Developing the capacity for knowing and understanding the basic hydro-technical facilities concepts.

COURSE CONTENTS:
1. General considerations;
2. Execution of earthworks in the drainage channels and collectors;
3. Dams of local materials;
4. Water leakage through and under earth dams;
5. Floods prevention and control;
6. Channel processes;
7. Accumulation works to mitigate flood waves;
8. Calculation of the gravity dams;
9. Setting the body and the comber of the rock-fill dams;
10. Hydraulic energy and power.

TEACHING METHODS:
Lecture, conversation, exemplification.

LEARNING OUTCOMES

- Understanding and knowing the basics of design, construction and operation of hydro-technical facilities and structures;
- Knowing and understanding the types of hydro-technical facilities and structures;
- developing the skills for design, construction and operation of hydro-technical facilities and structures;
- Knowing and understanding the calculation method of the gravity dams and of their design;
- developing skills for determining the loads acting on the arch dams;
- developing the ability to check the stability of the dam seepage;
- Understanding and calculating the seepage under dams,
- applying the resistance coefficient method and monitoring the seepage of dams detour

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 40%, Verification during the semester- 60%.

RECOMMENDED READING:

- Popovici, A., Popescu, C., *Baraje pentru acumulari de apa*, , vol. II, Tehnica Publishing House, Bucharest, 2002
- Popovici, A., Popescu, C., *Baraje pentru acumulari de apa*, vol. I, Tehnica Publishing House, Bucharest, 1992
- Priscu, R., *Constructii hidrotehnice*, vol. I, II, Didactic and Pedagogic Publishing House, Bucharest, 1993
- Raileanu, P., et al.., *Fundatii*, vol. I, II, Rotaprint Publishing House, IP Iasi,1992
- Nicolau, C., et al., *Executarea construcţiilor hidrotehnice pentru lucrări de imbunatatiri funciare*, CERES Publishing House, Bucharest, 1977;
- Popa,D., Amenajări si construcţii hidrotehnice, Seria Didactica,Alba Iulia,2013;

WASTEWATER TREATMENT AND RECOVERY II

Course Code: M 403

Type of course: compulsory

Language of instruction: English tutoring available for Erasmus students

Name of lecturer: Simona Varvara, PhD

Seminar tutor: Roxana Bostan, PhD

Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	4

COURSE AIMS:

- Developing the ability of the students to capitalize the practical knowledge of chemistry, biotechnology, biology and engineering and to apply them in the technological practice and control.
- Acquiring basic knowledge on urban wastewaters and on the mechanical and biological methods used for their treatment.

ENTRY REQUIREMENTS:

Chemistry, Analytical Chemistry and Instrumental Analysis, Mechanics, Hydraulics

COURSE CONTENTS:

1. Chemical treatment of wastewaters. Precipitation. Neutralization
2-3. Wastewaters coagulation and flocculation methods
4. Overview on advanced treatment technologies for urban wastewater. Nutrients removal from municipal effluents
5-6. Removal of phosphorus from wastewaters. Precipitation. Biological treatment. Treatment plants for biological phosphorus removal.
7-8. Removal of nitrogen from wastewaters. Nitrification. Denitrification. Treatment plants for biological nitrogen removal.
9. Adsorption. Ionic exchange. Electrocoagulation
10. Filtration, ultrafiltration, osmosis, reverse osmosis, air-stripping electrodialysis
11. Water sterilization
12-14. Sewage sludge treatment methods: Thickening. Dewatering. Digestion. Composting. Incineration.

LAB WORKS:

1. Laboratory safety rules. The use of various chemical and natural coagulants for wastewater turbidity removal using a Jar test equipment
2. Determination of phosphorous from wastewaters by UV-VIS spectrometry. Removal of phosphorous from wastewaters
3. Determination of ammonium from wastewaters by UV-VIS spectrometry. Removal of ammonium from wastewaters using natural and modified zeolites
4. The use of natural sorbents for the removal of heavy metals from wastewaters
5. Removal of nickel and chromium from wastewaters by electrocoagulation
6. Study visit to sludge treatment plant in Alba Iulia
7. Assessment of the laboratory knowledge

TEACHING METHODS:

Lecture, conversation, exemplification, laboratory work.

LEARNING OUTCOMES:

1. Management and resolution of specific environmental issues for sustainable development
   - Qualitative and quantitative evaluation of natural phenomena and human activities affecting the quality of the environment
   - Identifying the best technical and technological solutions to implement professional projects of environmental engineering
2. Introducing the best technologies in the implementation of environmental strategies and plans in accordance with the legislation
   - Identification and implementation of technical solutions to solve problems related to environmental engineering
   - Developing process analysis and technological projects in order to reduce environmental impact.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

A one-hour written examination (60% of the final grade). The examination of the practical abilities acquired in the laboratory (40% of the final grade).

The course is given as a combination of lectures and lab works. There is a 100% attendance requirement for lab works.

RECOMMENDED READING:

- D. Fatta-Kassinos, D. D. Dionysiou, K. Kümmerer (editors), Advanced Treatment Technologies for Urban Wastewater Reuse (The Handbook of Environmental Chemistry), Springer, 2016, ISBN-13: 978-3319238852
- F. R. Spellman Handbook of Water and Wastewater Treatment Plant Operations, Third Edition, CRC Press, 2013, ISBN 9781466553378

ENVIRONMENTAL IMPACT ASSESSMENT
Course Code: M 405
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Mihai Teopent Corcheș, PhD
Seminar tutor: Mihai Teopent Corcheș, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	70	5	Autumn	Grade	6

COURSE AIMS:
The overall objective of the course:
The objective of the course is to understand the process of assessing human impact on the environment and to develop the skills needed to prepare environmental impact assessment studies, to acquire knowledge of the environmental assessment applicable law, to learn the methods and practical procedures used for assessing the impact of various economic activities on the environment (matrices, checklists, cost-benefit analysis), as well as to construct graphical representations of the impact and to draw maps using GIS technology.
Specific objectives:
- Teaching the specific legislation and environmental impact assessment methods;
- Presenting the concepts, techniques and specific procedures used in environmental impact assessment;
- Training of practical skills needed to use noise measurement instruments and air pollutants dispersion modeling software - AERMOD;
- Preparing an environmental impact assessment study within project classes

ENTRY REQUIREMENTS:
-

COURSE CONTENTS:
The course covers the following main topics:
- Introduction to environmental impact assessment;
- Procedural stages of environmental impact assessment;
- Public participation in environmental impact assessment for plans and programs
- Environmental balance;
- Environmental Impact Assessment study;
- Assessment of plans and projects significantly affecting Natura 2000 sites
- Site report for IPPC environmental authorization
- Environmental risk assessment
- Methods of Environmental Impact Assessment
- Implementation phase of the Environmental Impact Assessment
- Legal aspects of the Environmental Impact Assessment

The seminar covers the following main topics:
- Environmental monitoring
- Methodology for Environmental Impact Assessment
- Health Impact Assessment
- Methodology for assessment of plans and projects significantly affecting Natura 2000 sites
- Qualitative determination of the environmental factors;
- Measures to reduce environmental impact;
- Methodology for environmental impact assessment for plans and programs.

TEACHING METHODS:
Lectures and seminars (The course is given as a combination of lectures and seminars.)

LEARNING OUTCOMES:
- Proper identification of all potential environmental effects of implementing a certain project
- Ability to establish proper measures for reducing the environmental effects of a specific project
- Ability to use instruments for measuring environmental noise
- Interpretation of environmental quality indicators in relation to the maximum admitted limits regulated by the relevant legislation
- Ability to establish a proper environmental monitoring program
- Ability to use GIS software for mapping the environmental impact of pollutants.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
A two-hour written examination (80% of the final grade)
Carrying out practical work / project writing. (20% of the final grade)

RECOMMENDED READING:

- Guidance on EIA Scoping, 2001, European Commission;
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment, 2013, European Commission;
- Strategic Environmental Assessment *Better Practice Guide - methodological guidance for strategic thinking in SEA*, 2012, Maria do Rosário Partidário, Lisbon;

FOOD SAFETY
Course code: M 406
Type of course: optional
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Maria, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Summer	Grade	4

COURSE AIMS:
This course will introduce the discipline and profession of food science through an overview of food composition, commodities, food quality and deterioration, food preservation, and product development.

COURSE CONTENTS:
1. Nature, aim and range of commodity science - commodity science as an interdisciplinary science
2. Division of commodity science - industrial and food commodity sciences
3. Commodities – properties and classifications
4. Quality of commodities - quality properties, factors determining quality, research, evaluation and control of quality
5. Microorganisms in food products - influence on quality characteristics of food products, classification, morphology and physiology of microorganisms.
6. Preservation and conservation of food products.
7. Normalization and certification - normalization and certification systems in the European Union, norms - structure, classification and numbering, normalization organizations

TEACHING METHODS:
Lecture, Discussions, Exemplification

LEARNING OUTCOMES:
- Better understand the field and processes involved with food science
- Recognize and identify basic characteristics of the chemical and physical properties of food.
- Recognize the types of microbial risks that may be present in foods
- Knowing the characterizing factors related to the primary food components carbohydrates, proteins, fats and sugar/sweeteners, etc.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 60%, Verification during the semester (project, practical activities) - 40%.

RECOMMENDED READING:

- Popa, M., *Food safety and quality*, Seria Didactica, Alba Iulia, 2012;
- Popa M., Dragan M., *Science of comodities*- The safety of food products, ROTABENE MEDIENHAUS, Rotenburg on der Tauber, 2013;

LAND MANAGEMENT
Course Code: M 408
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Popa Dorin Victor, PhD
Seminar tutor: Popa Dorin Victor, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Autumn	Grade	8

COURSE AIM:
Knowing the basics of the purpose and importance of spatial organizing and planning;

COURSE CONTENTS:
1. Geographical area. Organization, planning and sustainable development of the geographical area. General aspects;
2. Rural area;
3. Agricultural area - agricultural ecosystem;
4. Green area;
5. Urban area.

TEACHING METHODS:
Lecture, conversation, exemplification.

LEARNING OUTCOMES

- The ability to understand and apply the current Romanian legal framework and to align to the EU principles and directions
- Developing skills and aptitudes for optimal exploitation of natural and economic potential, organizing integrated energy transfer networks, information, goods, people, building an advanced technological infrastructure of the territory, development of settlements, equitable distribution of industrial sites and of social and cultural facilities.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
Written test examination - 60%, Verification during the semester- 40%.

RECOMMENDED READING:

- Candea, M.,Bran,F.,Cimpoeru,I., *Organizarea, amenajarea si dezvoltarea durabila a spatiului geografi*c – University Publishing House, Bucharest, 2006
- Motica,R., Trailescu,A., *Drept funciar amenajarea teritoriului si protectia mediului*.
- Bold, I., *Organizarea teritoriului*, Mirton Publishing House, Bucharest, 1999
- Minciu, R., - *Amenajarea turisctica a teritoriului* - Sylv Publishing House, Bucharest, 1995.
- 5. Mitrache St., Manole V., Bran, F., Stoian, M, Istrate I. - *Agroturism si turism rural* - Fax-Press Publishing House, Bucharest, 1996.
- Popa Cristin Nicolae, *Rolul administraţiei publice în procesul de urbanizare*, Doctoral dissertation, "Babeş-Bolyai" University, Cluj-Napoca, 2002
- ***2004,Romania – *Planul National de Dezvoltare 2004* – 2006 Ministerul Integrarii Europene, Bucharest
- ****Legislatie privind urbanismul si amenajarea teritoriului*, vol. I,II, MATRIX ROM Publishing House, Bucharest, 2008
- Popa D.,*Organizarea si Planificarea Teritoriului,* Seria Didactica, Universitatea „1 Decembrie 1918 ", Alba Iulia, 2011

ENVIRONMENTAL MANAGEMENT AND ECOLOGICAL RESTORATION
Course Code: M 410
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Mihai Teopent Corcheș, PhD
Seminar tutor: Mihai Teopent Corcheș, PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	48	4	Summer	Grade	4

COURSE AIMS:
The overall objective of the course:
To familiarize students with the main concepts, approaches, methods and techniques used in environmental management
Specific objectives:
-To learn specific concepts used in environmental management;
-To know the components of environmental management, its functions and the main mechanisms and tools used;
-To understand the role and importance of environmental management in organizations taking account of globalization;
-To develop the ability to design and draft an environmental policy and an environmental strategy;
-To develop the ability to synthesize and select the information necessary for making decisions on choosing and implementing an environmental management system.
-To create and develop the ability to analyze and propose solutions to improve the environmental management system in relation to legislation changes.

ENTRY REQUIREMENTS:
-

COURSE CONTENTS:
The course covers the following main topics:
- Ecology, environmental protection, sustainable development, management;
- Environmental Management System elements of an environmental management system;
- Environmental performance evaluation;
- Environmental audit;
- Life Cycle Assessment;
- Environmental labels and declarations;
- Ecological restoration;
- Protected areas management and reconstruction of degraded ecosystems;
- Exemplification of rehabilitation of degraded lands and possibilities of using these lands
- Exemplification of a rehabilitation study for waste rock dumps and tailings ponds from the mining industry;

The seminar covers the following main topics:
- Study of the regulations on environmental management; EMAS
- Study of the regulations on environmental management, ISO 14001
- Requirements for EMS;
- Integration of management systems within the organization. Synergy with quality management system and with other management systems;
- Analysis of the concept of continuous improvement of the environmental management system;
- Project management for the implementation of an environmental management system (presenting reports on the actions needed to implement an EMS in different organizations);
- Collecting the data required for environmental planning (thematic questionnaires, survey method);
- Interpreting the official and scientific data necessary in environmental studies. Case studies on corporate social responsibility.

SWOT analysis of environmental planning projects;
- Preparation and analysis of environmental plans;

TEACHING METHODS:
Lectures and seminars (The course is given as a combination of lectures and seminars.)

LEARNING OUTCOMES:
Professional Skills
- To master the specialized terminology used in environmental management;

- To demonstrate ability to use appropriate concepts of environmental management;
  To prepare projects for the analysis of the interaction between economic processes and natural and social environment;
- To apply methods, techniques and management tools for developing, implementing, monitoring and reviewing the organization's strategies and policies taking into account environmental management requirements.
- To prepare projects for the implementation of organizational strategies and policies taking into account environmental issues.
- To use methods and criteria for evaluating the organizational strategies and policies in relation to the environment.
- To adopt and implement decisions for small complexity organizations (on the whole or for a component).
  To develop and implement studies / papers on decision making in organizations
- To use standard criteria and methods for assessing the decision making process in organizations in relation to the environment
- To develop and implement studies / papers on decision making in organizations.
  To interpret the basic concepts and methods necessary for managerial decision making in lower complexity organizations (on the whole or for a component).
- To use domain-specific knowledge, to explain indicators that characterize the relation between organization and environment

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
A two-hour written examination (80% of the final grade)
Carrying out practical work. (20% of the final grade)

RECOMMENDED READING:

- Christopher J. Barrow, 1999, *Environmental Management: Principles and Practice*;
- Santosh Sarkar, 2010, *Environmental Management*;
- Bruce Mitchell, 2001, *Resource & Environmental Management* (2nd Edition);

ELECTROCHEMISTRY AND CORROSION

Course Code: M 411

Type of course: compulsory

Language of instruction: English tutoring available for Erasmus students

Name of lecturer: Simona Varvara, PhD

Laboratory tutor: Simona Varvara, PhD

Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	48	4	I	Grade	4

COURSE AIMS:

- Acquiring and understanding the basic concepts of electrochemistry in order to apply them for solving environmental issues.
- Acquiring theoretical knowledge and practical skills required to investigate metal corrosion phenomena and to identify technological measures to prevent the corrosion.
- Developing the students' scientific thinking and cognitive skills in order to find correct solution to specific problems related to environmental engineering.

ENTRY REQUIREMENTS:

Chemistry, Physics

COURSE CONTENTS:

1 Introduction to electrochemistry. Electrochemical Thermodynamics. Interactions in electrolyte solutions: Theory of electrolytic dissociation.
2. Transport of ions in electrolyte solutions: diffusion of ions. Conductance of electrolyte solutions. Transport numbers and ionic motilities.
3-4. Electrodes and primary cells: Electrode Potential. Nernst equation. Types of electrodes. Primary cells. Applications of EMF measurements.
5. Applications of electrode reactions. Electrochemical energy conversion.
6. Electrochemical methods. Polarography. Stripping voltammetry. Applications in environmental analysis
7. Electrolysis. The laws of electrolysis. Applications
8-9. Theoretical basis of corrosion. Phenomenology of corrosion. Electrochemical corrosion theory. Thermodynamics of corrosion phenomenon. Kinetics of corrosion
10. Passivation of metals. Methods for tracking and evaluating metal corrosion. Corrosion protection methods. Cathodic and anodic protection
11. Corrosion protection of industrial installations. Corrosion impact on the environment. Treatment of electroplating stations
12. Environmental implications in electrochemistry. Electrochemical remediation methods used in the environmental protection
13-14. Electrochemical sensors used in the environmental monitoring

LAB WORKS AND SEMINARS

1. Laboratory safety rules. Influence of concentration on the conductance of electrolyte solutions. Problems
2. Determining the standard potential of the electrode. Problems
3. Ion-selective electrodes. Determination of Cd^{2+} ions from wastewaters using a Cd-sensitive ion selective electrode
4. Daniell cell. Electromotive force. Problems
5. Determining the corrosion potential and corrosion rate of aluminum and steel
6. Determing the Cu^{2+}, Cd^{2+} and Pb^{2+} from wastewater samples by stripping voltammetry.
7. Presenting reports. Assessment of the laboratory knowledges

TEACHING METHODS:

Lecture, conversation, exemplification, practical laboratory work.

LEARNING OUTCOMES:

1. Assessment of the environmental degradation;
   - Understanding the basic concepts of interdependence between the pollution factors and their direct effects on the environment
   - Identifying interdependence between the pollution factors and their direct effects on the environment
   - Evaluation the environmental monitoring programs
   - Developing special chapters in sustainable development projects that take into account the environmental impact

2. Identification and compliance with professional ethics and deontology, taking responsibility for decisions and risks
3. Identify roles and responsibilities in a multidisciplinary team and application the techniques and effective work relationships within the team

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

A one-hour written examination (60% of the final grade).

The examination of the practical abilities acquired in the lab (40% of the final grade).

The course is given as a combination of lectures, lab works and seminars. There is a 100% attendance requirement for lab works and seminars.

RECOMMENDED READING:

- C. Brett, A.M. Oliveira Brett, Electrochemistry. Principles, methods and applications, Oxford Science Publications, 1993
- A. J. Bard, L. R. Faulkner Electrochemical Methods: Fundamentals and Applications, 2nd edition, Wiley, 2007
- C. Lefrou, P. Fabry Electrochemistry: The Basics, with Examples, Springer, 2012
- L. M. Mureşan, S. C.Varvara, Leveling and brightening mechanisms in metal electrodeposition, in Metal Electrodeposition, Novascience Publishers, New York, 2005

WASTE RECOVERY AND CONVERSION TECNOLOGIES
Course Code: M 412
Type of course: compulsory
Language of instruction: English tutoring available for Erasmus students
Name of lecturer: Maria Popa, Professor PhD
Seminar tutor: Mihai Teopent Corcheş, Lecturer PhD
Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	72	6	Summer	Grade	5

COURSE AIMS:
The overall objective of the course:
The aim of this course is to make students familiar with advanced knowledge of waste management problems.
Specific objectives:
-To learn specific concepts used in waste management field;
-To understand the role and importance of waste management field in organizations;
-To develop the ability to understand problems of building, operation and reclamation of landfills, collection centers, sorting lines and other facilities for waste management;
-To develop the ability to synthesize and select the innovative solutions in waste management, using new techniques and technologies.

ENTRY REQUIREMENTS:
-

COURSE CONTENTS:
The course covers the following main topics:
Waste management concepts.
Waste type and sources, factors that affects the waste composition.
The options and logistics of waste collection.
Waste disposal.
Waste separation and sorting technique.
Methods of reusing waste.
Waste recycling technologies.

The seminar covers the following main topics:
Waste management introduction.
European and related legislation.
Integrated waste management.
Waste recycling. Utilization of metal, glass, paper, plastic, textile wastes.
Biological waste utilization
Design of landfill recultivation, technical and biological recultivation, integration in the landscape.
Dangerous waste, waste records, collection, sorting, transport. Dangerous waste removal techniques and technologies.
Hazarduos waste recycling.

The project covers the following main topics:
Preparing a waste management plan.

TEACHING METHODS:
Lectures and seminars (The course is given as a combination of lectures and seminars.)

LEARNING OUTCOMES:
Professional Skills
- The overall aim is to give deeper knowledge in the problems and possibilities of waste management from a national and global perspective. Both industrial and municipal solid waste issues will be discussed. The course will employ a holistic view on solutions as well as technical aspects.
- After a passed course the student should be able to:
- Define and explain important concepts in the field of solid waste management, such as waste hierarchy, waste prevention, recirculation, municipal solid waste etc.
- Suggest and describe suitable technical solutions for biological and thermal treatment. The student should also be able to discuss the drawbacks and prerequisites for a chosen solution.

- Describe the construction and operation of a modern landfill according to the demands of the EU directive.
- Discuss social aspects connected to handling and recirculation of solid waste from a local as well as global perspective.
- Analyse and describe the potential as a secondary raw material, and thereby associated problems and possibilities in a sustainable society.
- Describe, analyse and discuss the connection between waste and consumption on a national and global level.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:
A two-hour written examination (60% of the final grade)
Carrying out practical work. (40% of the final grade)

RECOMMENDED READING:

- Popa, M., *Metode si tehnici moderne de determinare a poluării mediului cu metale grele*. Editura Casa Cărţii de Ştiinţă, Cluj - Napoca, 2005
- Atudorei A., Paunescu I., *Gestiunea Deşeurilor urbane*, Editura MATRIX, Bucureşti, 2001
- Vasile Oros, Camelia Drăghici, *Managementul deşeurilor*, Braşov, 2002;

REHABILITATION AND PROTECTION TECHNOLOGIES FOR BUILDINGS AND PROTECTED AREAS

Course Code: M 415

Type of course: compulsory

Language of instruction: English tutoring available for Erasmus students

Name of lecturer: Popa Dorin Victor, PhD

Seminar tutor: Popa Dorin Victor, PhD

Full time studies

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Class	56	4	Summer	Grade	4

COURSE AIM:

Developing the capacity for knowing and understanding the basic concepts related to general notions of heritage and buildings rehabilitation and protection technologies;

COURSE CONTENTS:

1. General considerations;
2. The movement of water through soil
3. Highlighting the factors influencing the emergence and development of over-moisture phenomenon in the masonry and / or concrete elements;
4. Migration of the capillary water in the ground towards foundations and walls;
5. Degradation of structural elements in the presence of moisture;
6. Methods for cleaning up the masonry foundations and walls.

TEACHING METHODS:

Lecture, conversation, exemplification.

LEARNING OUTCOMES

- the ability to establish the degradation causes of the structural elements in the presence of moisture
- understanding and knowing the basics of correlating different factors that favour the capillary rise
- knowing and understanding the methods of masonry foundations' and walls' drainage
- the ability to understand the mechanism of capillary rise in the building elements
- developing the ability to apply in practice but also to track the modern technologies of cultural heritage rehabilitation and protection;

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Written test examination - 50%, Verification during the semester- 50%.

RECOMMENDED READING:

- Popa,D., *Contributii la tehnica si practica asanarii fundatiilor si peretilor pentru constructii istorice si social culturale*, Casa Cartii de Stiinta Publishing House, Cluj-Napoca, 2007
- Popa, D., *Studiu privind cauzele şi efectele în umidificarea construcţiilor*, Analele Universităţii, Tom X, ISSN- 1582-5450, Oradea, 2001, p. 380-384;
- Manoliu, I., *Fundaţii şi procedee de fundare*, Didactic and Pedagogic Publishing House, Bucharest, 1977;
- Păunescu, M., Pop, V., Silion, T., *Geotehnică şi fundaţii*, Didactic and Pedagogic Publishing House, Bucharest, 1982, p.55 – 56;
- Program Leonardo da Vinci*, Umiditatea în elementele de zidărie – Modul de curs*, Technical University of Cluj – Napoca;
- Silaşi, P., *Raportul dintre pănzele de apă subterană, umezirea şi uscarea construcţiilor*, Construcţii no. 4 – 5, 1988;
- Popa, A., Popa, D., *Cauzele apariţiei fenomenelor de igrasie şi soluţii de reabilitare, Al 6-lea Simp. Stiinţific – Structuri portante, istorice,* Cluj Napoca, 2002, p.78-82;
- Popa, A., Farcas, V., *Geotehnică*, U.T. Pres Publishing House, Cluj – Napoca, 2004;