Óbuda University

Rejtő Sándor Faculty of Light Industry and Environmental Engineering



**TRAINING PROGRAM**

**Environmental Engineering BSc (F)**

Budapest, 01 September 2023

**DEGREE PROGRAM CURRICULUM**

**1. Degree program name:**

Environmental Engineering BSc

**2. Field of training:**

agricultural / economic sciences / informatics / technical / pedagogical/ natural sciences

**3. Language of training:**

English

**4. Training schedule(s) and duration of courses in semesters, number of contact hours:**

regular / evening / correspondence / distance training

full time, 7 semesters, 2212 hours/semester

**5. Optional specialties:**

Sustainable Energy Management, Green Energy Specialisation regular

Sustainable Land Development, Water Management Specialisation regular

**6. Number of credits to collect to earn degree:** 210 credits

**7. Level of qualification and professional qualification as indicated in the degree certificate:**

* level of qualification: bachelor - BSc
* professional qualification: Environmental Engineer

**8. Study area classification of professional qualification according to the standard classification system of training areas:**

851/0712

**9. Educational objective:**

The aim is to train environmental engineers with up-to-date knowledge and skills of applied natural sciences, ecology, technology, economics, and management. They can identify environmental hazards in various areas, and they can use their professional experience to manage prevention and remediation actions economically and efficiently. In possession of their professional knowledge and skills, they are capable to take part in the prevention, reduction and elimination of environmental pollution and damage; inendeavors towards the rational use of natural resources; and in the operation of low-waste and energy-efficient technologies. They are prepared to continue their studies at a master’s course.

**10. Professional competencies to be mastered:**

ENVIRONMENTAL ENGINEER

***a)*knowledge**

- Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.

- In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation softwares depending on their specialty.

- Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.

- Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.

- Knowledge of the concepts and tools of economics and environmental economics, project and environment management in environment protection.

- Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.

- Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments and limitations thereof, as well as methods for the evaluation of data measured.

- Knowledge of the basics of energy management, options for energy production, their advantages and disadvantages, as well as the concept and feasibility options of sustainable development.

- Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies.

- Knowledge of requirements and methods for health and safety, fire protection, safety engineering and remediation as related to the field of environment protection.

***b)*capabilities**

- Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.

- Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.

- Able to perform environmental impact assessments and to participate in compiling impact studies.

- Able to apply environmental remediation methods, to prepare for and participate in remediation.

- Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field.

- Able to communicate both verbally and in writing in their mother tongue and in at least one foreign language, in respect of professional issues, and to continuously develop their professional skills as required.

- Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them.

- Adequate perseverance and endurance of monotony to perform practical operations.

- Able to carry out assignments as environmental officer.

- Able to participate in project and proposal implementation and audit tasks based on their knowledge.

- Able to carry out management duties subject to sufficient professional experience.

- Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.

- Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.

- Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.

- Able to take part in environment expertise, advisory, and decision preparation work.

***c)*attitude**

- Undertaking and authentically representing the social role of environment protection, its basic relationship with the world.

- Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.

- Open to professional cooperation with specialists related to their profession but involved in other areas.

- Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.

- Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.

- Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith.

- Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks.

- Sharing experiences with colleagues, thus promoting their development.

***d)*autonomy and responsibility**

- Taking responsibility towards society for their decisions made in the scope of environment protection.

- Performing environmental tasks individually and managing special environment protection work independently even in unexpected decision-making situations.

- Cooperation with qualified experts from other special areas (primarily economic and legal) in the course of completing professional tasks.

- Monitoring regulatory, technical, technological, and administrative changes related to the special field and enforcing them in their professional work.

**11. Main training areas:**

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| **According to the Regulation of 18/2016. (VIII. 5.) EMMI** | **Credit points** |
| **Basics of Natural Sciences (40-60 credits)** | **45** |
| **Economic and Human Knowledge (10-30 credits)** | **22** |
| **Technical Engineering Skills (20-50 credits)** | **20** |
| **„Protection of Environmental Elements” Knowledge (30-70 credits)** | **30** |
| **Environmental Analysis, Environmental Informatics (10-30 credits)** | **13** |
| **Environmental Management (10-30 credits)** | **11** |
| **Specific professional knowledge (40 credits)** | **40** |
| **Optional subjects (10 credits)** | **10** |
| **Thesis (15 credits)** | **15** |
| **Physical education** | **4** |
| **Total:** | **210** |

**12. Criteria prescribed:**

**Physical education:** Each regular student is required to complete four semesters of Physical education. The subject is announced in semesters 1-4 in the model curriculum, with a load of 1 lessons per week.

**Specialty language requirements: -**

**Professional traineeship:**

Professional traineeship of at least six weeks, organized at a location of professional practice. Professional traineeship is included in the criteria prescribed.

**13. Knowledge verification:**

a) during the study period, by written or verbal reports, written (classroom) tests, by the evaluation of home assignments (designs, measurement records, etc.), mid-semester grading or signature,

b) by preliminary examination passed in the study period,

c) by examination or comprehensive examination passed in the examination period, and

d) by final examination.

**14. Criteria for admission to a final examination:**

a) Final completion certificate (absolutorium) granted,

b) Thesis accepted by supervisor.

Admission to a final examination is subject to a final completion certificate being granted. A final completion certificate is issued by a higher education institution to a student who has complied with the study and examination requirements prescribed in the curriculum and completed the professional traineeship required – except for meeting the foreign language requirement and completion of the thesis –, and has acquired the credits prescribed.

**15. Parts of the final examination:**

The final examination consists of defending the thesis and oral examinations taken on the subjects prescribed in the curriculum (time allowed for preparation: at least 30 minutes per subject), to be passed by the student consecutively within the same day.

Subjects (subject groups) comprising, in the aggregate, a body of knowledge corresponding to at least 20 and up to 30 credit points may be designated for the final examination.

The list of questions of the oral examination is made available to candidates 30 days before the date of the final examination.

Candidates may start the examination if their thesis has been accepted by the final examination board with at least sufficient (2) qualification. Criteria for correcting a failed thesis are defined by the competent institute.

**16. Result of the final examination:**

The weighted average of the grades of the thesis and the oral part of the final examination – taking into consideration the number of subjects included in the final examination – as follows:

***Z =(SZD + Z1+Z2+…+Zm)/(1+m).***

**17. Criteria for issuing a diploma:**

a) Successful final examination,

b) Compliance with the foreign language requirement.

**18. Dual training option: -**

**19. Cooperative training option:**

Cooperative training is a voluntary supplementary practice module linked to a regular bachelors training course at the university, in the framework of which the university and a business company, firm or institution cooperate in order to enable university students to acquire professional experience as specified in the educational objective.

**20. Date of entry into effect:** 01 September 2023.

Dated in Budapest, 01.12. 2022.

Dr. habil. Koltai László

Dean

**CURRICULUM**









SUBJECT DESCRIPTIONS

**Science basics (40-60 cr.):**

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| ***Title of the course:***  **Fundamentals of Natural Sciences** | ***NEPTUN-code:***  RKXTA1EBNF | ***Weekly teaching hours:***l+cw+lw  1+3+0 | ***Credit*:** 5  ***Exam type***: tm |
| ***Course leader:***  Csaba Ágoston Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  *-* | |
| ***Curriculum:*** | | | |
| The primary aim of the course is to develop students' scientific literacy, critical thinking and problem-solving skills. In addition to learning about natural laws, systems and processes, emphasis is placed on developing students' ecological perspectives. The practical tasks and projects are based primarily on the knowledge acquired in secondary school, thus enabling the knowledge acquired to be assessed and providing a basis for learning the subjects at university. In addition to basic knowledge of physics, biology, geography, chemistry and environmental protection, the course will provide a synthesis of knowledge focusing on the interrelationship of environmental elements that will help to solve engineering problems and develop environmentally aware behaviour. The integration of complex knowledge is realised in the understanding of the basic interrelationships between natural systems and is applied in project work and integrated into the students' thinking and actions. | | | |
| ***Professional competencies:*** | | | |
| Open and receptive to the application of new, modern and innovative organic farming practices and methods.  In his/her work, he/she strives to act in a law-abiding manner and to respect engineering ethics.  Ability to acquire new knowledge through the empirical solution of practical problems.  Ability to translate solutions developed in nature into technical practice.  Ability to participate in and lead teamwork.  Understand and authentically represent the role of the environment in society and its fundamental relationship with the world. | | | |
| ***Literature:*** | | | |
| Townsend, C.R., Begon, M., Harper, J.L. (2006). Essentials of Ecology (2nd Edition). Blackwell Publishing.  Darrell Ebbing,‎ Steven D. Gammon: General Chemistry, Cengage Learning, 2015, Cengage Learning, Boston, ISBN-13: 978-1305580343; ISBN-10: 1305580346  Serway Jewett: Physics for Scientist and Engineers  William M. Marsh, Martin M. Kaufman: Physical geography, Cambridge University Press, 2013.  Michael Allaby (2000): Basics of Environmental Science, Routledge, New York, ISBN 0415-21175-1 | | | |

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| ***Title of the course:***  **Mathematics I.** | ***NEPTUN-code:***  RKXMA1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 6  ***Exam type****:* e |
| ***Course leader:***  Aurél Galántai, Dr.Prof. | ***Position:***  professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The main goal of the course is to introduce the set theory marks and to describe the algebraic and geometric properties of the real number line, complex numerical plane and the three-dimensional space. Additionally, with the help of the concepts of sequences, real functions and convergence to construct univariate differential and integral computing in a way which makes the students capable of solving any technical / mathematical / physical problems that arise in subsequent studies.  + using Matlab's numerical / symbolic mathematics software suite in the education. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Open to professional cooperation with specialists related to their profession but involved in other areas. | | | |
| ***Literature:*** | | | |
| Thomas – Weir – Hass: Thomas’ Calculus, 13e, Pearson, 2013.  Anton – Bivens – Davis: Calculus, 10e, Wiley, 2012.  Anton – Rorres: Elementary Linear Algebra, 11e, Wiley, 2013.  Gilbert Strang: Differential Equations and Linear Algebra, Cambridge University Press, ISBN 9780980232790, 2015 | | | |

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| ***Title of the course:***  **Mathematics II.** | ***NEPTUN code:***  RKXMA2EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit:*** 6  ***Exam type: e*** |
| ***Course leader:***  Aurél Galántai Dr.Prof. | ***Position:***  professor | ***Required preliminary knowledge:***  RKXMA1EBNF sign | |
| ***Curriculum:*** | | | |
| Introduction of complex numbers. The most important types of ordinary differential equations and construction of their solutions. Basic concepts of linear algebra. Vector geometry of the 3-dimensional Euclidean space. Convergence in n-dimensional Euclidean spaces. Differential calculus of functions in several variables. Geometrical problems connected to smooth curves and surfaces. Basic concepts of mathematical statistics. Construction of the line of linear regression. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation softwares depending on their specialty.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Open to professional cooperation with specialists related to their profession but involved in other areas. | | | |
| ***Literature:*** | | | |
| Anton, H., Rorres, C.: Elementary Linear Algebra with Applications, 9e, Wiley, 2005, ISBN: 0-471-66959-8.  Thomas, G.B. et al.: Thomas’ Calculus, 11e, Addison-Wesley, 2005, ISBN: 0-321-18558-7.  Gilbert Strang: Linear Algebra for Everyone, Wellesley Cambridge Press, ISBN 9781733146630, 2020  Douglas C. Montgomery-Elizabeth -A Peck, G. Geoffrey Vining: Introduction to Linear Regression Analysis, Yohn Wiley & Sons, INC. ISBN 0 471 31565 6, 2001 | | | |

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| ***Title of the course:***  **Chemistry I.** | ***NEPTUN-code:***  RMXCA1KBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+2 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Csiszér Tamás Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The goal of the subject is to acquire the essential knowledge of the structure, properties and transformations of chemical substances. The subject discusses the characteristics and reactions of the substances through the formation of unique atomic and molecular structures through chemical bonds and interactions to the characterization of homogeneous and heterogeneous sets. It also describes the grouping, production and most important applications of elements and inorganic compounds with students. In practice, students practice solving the most important computational tasks in the field of inorganic chemistry (writing and sorting reaction equations based on oxidation numbers, stoichiometry, concentration of solutions concentration, conversion of concentration units, gas laws). | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments and limitations thereof, as well as methods for the evaluation of data measured.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned. | | | |
| ***Literature*** | | | |
| A. Pahari, B. Chauhan: Engineering Chemistry, Infinity Science Press LLC, Hinghan, Massachusetts, New Delhi, India, 2007  Darrell Ebbing,‎ Steven D. Gammon: General Chemistry, Cengage Learning, 2015, Cengage Learning, Boston, ISBN-13: 978-1305580343; ISBN-10: 1305580346  Peter G. Nelson: Introduction to Inorganic Chemistry, Key ideas and their experimental basis, 2018, 3 edition, Pages: 177, ISBN: 978-87-403-1912-5 | | | |

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| ***Title of the course:***  **Chemistry II.** | ***NEPTUN-code:***  RMXCA2KBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+2 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Tamás Csiszér Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RMXCA1KBNF | |
| ***Curriculum:*** | | | |
| The goal of the subject is the transfer of the basic concepts of organic chemistry required for other professional subjects. During the exercises, the students can acquire basic laboratory knowledge that is essential for the successful completion of other professional subjects.  Basic Concepts of Organic Chemistry: The structure and properties of alkanes. Nomenclature. The structure, reactions and properties of open-chain unsaturated hydrocarbons. The structure, reactions and properties of closed-chain saturated and unsaturated hydrocarbons. Production, Physical and Chemical Properties of Halogenated Organic Compounds. The grouping, physical and chemical properties of oxygen-containing organic compounds. The Grouping, Structure and Properties of Nitrogenous Organic Compounds. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments and limitations thereof, as well as methods for the evaluation of data measured.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned. | | | |
| ***Literature:*** | | | |
| Darrell Ebbing,‎ Steven D. Gammon: General Chemistry, Cengage Learning, 2015, Cengage Learning, Boston, ISBN-13: 978-1305580343; ISBN-10: 1305580346  John E. McMurry: Organic Chemistry, Edition: 9TH 16, Copyright: 2016, Publisher: Cengage Learning, Published: 2016, ISBN-13: 978-1305080485; ISBN-10: 1305080483  David R. Klein: Organic Chemistry, 2015, Wiley, Edition: 2nd, ISBN: Main edition: 978-1-118-45228-8; Binder version: 978-1-118-45431-2 | | | |

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| ***Title of the course:***  **Physics for Engineers** | ***NEPTUN-code:***  RKXFI1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Sándor Pekker, Dr. | ***Position:***  research professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The following topics will be covered in the course: the propagation and speed of light. Fundamentals of physical optics. Interference and diffraction phenomena. Principles of light scattering. Optical fibres. Lens exchange systems, imaging errors. Imaging of optical devices. Temperature. Thermal expansion of solids, liquids and gases. Basic thermodynamic concepts. Principles of thermodynamics. Fundamentals of statistical physics. Phase transitions. Irreversible thermodynamic processes. Electrostatics. Current conduction, direct currents. Basic magnetic phenomena. The magnetic field. Forces in magnetic field. Magnetic properties of materials. Law of excitation. Mechanisms of conduction. Electromagnetic induction. Electromagnetic waves. Theory of relativity. Thermal radiation. The photoelectric phenomenon. Photons. Fundamentals of quantum mechanics. Basics of quantum electronics, lasers. Basic properties of nuclei, models of nuclei.  The following topics are presented in the Fundamentals of Science subject: Newtonian mechanics, such as Description of motions, reference frame. Newton's laws. Laws of force and the equation of motion. The work theorem. Periodic motion. The law of angular momentum. The gravitational force field. Description of motions in an accelerating coordinate system. Basics of mechanics of point systems. Plane motion of a rigid body. Spinning motion. Elastic deformations. Mechanics of quiescent liquids and gases. Molecular forces in fluids. Flow of liquids. Wave theory. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world. | | | |
| ***Literature:*** | | | |
| Serway Jewett: Physics for Scientist and Engineers  Bueche, F., Hecht, E.: Schaum’s Outline of College Physics, 11th edition, McGraw-Hill Education, 2011.  Feynman R., Leighton, R.B. and Sands M.: The Feynman Lectures on Physics. Volumes I-III. Revised and extended edition, Addison-Wesley, 2005.  Shankar, R.: Fundamentals of Physics: Mechanics, Relativity, and Thermodynamics. Yale University Press, 2014.  Shankar, R.: Fundamentals of Physics II: Electromagnetism, Optics, and Quantum Mechanics. Yale University Press, 2016.  Feynman R., Leighton, R.B. and Sands M.: The Feynman Lectures on Physics. Volumes I., II. Revised and extended edition, Addison-Wesley, 2005.  Fleisch, D., Kinnaman, L.: A Student’s Guide to Waves, Cambridge University Press, 2015.  Shankar, R.: Fundamentals of Physics: Mechanics, Relativity, and Thermodynamics. Yale University Press, 2014. | | | |

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| ***Title of the course:***  **Fundamentals of Environmental Biology** | ***NEPTUN-code:***  RKXBI1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Hosam Hamuda Bayoumi, Dr. | ***Position:***  associate professor | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The aim of the course is to fill the gap between basic environmental science and advanced environmental biotechnology. The course is divided into two parts, the first dealing with biology and topics related to environmental sciences, and the second with environmental biotechnology. Environmental biology is a multidisciplinary subject and covers a wide range of topics such as ecological issues, global environmental problems and socio-economic scenarios, as well as modern fields such as molecular biology, genetics, ecology, etc. Topics covered. Biodiversity, taxonomy and modern classification. Hierarchy of biomolecules. Plasmids and their role in the adaptation of microorganisms to their environment. Biogenic elements. Types of micro-organisms. Fungi. Degradation of carbohydrates. Phototrophy and photosynthesis, light and dark phase. General characterisation and basic concepts of ecological systems. Soil microbiology. Water microbiology. Air microbiology. Microbiology of anaerobic environments. Antibiotics and their mechanism of action. Understanding environmental effects on animal and plant cells. Understanding the relationship between living organisms and environmental factors, the systems involved in the regulation of life functions and the behaviour and functioning of living systems. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Sharing experiences with colleagues, thus promoting their development.  Taking responsibility towards society for their decisions made in the scope of environment protection. | | | |
| ***Literature:*** | | | |
| J.H. Postlethwait and J.L. Hopson (2009): Modern Biology. Holt, Rinehart and Winston. A Harcourt Education Company, New York, London. ISBN-13: 978-0-03-006769-4  Kenneth Todar (2008): [Todar’s Online Textbook of Bacteriology](http://www.freebooks4doctors.com/link.php?id=1427). University of Wisconsin  David M. Sander (2007): [Big Picture Book of Viruses](http://www.freebooks4doctors.com/link.php?id=1452).  Julie B. Wolf (2005): [Applied Molecular Biology](http://www.freebooks4doctors.com/link.php?id=1221). Beginning Laboratory Manual. University of Maryland, Baltimore County (UMBC).  T. A. Brown (2002): [Genomes](http://www.freebooks4doctors.com/link.php?id=1378) 2nd edition Bios Scientific Publishers Ltd IBSN: 9781859962282  Harry L. T. Mobley, George L. Mendz, Stuart L. Hazell (2001): [Helicobacter pylori: Physiology and Genetics](http://www.freebooks4doctors.com/link.php?id=1376). ASM Press ISBN: 9781555812133  Madigan, Martinko and Parker (2000): Biology of Microorganisms. 8th edition Southern Illinois University, Carbondale | | | |

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| ***Title of the course:***  **Electrotechnics** | ***NEPTUN-code:***  RKXEL1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Sándor Pekker, Dr. | ***Position:***  research professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| Production and features single-phase alternating current. Peak and RMS value. The coil and the capacitor AC circuit. RLC circuits. AC power, power factor correction. Production of three-phase voltage. Three-phase networks. Star and delta. Transformers operating principle, equivalent circuit, operating conditions. The transformer structure. Special transformers. The basics of electronics. Semiconductor devices. The diode characteristics, application areas. Rectifier circuits. Special properties diodes. Power supplies. The thyristor, triac and diac structure, characteristic curves and application areas. Transistors construction, operation, characteristic curves. Amplifier basic circuits. The transistor switching operation. Amplifier circuit features. Operational Amplifiers construction, operation modes. Oscillators. Multi Plate. Operating principles, structure, replacing the coupling of the asynchronous machine. The single-phase asynchronous motor. Operating principle, starting torque and asynchronous machines. Principle of operation of DC machines, excitation solutions and operational features. | | | |
| ***Professional competencies:*** | | | |
| In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks.  Sharing experiences with colleagues, thus promoting their development. | | | |
| ***Literature:*** | | | |
| Valery Vodovozov: Introduction of to Electronic Engineering, 2010. <http://bookboon.com>; ISBN: 978-87-7681-539-4  Don Johnson: Fundamentals of Electrical Engineering I, Connexions , 2010; <https://cnx.org/contents/d442r0wh@9.72:g9deOnx5@19/Themes>; 1999-2018, Rice University; ID: 778e36af-4c21-4ef7-9c02-dae860eb7d14@9.72  John A. I. E. E. Henderson: Electrotechnics, Wentworth Press, 2016. aug. 25. - 188 pages, ISBN: 1362012750, 9781362012757 | | | |

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| ***Title of the course:***  **Ecology** | ***NEPTUN-code:***  RKXOK1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Hosam Hamuda Bayoumi, Dr. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXBI1EBNF | |
| ***Curriculum:*** | | | |
| The ecological concepts and principles (environmental tolerance, and indications limitation, examples of the general principle indicator principle, the principle of general indication, the complementation principle;. Multiplurális the environmental principle). Ecology, biology subject of continually, the organization above the individual units and scales: the organization over individual units); levels of biological organization, particularly with regard to the supra-organizational levels, definitions and characterizations. The interaction between man and nature, biological and cultural coevolution of biological complementarity of capacity and mediation systems. The population of the association and community life, the biome and biosphere. The concepts behind and plant populations; properties and structures; Ecology of clonal herbs. Uniformity of globalization, identifying global problems, search for solutions; the need for sustainable livelihoods and opportunities, diversifying globalization. The competition and Herbivorian, their role in the regulation of communities; intra- and interspecific competition, competitive exclusion and stable coexistence; a niche subdivision and segregation plant associations. Theories Association: Clements - Gleason core hypotheses. Plant community structure (the space-time structure, the main reasons for their formation); and textures (floral elements, cönotype, etc.); diversity, diversity indices; diversity maintenance mechanisms. The interpretation of the environment and nature protection; the environment and tolerance: the relationship between population and environment; based on the turnover. The concept of primary production, distribution of the earth; primary productivity and energy utilization producers, the primary level; the trophic structure of food chains and webs; material and energy flows, on biogeochemical cycles; limiting the production of primary environmental factors: light, heat, water, CO2, nutrients. Communities change in time, the main succession types: a secular, primary, secondary, biotic, ecogenetic and plant cover; a niche subdivision changes during succession; Basics of the island biogeography, ecological isolates; stability. The main indicator of ecosystem status, the system is interpreted as characteristics of organisms communities. The biosphere and its history; The concept of biodiversity, importance, need for protection; Gaia Hypothesis; Change the associations and global biogeochemical cycles and their consequences; The history of human nature conversion activities; the world food problem; freshwater shortages; the growth of the world population problem; world economic growth, economic globalization; environmental technologies, environmental protection. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Sharing experiences with colleagues, thus promoting their development.  Taking responsibility towards society for their decisions made in the scope of environment protection***.*** | | | |
| ***Literature:*** | | | |
| Townsend, C.R., Begon, M., Harper, J.L. (2006). Essentials of Ecology (2nd Edition). Blackwell Publishing. (Highly recommended).  Begon, M., Townsend, C. R., Harper, J. L. (2006). Ecology (4th edn).  Towsend, C.R., Begon, M., Harper, J. (2003): Essentials of Ecology. 2nd ed. Blackwell Science, Oxford.  Press, M.C., Huntly, N.J., Levin, S. (2001): Ecology: Achievement and challenge. Blackwell Science, Oxford.  Crawley, M. J. (1997): Plant ecology. 2nd ed. Blackwell Science, Oxford.  Begon M., Harper J.L., Townsend C.R. (1996): Ecology. Blackwell Science  Krebs, C. J. (1994 & 2001). Ecology. (4th & 5th edns). Harper Collins, New York. | | | |

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| ***Title of the course:***  **Earth sciences knowledge** | ***NEPTUN-code:***  RKXFT1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+2 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Krisztina Demény Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The geological history of the Earth. The internal structure of the Earth (the crust, the mantle, the core). Volcanism (type of volcanoes, volcanoes, and plate boundaries) and plate tectonics. Rocks (igneous, sedimentary, and metamorphic) and minerals classification systems. Major types of landforms (plains, mountains, cratons). Exogenous processes and main landform methods (the work of rivers, the formation of shores and coastlines, glacial processes, the work of wind). Main features of surface waters (rivers and lakes) and waters below the surface (groundwater, confined water, crack water). Karst processes (karst forms on or below the surface). Main soil types in the world (definition, functions, and major soil formations). | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Open to professional cooperation with specialists related to their profession but involved in other areas. | | | |
| ***Literature:*** | | | |
| William M. Marsh, Martin M. Kaufman: Physical geography, Cambridge University Press, 2013.  PPT files on the homepage of Moodle learning system  Jane H. Hodgkinson, Frank D. Stacey: Practical Handbook of Earth Science, ISBN 9781138054448. CRC Press, 2017 | | | |

**Economic and human knowledge (10-30cr.):**

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| ***Title of the course:***  **Economics** | ***NEPTUN-code:***  GKXKG1QBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  András Medve, Dr. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| Introduction to Macroeconomics and National Income Accounting. The MPS and the SNA-system. Gross Output, GDP, GNI, NDP, Nni, GNDI, NNDI. The Determination of National Income. The Circular Flow. The Consumption Function. The Investment Demand. Money and Modern Banking. Money and its Functions. The Monetary Base and the Money Multiplier. Commercial Banks and the Central Bank. Equilibrium in the Financial Markets. Money and Inflation. The Cost of Inflation. The Government in the Circular Flow. The Government Budget. Monetary and Fiscal Policy. Lorenz Curve and the Gini Coefficient. Economic Growth and the Business Cycle. International trade and Commercial Policy. Absolute and Comparative Advantage in the World Trade. The Components of the Balance of Payments,  The Tools of Economic Analysis. The Market. Demand, Supply and Equilibrium. Free Markets and Price Controlls: Price Ceilings and Maximum Prices. Price Elasticity Of Demand, Cross-elasticity of demand, Income-elasticity.The Theory Of Consumer Choice. Complements and Substituties. Business Organization and Behaviour. The Firms Production Decision. Production costs.Type of Business Organizations. Market Structures and Mesurement of Market Power: Herfindahl, CR and Lerner-index. Perfect Competition and Pure Monopoly. Monopolistic Competition. Oligopoly. Game-theory.and interdependent Decision. Nash- Equilibrium. Dominant Equilibrium. The Analysis of Factor Markets: Labour Market. Human Capital. Capital Markets. Rentals, Interest Rates and Assets Prices. Net Present Value. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the concepts and tools of economics and environmental economics, project and environment management in environment protection.  Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them.  Undertaking and authentically representing the social role of environment protection, its basic relationship with the world.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks. | | | |
| ***Literature:*** | | | |
| Begg, David et al. Economics. McGraw-Hill Edition, 2014.  Peter Jochumzen: Essentials of Macroeconomics. 2010. www.bookboon.com  Ian Jaques: Mathematics for Economics and Business, Addison-Wesley | | | |

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| ***Title of the course:***  **Management and Enterprise Economics** | ***NEPTUN-code:***  GVEVG2QBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Péter Szikora Dr. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The aim of the course is for students to acquire knowledge which will enable them to deal with economic and financial problems from a corporate point of view. Management as a scientifical discipline (theories and waves). Content of the managerial activity, skills and tasks. Decision like the centre of the managerial activity. Decision theories. Relationship of the leader and employees. Leadership styles and typology of the leadership. The organizations, structures (organogram) and characteristics. The successful and effective managers. Fields of management: strategical-, project-, innovation-, and marketing management, TQM. Environmentally friendly management. Deal and handle the problems, conflicts, crisis management. Goals for the Human Resource Management (recruitment and selection). Corporate culture and identity. Self-management, communication skills, personality tests. Creation, creativity techniques. Case studies from the fields of decision, responsibilty, emotions, moral. Recruitment and selection, demontsration of a job interview.  Students are introduced to the concepts of enterprise, objectives, business environment, business forms, value creation, production processes, organizational forms, strategy creation and corporate marketing. Students also gain an insight into the development of enterprises, different development strategies, problems of growing, optimal operational size and various other essential aspects of managing a corporation. Students are introduced into company asset management, labor management issues, cost management, cost accounting methodology, analysis of the economics of investments and the basics of corporate finance. Students also gain an insight into basic marketing concepts and methods. | | | |
| ***Professional competencies:*** | | | |
| Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them.  Able to take part in environment expertise, advisory, and decision preparation work.  Undertaking and authentically representing the social role of environment protection, its basic relationship with the world.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks.  Taking responsibility towards society for their decisions made in the scope of environment protection.  Cooperation with qualified experts from other special areas (primarily economic and legal) in the course of completing professional tasks.  Knowledge of the concepts and tools of economics and environmental economics, project and environment management in environment protection.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to carry out management duties subject to sufficient professional experience.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith.  Sharing experiences with colleagues, thus promoting their development.  Performing environmental tasks individually and managing special environment protection work independently even in unexpected decision-making situations. | | | |
| ***Literature:*** | | | |
| Kadocsa, Gy. (2007): Entrepreneurial Management. Amicus Press, Budapest – München  Spinelli, S., Adams, R. (2011): New venture creation: Entrepreneurship for the 21st Century. McGraw-Hill Education  Dr. Bianka Parragh (2011): “Management” – digitally available textbook of theory and practice, Óbuda University, VMI  Montana P. J. – Charnov B. H. (2008): Management, Barron's Educational Series  Recommended:  Manfred Kets de Vries (2006): The leadership mystique – Leading behavior in the human enterprise, Prentice Hall  Derek Rowentree (2006): The manager’s checklists, Pearson Prentice Hall | | | |

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| ***Title of the course:***  **Project management** | ***NEPTUN-code:***  RMEPR1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+1+0 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Áron Takács Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| Fundamentals of management science (trends and theories). The characterization of management activity, skills, and tasks. Decision-making as the core activity of the managerial work. Decision theory. The relationship between leader and subordinate. Leadership styles and leadership theory. Organizational forms, organigrams, structures, and their characterization. Discipline of management: strategy management, project management, innovation management and marketing management, TQM. Environmentally conscious management. Problem and conflict solving, crisis and conflict management. The objective of human resource management (selection and recruitment). Organizational culture and identity. Self-management, communication styles, personality traits (tests). Creativity-inspiring techniques. Case studies in the matters of decision, responsibility, power, and authority. Recruitment and selection, job interview situational practice. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the concepts and tools of economics and environmental economics, project and environment management in environment protection.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to carry out management duties subject to sufficient professional experience.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to take part in environment expertise, advisory, and decision preparation work.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith.  Sharing experiences with colleagues, thus promoting their development.  Performing environmental tasks individually and managing special environment protection work independently even in unexpected decision-making situations. | | | |
| ***Literature:*** | | | |
| A Guide to the Project Management Body of Knowledge, Project Management Institute, 1996 - 176 pp.  Project management guide (PMBOK® Guide) 5. Akadémiai Kiadó, Budapest, 2013, ISBN: 978 963 05 9426 4  PPT files on the homepage of Moodle learning system | | | |

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| ***Title of the course:***  **Learning methodology** | ***NEPTUN-code:***  RTXTM1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Marianna Halász Ph.D.Prof. | ***Position:***  professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The aim of the course is to prepare students entering higher education to learn effective and efficient learning strategies, to develop individual conditions for self-regulated learning. Students will learn techniques for tuning in to learning, learning and resting while learning. They develop individual and cooperative learning skills. They will learn to deal with learning difficulties in a conscious way and to form success-oriented learning attitudes. Students will gain comprehensive and practical knowledge of factors influencing learning effectiveness, effective learning methods, effective ways of obtaining and organising information online, learning support interfaces and constructive career development. The main aim is to develop competences that will help students to succeed in the subjects they have studied and to prepare for exams. | | | |
| ***Professional competencies:*** | | | |
| The ability to see and manage the phenomenon of learning in a complex way, and to use effective communication techniques.  Ability to make adequate use of a varied and up-to-date toolbox of learning methods, based on individual needs.  Ability to learn independently.  Ability to work in a cooperative way, preferably by listening to the opinions of colleagues under his/her control, in order to solve problems and make management decisions.  Ability to implement lifelong learning.  Ability to continuously develop his/her skills by participating in organised training in his/her field. | | | |
| ***Literature:*** | | | |
| Nick Rushby- Dan Surry: The Wiley Handbook of Learning Technology, Wiley-Blackwell, 2016, ISBN: 978-1-118-73643-2  John Branch - Paul Bartholomew - Claus Nygaard :Technology-Enhanced Learning in Higher Education, Libri Publishing Ltd., Oxfordshire, UK, 2015, ISBN: 9781909818613  Terri Pantuso -Sarah LeMire - Kathy Anders: Informed Arguments: A Guide to Writing and Research, Texas A&M University, 2019  Chunfang Zhou: Handbook of Research on Creative Problem-Solving Skill Development in Higher Education, Paratext, 2017, ISBN: 9781522506430 | | | |

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| ***Title of the course:***  **Construction of a tutoring system and modern learning techniques** | ***NEPTUN-code:***  RTXTK1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+1+0 | ***Credit*:** 3  ***Exam type****:* tm |
| ***Course leader:***  Marianna Halász Ph.D. Prof. | ***Position:***  professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The aim of the course is to prepare students for tutoring, where one or a small group of students receive individual, personalised instruction. The tutorials are designed to develop individual learning pathways, independent learning, subject skills, communication, and social competences, so that students are able to help each other in their learning and thus reduce dropouts. The role of the tutor in reducing dropouts and catching up. The responsibilities of the student mentor, data management of mentored students. The role of the peer mentor. Mentor responsibilities related to role provision. The person of the mentor, the competency requirements of mentoring. Getting to know the peer mentor, the specificities of communication with them. Developing relational skills. Exploring the mentor's prior knowledge, subject skills, and personal characteristics. The characteristics of adult learning. Subject-specific support for the mentored person (mentoring and tutoring). Identification of mentoring problems. Personal mentoring support needs for successful learning progress. Objectives of mentoring support, stages of mentoring work, the spectrum process of mentoring. Planning mentoring support. Choice of mentoring strategies, their application. Methods of mentoring support. Motivating the mentored. Peer learning strategies and techniques. Developing reflective thinking. Levels of reflection. Opportunities for self-development. Processing, analysis, and evaluation of contemporary mentoring case studies. Diagnostic-, formative-, formative-, developmental assessment-, sensitive feedback/evaluation in mentoring. Outcomes of mentoring, holistic evaluation of the mentee. Aftercare of the mentored. | | | |
| ***Professional competencies:*** | | | |
| Able to listen to others sympathetically and give meaningful answers.  The ability to ask questions that help to self-discover the other person's abilities, personal qualities and aspirations.  Ability to create an atmosphere of trust that supports the learning/acquisition/catching-up process.  Ability to consider the confidentiality of the mentored person.  Empathic and cooperative.  Ability to help a less experienced student to correct minor mistakes and prevent major mistakes.  Ability to make a consistent, effective, and efficient professional impact in the mentoring relationship.  Ability to recognize the needs of the mentored, even if the mentored cannot articulate them.  Believes in the positive impact of mentoring, especially in professional identification, and is willing to help others. | | | |
| ***Literature:*** | | | |
| Joseph Psotka - L. Dan Massey - Sharon A. Mutter: Intelligent Tutoring Systems: Lessons Learned, Psychology Press, 1988, ISBN: ‎978-0805801927  Scotty D. Craig: Tutoring and Intelligent Tutoring Systems, Nova, 2016, ISBN: 978-1-53614-085-9  Beverly Park Woolf: Building Intelligent Interactive Tutors: Student-centered Strategies for Revolutionizing E-learning, Morgan Kaufmann Publishers, 2009, ISBN: 978-0123735942 | | | |

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| ***Title of the course:***  **Student tutorial** | ***NEPTUN-code:***  RTXHT1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  0+2+0 | ***Credit*:** 3  ***Exam type****:* tm |
| ***Course leader:***  Marianna Halász Ph.D., Prof | ***Position:***  professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The aim of the course is to provide tutoring to a student or a small group of students in an individual, personalised way. The practical lessons are designed to develop individual learning pathways, independent learning, subject-specific skills, communication and social competences, and to help students meet subject requirements by explaining and practising the subject matter of a particular subject, in order to reduce drop-out rates. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the subject content and ability to transfer knowledge.  Ability to provide personalised assistance.  Ability to listen to others sympathetically and give meaningful answers.  Ability to ask questions that help to self-discover the other person's abilities, personal qualities and aspirations.  Ability to create a climate of trust that supports the learning/acquisition/catching-up process.  Ability to take into account the confidentiality of the mentored person.  Empathic and cooperative.  Ability to help a less experienced student to correct minor mistakes and prevent major mistakes.  Ability to make a consistent, effective and efficient professional impact in the mentoring relationship.  Ability to recognize the needs of the mentored, even if the mentored cannot articulate them.  Believes in the positive impact of mentoring, especially in the area of professional identification, and is willing to help others. | | | |
| ***Literature:*** | | | |
| Catherine A. Simon - Stephen Ward: A Student's Guide to Education Studies, Routledge, 2020, ISBN 9780367276690  Charles Neil : The Tutorial Prayer Book: For the Teacher, the Student, and the General Reader (Classic Reprint) Forgotten Books, 2017, ISBN: ‎978-1331693697 | | | |

**Environmental elements protection (30-70cr.):**

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| ***Title of the course:***  **Environmental elements protection I-II. (Water and Soil Protection)** | ***NEPTUN-code:***  RKXKE1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+4 | ***Credit:*** 5  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| Course objective is to provide overall knowledge about topics of water quality protection and water management. Within this scope it deals in detail with water circulation in the nature and in the society and with water incidences available for residential utilization. It examines impacts and impurities affecting natural waters of the industrializing world and water quality resulting from that, together with monitoring possibilities. It reviews general questions of water and water management, like basics of water management, fundamentals of water resources management, current and future water demands. It shows different types of water utilization and the return options of used waters to the nature. It presents basic hydrological notions, transmission of impurities in surface and subsurface waters, as well as impacts of oil pollution to water quality and possibilities of environmental clean-up.  The other aims of this course to present the basic knowledge of the soil - soil concept, features, soil forming materials, physical properties of soil, soil nutrient supply, soil classification. It summarizes the analysis of soil degradation processes and the impacts of human activities on soil quality within the soil conservation process. It provides comprehensive knowledge about soil organic and inorganic pollutants, their effects and the factors determining the spread of contamination. It presents the various remediation technologies and opportunities for remediation of contaminated sites and international experience. A particular lecture is devoted to on-site (in-situ, ex-situ) and off-site procedures. Furthermore, a special lecture deals with the various polluting substances and their detection and termination. | | | |
| ***Professional competencies:*** | | | |
| Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments, and limitations thereof, as well as methods for the evaluation of data measured.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to carry out assignments as environmental officer.  Able to carry out management duties subject to sufficient professional experience.  Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies.  Able to apply environmental remediation methods, to prepare for and participate in remediation.  Able to take part in environment expertise, advisory, and decision preparation work.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses. | | | |
| ***Literature:*** | | | |
| Dr. Pregun, Csaba: Hydrology, Publication date 2011,  Szerzői jog © 2011 Debreceni Egyetem. Agrár- és Gazdálkodástudományok Centruma, in e-learning system  R.C.Gaur: Basic environmental engineering, New Age International Publishers. 2008 in e-learning system  RPC Morgan: Soil Erosion and Conservation, National Soil Resources Institute, Cranfield University, Blackwell Publishing, 2005,  Humberto Blanco, Rattan Lal: Principles of Soil Conservation and Management, Springer Verlag, 2008 | | | |

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| ***Title of the course:***  **Environmental elements protection III-IV. (Noise, Vibration, and Air Protection)** | ***NEPTUN-code:***  RKXKZRABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+4+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The study of this subject of the first part can be divided into two main parts:  1. noise, noise pollution and effect on human, physical describing of sound waves, sound levels (SWL, SPL, SIL) loudness and frequency (Fletcher-Munson curves), noise reduction methods, noise filters, noise measurement and calculation, noise map. Noise protection at the source, transmission path and receiver.  2. vibration, vibration pollution, modelling of vibration (free and damped), levels in decibels (acceleration, velocity, displacement), forced oscillations, resonance frequency (Tacoma Narrows Bridge), effects of vibration on human depend on many factors, whole body and hand-arm vibrations, vibration absorption, vibration measurement. Vibration insulation and damping.  The aim of the second part of the course is to prepare students to protect air quality by learning about the structure of the atmosphere, the damaging effects of the atmosphere, the effects of solar radiation, the greenhouse effect, the spread of pollutants, self-pollution, air quality protection limits, and emission-emission standards. In the context of the practical training, they will learn the basic concepts of dust technology, air quality measurement methods, the principles of operation of dust collection chambers, filters, cyclones and electrostatic precipitators. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to carry out assignments as environmental officer.  Able to carry out management duties subject to sufficient professional experience.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to communicate both verbally and in writing in their mother tongue and in at least one foreign language, in respect of professional issues, and to continuously develop their professional skills as required.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks | | | |
| ***Literature:*** | | | |
| Serway Jewett: Physics for Scientist and Engineers,  http://pcfarina.eng.unipr.it/Public/Acoustics-Course/Penn-State-Course/10\_osp.pdf  http://www.processindustryforum.com/hottopics/nucleardisasters  Sivakumaran Sivaramanan: Noise, Vibration and Light pollution: Complete review on noise, vibration and light pollution causes, effects and solutions, Kindle, 2016, ISBN ‏ :1976942349 Nicholas P. Cheremisinoff, Ph.D. : Handbook of Air Pollution Prevention and Control  Margeret Pence - Handbook of Air Pollution control Systems and Devices  Roy M. Harrison - Handbook of Air Pollution Analysis 2 Sub Edition  Joel M. Haight Ph.D., P.E. - Control of Air Pollution | | | |

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| ***Title of the course:***  **Environmental elements protection V-VI. (Radiation Protection and Waste Management)** | ***NEPTUN-code:***  RKXKE3ABNF | | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit:*** 4  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge (with Neptun code):*** | | |
| ***Curriculum:*** | | | | |
| The aim of the course is to introduce students to the radiation protection and the waste management. History of atomic structure. Classification of radiations (ionizing and non-ionizing). Radiation from environmental. Detect of natural radioactivity. Law of natural activity. Particle radiations (α, γ, neutron). Penetrating power of radiations. Uses of nuclear energy and radiation (food preservation, nuclear power stations and weapons). Working method of a pressurized-water nuclear station. Relationship between mass defect and binding energy. Nuclear fission. Dose quantities in SI units. Radiation effects on human. Protection against radioactive radiation (time, distance, shielding). Nuclear disasters.to waste management technologies. The subject provides a comprehensive knowledge of theoretical concepts, types of waste quantity and composition of the waste. Furthermore, in the frame of the course, expectations and conceptions of the European Union’s waste management and the Sustainable Waste Management in Hungary will be taught.  The subject deals primarily with sustainable management of waste materials and the available technologies that treat those materials successfully. Moreover, the course contains knowledge about technological solutions like emission streams. Part of the curriculum includes municipal solid waste, used (wreck) cars, electronic waste, batteries, rubber, plastic, glass, construction waste, packaging waste and other types of waste generated by industrial activity. Waste recovery, recycling as possible enemy solutions and the necessary preparation technologies will be presented as well. During the semester, we will examine how the composition of the various areas (residential, agricultural, industrial, etc.) influences waste and environmental impacts and sustainability principles in waste management. It shows the importance of the connection between waste management plan and the steps that are taken to deal with waste and its legal context as well. Waste collection, reloading and delivery of technological progress will be discussed in detail. The course describes the technological possibilities of disposing waste, such as orderly disposal, disposal of thermal and chemical processes or mechanical-physical processes. Main fields of the subject:   * environmental issues; waste as an environmental issue; applying environmental science to the management of waste. * managing legal issues and activities in the cleaning and waste industries; managing human resources in the cleaning and wastes industries. * mechanical, biological and thermal treatment of waste. * environmental laws of waste management. * contaminated land; landfill processes. | | | | |
| ***Professional competencies:*** | | | | |
| Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to carry out assignments as environmental officer.  Able to carry out management duties subject to sufficient professional experience.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Able to communicate both verbally and in writing in their mother tongue and in at least one foreign language, in respect of professional issues, and to continuously develop their professional skills as required.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks. | | | | |
| ***Literature:*** | | | | |
| Márton Herczeg: Municipal waste management in Hungary EEA project manager Almut  Reichel ETC/SCP February 2013 Eurostat, 2012: ‘Waste database municipal waste‘ http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/database Accessed May 2012  European Commission (2012). Support to Member States in improving waste management based on assessment of Member States’ performance. Screening Report. Screening of all EU Member States’ waste management performance. DRAFT Version 1. 12 April 2012  Nijkerk, A.A., Dalmijn, W.L. : Handbook of Recycling Techniques (ISBN 90-802909-3-9). Nijkerk Consultancy February 2001, 5th Revised edition (pp.1-254 )  Ram Chandra: Environmental Waste Management, 2015 by Taylor and Francis Group, U.S. | | | | |

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| ***Title of the course:***  **Environmental Technologies and Operations I.- Water and waste-water treatment technologies** | ***NEPTUN-code:***  RKXKM1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit:*** 4  ***Exam type****:* e |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXKE1ABNF | |
| ***Curriculum:*** | | | |
| The course objective is to show water (drinking) and wastewater treatment technologies and the requirements of drinking water, law and standard of drinking water and cleaned wastewater. The first aim of this course is to provide technological knowledge about advanced drinking water treatment. Focus is on both, conventional and new, emerging technologies. The course discusses relevant unit processes involved, and their role and location in a typical treatment chain. Physical, chemical and biological unit processes will be covered in the course. Further emphasis is on the effect of treatment on water quality and the transformations taking place in the water phase.  The second aim of this course is to describe wastewater definition, types of wastewaters, and components of wastewater and sewer systems. Introduces wastewater treatment steps: Pre-treatment, Primary, Secondary and Tertiary treatment steps and available technologies within each step.  Highlights treatment technologies and reuse of sludge remaining in large volumes at the end of the treatment process. | | | |
| ***Professional competencies:*** | | | |
| Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to carry out management duties subject to sufficient professional experience.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses. | | | |
| ***Literature:*** | | | |
| Nicholas P. Cheremisinoff, Ph.D.: Handbook of water and wastewater  treatment technologies, ISBN: 0-7506-7498-9, in e-learning system  Dr. Michael R. Templeton, Prof. David Butler: Introduction to wastewater treatment in e-learning system, bookboon.com, 2011., ISBN: 978-87-7681-843-2  Frank Spellman: Water and Wastewater Treatment, Taylor & Francis Inc, 2012, ISBN: 9781439854006 | | | |

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| ***Title of the course:***  **Environmental Technologies and Operations II.- (energy in environmental protection)** | ***NEPTUN-code:***  RKXKM2ABNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit:*** 4  ***Exam type****:* e |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The aim of the course is to introduce the basic concepts of energy, the energy chain, energy transformation, efficiency, and forms of energy. Students will learn about the types of renewable energy sources, their importance, and environmental benefits. They will be introduced to the history of wind power, the components of wind energy, wind turbines and the basics of their operation. Students will learn about the concept of biomass, its possible applications and biogas production. Hydropower, hydroelectric power plants, and geothermal energy sources and applications will be introduced. The potential of solar energy (solar collectors and solar panels) will be introduced at a basic level, including the types of solar collectors and solar panels, and the calculation of efficiency and payback time. | | | |
| ***Professional competencies:*** | | | |
| Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to carry out management duties subject to sufficient professional experience.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Taking responsibility towards society for their decisions made in the scope of environment protection. | | | |
| ***Literature:*** | | | |
| Ristinen R.: Energy and the Environment, John Wiley and Sons Ltd, 2022, ISBN: 9781119800255  Bent Sørensen: Renewable Energy, 4th Edition, Physics, Engineering, Environmental Impacts, Economics and Planning, Academic Press, 2010, eBook ISBN: 9780080890661  Hardcover ISBN: 9780123750259  B Viswanathan: An Introduction to Energy Sources, Indian Institute of Technology 2006, 289 pages, https://nccr.iitm.ac.in/ebook%20final.pdf  Robert Ferry, Elizabeth Monoian: A Field Guide to Renewable Energy Technologies, Society for Cultural Exchange 2012, ISBN/ASIN: 061561597X, ISBN-13: 9780615615974; Number of pages: 71  Vaclav Smil: Energy in Nature and Society: General Energetics of Complex Systems (MIT Press) First Edition (1st printing) Edition, ISBN-13: 978-0262693561; ISBN-10: 0262693569 | | | |

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| ***Title of the course:***  **Public Health and Health Protection** | ***NEPTUN-code:***  RKXKU1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Hosam Hamuda Bayoumi Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The science of public health and environmental hygiene tasks and methods. The concept of health and disease. History and outstanding personalities of Public Health. Organizational structure and system of national and international public health. Demographic Fundamentals, demographic characteristics of Hungarian and international situation. Demography and epidemiology basics, risk assessment and testing methods. Domestic and international epidemiological situation report. The main tasks of our education and health sectors. The structure of public health, including health care. The levels of prevention and levels. The health care and public health systems in Hungary. Non-communicable disease epidemiology, prevention. The impact of globalization on health. Health care and health promotion. Mental Health. City health study. Air, soil and water hygiene. Infection Control. Ionizing and non-ionizing radiation. Structure of immune system functioning. Antibodies. Immunity and vaccines. Transplantation, transfusion. Antibiotics. Allergy, AIDS, autoimmune disease. The skin organ system, the respiratory system and the movement of the body and the metabolic processes of environmental health problems. Diet and Health Study. The Hungarian diet features. Nutrition environmental health aspects. Alternative forms of the nutrition. Environmental health: consequences of globalization. Epigenetics. Climate change. Occupational hygiene and health care. Non-infectious diseases: Heart vascular- and cancer epidemiology. Mental health promotion. Old- and new addictive diseases. Protection current tasks for mother, child and youth. The aging societies and public health challenges of old age. Wastes caused health problems. Pollution effects. The basic terms of toxicology. The presence of environmental toxicants in food. The metals and their compounds and toxicology of pesticides. Toxicological tests and their characteristics, measurement options. Genotoxicity and the expected effects. Epidemiology and epidemiological tasks of infectious disease and the environment. Hospital hygiene, prevention of nosocomial infections. Acquisition of Health and public health knowledge. Environmental and health-conscious lifestyle education. The weather and the human’s body adaptation. The recognition of the relationship between environment and health. The expected health effects due to climate change. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Collaboration with civil organizations engaged in environment protection, but willing to argue in order to develop optimal solutions.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Sharing experiences with colleagues, thus promoting their development.  Taking responsibility towards society for their decisions made in the scope of environment protection. | | | |
| ***Literature:*** | | | |
| [V. Rozanov](http://store.elsevier.com/authorDetails.jsp?authorId=ELS_1195542) (2016): Stress and Epigenetics in Suicide, 1st Edition, Academic Press, Print Book ISBN: 9780128051993  Emerging Infectious Diseases www.cdc.gov/eid Vol. 22, No.10, October 2016  [International travel and health (2013](http://www.freebooks4doctors.com/link.php?id=1304)): Information on health risks for travellers. IBSN: 9789240686434  Merck and the Merck Manuals (2011): [Infectious Diseases, in: Merck Manual](http://www.freebooks4doctors.com/link.php?id=1124) Merck Sharp & Dohme Corp.  Michael Stuart Bronze, Burke A Cunha, Ronald A Greenfield, et al. (2011): [Infectious Diseases](http://www.freebooks4doctors.com/link.php?id=1041) Medscape Reference WebMD  Victorian State Government, Australia (2009): [Blue Book](http://www.freebooks4doctors.com/link.php?id=1283). Guidelines for the control of infectious diseases Victorian State Government  Paget Stanfield et al. (2008): [Diseases of Children in the Subtropics and Tropics](http://www.freebooks4doctors.com/link.php?id=1373). 4th edition ISBN: 9780340506332  David Coggon, David Barker, Geoffrey Rose (2008): [Epidemiology for the Uninitiated](http://www.freebooks4doctors.com/link.php?id=1421). BMJ Publishing Group | | | |

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| ***Title of the course:***  **Environmental analytics-Analytical chemistry** | ***NEPTUN-code:***  RKXKA1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+3 | ***Credit*:** 5  ***Exam type****:* e |
| ***Course leader:***  Ágnes Bálint-Mészáros, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RMXCA2KBNF, RKXFI1ABNF | |
| ***Curriculum:*** | | | |
| The aim of the course is to present the possibilities of testing and analytical methods for toxic pollutants released into the environment because of human activities. Environmental analytics uses analytical chemistry and other techniques to study our environment. The primary objective is to familiarise you with the possibilities of sampling different environmental elements (atmosphere, surface and subsurface water and soil) to assess whether they are contaminated with organic and inorganic toxic substances. The course introduces the physical and chemical principles of environmental analysis, presents the different validation methods, and highlights the importance of standardisation. Students will learn about different sampling and sample preparation procedures, review atomic and molecular spectroscopy techniques and the most important separation techniques. In laboratory exercises, they will apply the methods learned in theory to environmental samples, from sampling to sample preparation, using appropriate analytical instrumentation to measure the possible presence of inorganic or organic toxicants. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies.  Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Able to perform environmental impact assessments and to participate in compiling impact studies.  Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field. | | | |
| ***Literature:*** | | | |
| David Harvey: Modern Analytical Chemistry, McGraw Hill, Boston Burr Ridge, IL Dubuque, IA Madison, WI New York, San Francisco, St. Louis, Bangkok, Bogotá Caracas, Lisbon, London, Madrid, Mexico City, Milan, New Delhi, Seoul, Singapore, Sydney, Taipei, Toronto, 2000  Gary D. Christian: Analytical Chemistry, John Wiley and Sons Inc., 2004  Roger N. Reeve: Introduction to Environmental Analysis, Wiley, 2002, ISBN 0-471-49295-7  Chunlong Zhang: Fundamentals of Environmental Sampling and Analysis, Wiley, ISBN: 978-0-471-71097-4, 456 pages April 2007  Baranowska, Irena (Ed.): Handbook of Trace Analysis, Fundamentals and Applications, Springer International Publishing Schwitzerland, 2016, ISBN 978-3-319-19614-5 | | | |

**Technical engineering skills (20-50cr.):**

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| ***Title of the course:***  **Technical mechanics** | ***NEPTUN-code:***  RKXME1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| Engineering mechanics is the application of mechanics to solve problems involving common engineering elements. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios. Dividing of Engineering mechanics. Physical quantities.  **Statics** (part of dynamics). Basic concepts, fundamentals. Planar forces, force systems. Power system bound to tractrix action on the rigid body. Planar forces, force systems. Centre of gravity, bearing force. Holders and articulated mechanisms. Friction. Strength of Materials. Basic concepts, stress and stress states. Material Laws. Simple strain of prismatic bars. Stress theories.  **Kinematics.** The kinematics of a point. Basic concepts, uniform and uniformly changing motion. Projectile motions, circular motion, harmonic motion, swinging motion. Kinematics of the rigid body. Basic concepts, velocity and acceleration states, elemental and finite motions. The kinematics of relative motions.  **Kinetics** (part of dynamics). Kinetics of the material point, axioms, general theorems. The free, forced and relative motion of the material-point. The kinetics of a rigid body. The moment of inertia, and general theorems and principles. The rotation of a rigid body around an axis, translational and plane motion of a rigid body. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Adequate perseverance and endurance of monotony to perform practical operations.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks. | | | |
| ***Literature:*** | | | |
| Serway Jewett: Physics for Scientist and Engineers  (**Statics**) <http://www.icivil-hu.com/Civil> team/2nd/Statics/Statics,%20R.C.%20Hibbeler,%2012th%20book.pdf  (**Dynamics**) https://docs.google.com/file/d/0Bw8MfqmgWLS4V0NFR2dVUWpuYzg/edit | | | |

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| ***Title of the course:***  **Technical drawing and documentation** | ***NEPTUN-code:***  RKEMR1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+0+2 | ***Credit:*** 4  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| The aim of this course is to introduce drawing fundamentals and to develop drawing skills of students. The first part of the course covers such topics as layout of Technical Drawings, line styles, lettering, scale, geometric construction, transformation, projection (orthographic projection, central or perspective projection, oblique projection), axonometric view (isometric, diametric, Cavalier etc.). The second part of the course focuses on topics as follows: sketching, dimensioning, sectioning, fits and tolerances, surfaces roughness, symbolical representation, detail and assembly drawing. | | | |
| ***Professional competencies:*** | | | |
| In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Adequate perseverance and endurance of monotony to perform practical operations.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances. | | | |
| ***Literature*** | | | |
| Addisu Dagne Zegeye: A Textbook of Engineering Drawing: for Undergraduate Engineering Students, Independently Published, 2020, ISBN: 9798656430043  Coli H.Simmons, Dennis E. Maguire: Manual of Engineering drawing in e-learning system  David Anderson: Technical drawing, Spring, 2006  Sachidanand Jha: AutoCAD Mechanical: 400 Practice Drawings For AUTOCAD MECHANICAL and Other Feature-Based 3D Modeling Software, Independently Published, 2019, ISBN: 1070883298 | | | |

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| ***Title of the course:***  **Machine elements** | ***NEPTUN-code:***  RKXGZ1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit:*** 4  ***Exam type****:* tm |
| ***Course leader:***  Andrea Paukó, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge (with code too):*** RKXMR1EBNF | |
| ***Curriculum:*** | | | |
| The course aims to introduce the most basic machine parts, giving insight to the engineering speciality. The subject deals with machine parts and machine structures used in up-to-date machines, their types, properties, and design principles. Main topics:  The concept of machine elements, groups, and design principles   * rotating machine parts, shaft joints, * mechanical drives: gear drives, worm gearing, chain drive, belt drive. Principle of friction transmission, * brakes: structure, function, and design basics, * supporting shafts, bearings, basic concepts of tribology * storage elements: pipelines and fittings, pipe joints, valve, gate valve, check valve. Flow losses of pipe networks, characteristic curves, reservoirs and seals, * grouping of fluid machinery, characteristic parameters. Essential features of pumps, pump head, efficiency, and useful power. * structure of ventilation equipment and operation (fans, blowers, compressors, vacuum pumps). | | | |
| ***Professional competencies:*** | | | |
| Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.  Adequate perseverance and endurance of monotony to perform practical operations.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned. | | | |
| ***Literature:*** | | | |
| Steven R. Schmid, Bernard J. Hamrock, Bo. O. Jacobson: Fundamentals of Machine Elements, ISBN 9781439891322  Machine elements, handbook, http://www.gbi.bgk.uni-obuda.hu/oktatas/segedanyagok/gepelemek/Machine\_Design\_2/Machine%20Element.pdf | | | |

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| ***Title of course:***  **Data processing of measurements** | ***NEPTUN-code:***  RKXMF1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  1+0+2 | ***Credit*:** 4  ***Exam type****:*tm |
| ***Course leader:***  Ágnes Bálint-Mészárosné, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXMA2EBNF | |
| ***Curriculum:*** | | | |
| If the environmental components (air, water, soil) are examined, then a big amount of measurement data will be collected. The data with a big quantity cannot be interpreted. It is necessary to evaluate our data. Our data should be processed to interpret them.  In simpler cases data processor programs are used, than e.g., Microsoft Excel.  The principle of data sorting will be presented.  We may need special statistical software packages, that we may establish contexts between our measured data with their help. We present the statistical basic principles (descriptor statistics, ANOVA etc.).  Several statistical software packages exist: eg. SPSS, SAS etc.  Origin software package will be presented which is one of the most important programs of scientific data processing.  The freeware software R can be written our necessary procedures for analysis of our data statistically. We can compare our algorithms which can be manufactured by Matlab help with the programs written with statistical software packages. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments, and limitations thereof, as well as methods for the evaluation of data measured.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses. | | | |
| ***Literature:*** | | | |
| Matthias Kohl: Introduction to statistical data analysis with R, bookboon.com, 2015, ISBN: 978-87-403-1123-5, 1 edition. Felix C. Veroya: Introduction to Statistical Process Control, A Problem Solving Process Approach, bookboon.com, 2014, ISBN: 978-87-403-0789-4, 1 edition, | | | |

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| ***Title of the course:***  **Open and Closed loop Control** | ***NEPTUN-code:***  RKXSV1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+0+2 | ***Credit*:** 4  ***Exam type:***  tm |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| Learning the basic concept of the open and closed loop control. The open loop control using only On/Off signals. Overview PLC systems. Open loop control with pneumatic final elements.  Review the theoretical background of closed loop control, structure of a control system, signals and basic control blocs. Time response, frequency response, steady state characteristics. | | | |
| ***Professional competencies:*** | | | |
| In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Responsible proclamation and representation of the value system of the engineering profession; openness to professionally well-founded critical remarks.  Sharing experiences with colleagues, thus promoting their development. | | | |
| ***Literature:*** | | | |
| Javad, Mohammadpour: Control of Linear Parameter Varying systems. Chapter: 1, 2, 3; ISBN: 978-1-4674-1832  Keviczky, László: Control Engineering, Chapter: 1, 2, 4, 6, 8; ISBN: 978-963-9819-74-0  E-learning materials in Moodle (lectures) | | | |

**Environmental analysis and environmental informatics (10-30cr.):**

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| ***Title of the course:***  **Informatics** | ***NEPTUN-code:***  RMEIN1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+0+3 | ***Credit*:** 4  ***Exam type****: tm* |
| ***Course leader:***  Eszter Kormány, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The aim of the course is to form a basis of informatics for the respective university studies and for the subsequent engineering career as well. Throughout the lectures one will receive insight of the formation, development, current state and areas of development related to the science of informatics. The course covers computer architectures and the necessary hardware and software components as well as the application of the ethical and safe use. The seminars are focusing on data analysis, problem solving and building algorithms. The skills acquired thereof could be applied to solve tasks of the corresponding subjects and to professional work later.  In the framework of the course the basics of database manipulation and programming are covered. With the aid and application of MS Access one will be able to construct and manipulate databases. The course introduces database design, normalization steps, creation of tables, setting of keys and relations. Queries and reports are also included. The use of the SQL is part of the course as well. The course covers the basis of programming and means of algorithm description as well as their usage. One will have the opportunity to create simple algorithms and functions for MS Office applications. | | | |
| ***Professional competencies:*** | | | |
| In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation softwares depending on their specialty.  Adequate perseverance and endurance of monotony to perform practical operations. | | | |
| ***Literature:*** | | | |
| PPT files on the homepage of Moodle learning system | | | |

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| ***Title of the course:***  **Nature and landscape protection, Environmental and nature field exercises** | ***NEPTUN-code:***  RKXTT1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+4+0 | ***Credit*:** 5  ***Exam type****:* 1m |
| ***Course leader:***  Krisztina Demény Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The purpose of the subject is to present the basic knowledge of nature and landscape protection through the following topics, and to prepare students for effective nature protection: Definition of landscape, natural and cultural landscape. Hierarchical system of landscape. Landscape-forming factors (biotic and abiotic factors). Types of landscape, landscape potential and protection. History of nature protection/conservation in Hungary and in the world. Major types of protected areas. Subjects of nature protection/conservation: geological, hydrological, zoological, botanical, cultural values. Main protected areas in Hungary and in the world.  The aim of the course is to apply the theoretical knowledge acquired in professional subjects to practical work, field work and field visits. Sampling and measurements on the field and in the lab provide students with experience that they can build upon to solve a problem later on. The main objective of the course is to create a competence-based environmental engineer training in addition to advanced theoretical science training. During the semester the students will participate in field visits and field work to identify environmental and nature conservation issues. Direct contact with the environment helps to develop an environmentally conscious approach, to recognize the causal relationships and relationships between the state of the natural environment and human activity. It is possible to observe anthropogenic impacts in the environment - waste incineration plant, sewage treatment plant, landfill, small water streams, municipal infrastructure, etc., and to carry out impact studies. During the course students will have the opportunity to interpret and analyze complex environmental and nature conservation problems. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Undertaking and authentically representing the social role of environment protection, its basic relationship with the world.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments, and limitations thereof, as well as methods for the evaluation of data measured.  Able to perform environmental impact assessments and to participate in compiling impact studies.  Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances. | | | |
| ***Literature:*** | | | |
| Kertész, A. (2013): Landscape and environmental assessment (http://p2014-1.palyazat.ektf.hu/public/uploads/kertesz-landscape-and-environmental-assessment\_532c37799f86c.pdf)  Stuart Chape et al.(edit) 2008: The world protected areas (statues, values and prospects in the 21th century), University of California Press (http://www.the-eis.com/data/literature/The%20worlds%20protected%20areas.pdf  PPT files on the homepage of Moodle learning system  Ravi Jain - Lloyd Urban - Harold Balbach - M. Diana Webb: Handbook of Environmental Engineering Assessment: Strategy, Planning, and Management, Elsevier - Health Sciences Division, 2012, ISBN: 9780123884442Brian  Barkdoll: Field guide to environmental engineering for development workers: water, sanitation, and indoor air, 2009, https://www.academia.edu/73112295/Field\_guide\_to\_environmental\_engineering\_for\_development\_workers\_water\_sanitation\_and\_indoor\_air | | | |

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| ***Title of the course:***  **Geoinformatics (GIS)** | ***NEPTUN-code:***  RKXTI1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+2 | ***Credit*:** 4  ***Exam type****: tm* |
| ***Course leader:***  Krisztina Demény Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:*** | |
| ***Curriculum:*** | | | |
| The teaching aim of the course is to introduce the basic theory and practice of GIS. The course will highlight the development of GIS, it will present the database model of GIS, the basic data management techniques and the data analyses method. The course will also demonstrate the data visualisation methods and possibilities of GIS. | | | |
| ***Professional competencies:*** | | | |
| In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Adequate perseverance and endurance of monotony to perform practical operations. | | | |
| ***Literature:*** | | | |
| Tomislav Hengl: Geostatisitcal mapping http://spatial-analyst.net/book/  Michael de Smith, Paul Longley, Mike Goodchild: Geospatial Analysis - A comprehensive guide (http://www.spatialanalysisonline.com/)  John P. Snyder : Map Projections: A Working Manual http://pubs.er.usgs.gov/publication/pp1395 | | | |

**Environmental management (10-30cr.):**

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| ***Title of the course:***  **Environmental law** | ***NEPTUN-code:***  RKXKJ1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+0 | ***Credit*:** 3  ***Exam type****: e* |
| ***Course leader:***  Imre Biczó Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| Introduction to Law: Overview of the main legal traditions of the World. Introduction to the Common law tradition (Introduction to the English Law. Sources of law. English court system, Contracts in English law, the law of torts, Corporate Law), Introduction to the Civil law tradition (German, French law), EC law, Introduction to Hungarian law: Structure, Hungarian law of contracts, corporations, environmental law, Introduction to Environmental protection, history, EC/EU Environmental law: EU Primary legislation, right to environment, Principles, Programmes and Strategies, Legal Instruments I.: Substantive environmental law, Legal instruments II: Procedural rules, Liability measures, Organs, Authority, Environment and development: sustainable development, Environmental protection in EU Funds | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies.  Knowledge of requirements and methods for health and safety, fire protection, safety engineering and remediation as related to the field of environment protection.  Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them.  Able to carry out assignments as environmental officer.  Able to take part in environment expertise, advisory, and decision preparation work.  Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith.  Taking responsibility towards society for their decisions made in the scope of environment protection.  Performing environmental tasks individually and managing special environment protection work independently even in unexpected decision-making situations.  Monitoring regulatory, technical, technological, and administrative changes related to the special field and enforcing them in their professional work. | | | |
| ***Literature:*** | | | |
| Nancy E. Marion: Making Environmental Law: The Politics of Protecting the Earth, Praeger Publisher, Santa Barbara, CA, 2011, 376 pages  Angelo, Mary Jane: Harnessing the Power of Science in Environmental Law: Why We Should, Why We Don't, and How We Can, Texas Law Review Publisher, 2008 | | | |

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| ***Title of the course:***  **Environmental managment and impact assessment** | ***NEPTUN-code:***  RKXKH1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit:*** 4  ***Exam type****:* tm |
| ***Course leader:***  Imre Biczó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| Students get the concept of impact assessment and to study the methodology of impact assessments. Learn the main steps of creating the environmental impact assessment and its purpose, as well as the structure of the environmental management system and the methodology of environmental auditing. To get know with the procedures that occur during the environmental engineering practices within the impact assessment methodology. The objective of this course is attitude shaping and transferring knowledge which can be used in practice. | | | |
| ***Professional competencies:*** | | | |
| Able to perform basic tests of the quantity and quality characteristics of environmental elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.  Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.  Performing environmental tasks individually and managing special environment protection work independently even in unexpected decision-making situations.  Cooperation with qualified experts from other special areas (primarily economic and legal) while completing professional tasks. | | | |
| ***Literature:*** | | | |
| Alan Gilpin: Environmental Impact Assessment Cutting Edge for the 21st Century Cambridge University Press, ISBN: 9781139166539, https://doi.org/10.1017/CBO9781139166539  Edited by Peter Wathern: Environmental Impact Assessment, Theory and Practice, ISBN: 9781138137448, eBook ISBN: 9780203409978, Adobe ISBN: 9781134897728, 10.4324/9780203409978  Charles H., Eccleston: Environmental Impact Assessment: A Guide to Best Professional Practices 1st, Kindle Edition,  C.J. Barrow; Environmental Management for Sustainable Development, 2nd edition, Routledge  S. Schaltegger, R Burritt, H. Petersen; An Introduction to Corporate Environmental Management, Greenleaf Publishing | | | |

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| ***Title of the course:***  **Risk analysis** | ***NEPTUN-code:***  RKXKO1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type****: e* |
| ***Course leader:***  Sándor Pekker, Ph.D. | ***Position:***  research professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| Main topics of the subject: Definition and types of risk, The risk-taking, Risk measures, The controllability of risk, Environmental risks and environmental functions of companies, Health Risk Assessment (HRA), Ecological Risk Assessment (ERA), The risk of natural hazards, disasters, The environmental risk of toxic elements, Environmental risks in the information society, Special and border areas. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  In possession of state-of-the-art IT skills, being able to use professional databases and certain design, modelling, and simulation software depending on their specialty.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies.  Able to perform environmental impact assessments and to participate in compiling impact studies.  Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them. | | | |
| ***Literature:*** | | | |
| Marvin Rausand: Risk Assessment: Theory, Methods, and Applications (Statistics in Practice), 1st Edition, Wiley, 2011, ISBN-13: 978-0470637647; ISBN-10: 0470637641  Thomas Simon: Edition: Fundamentals of Applied Risk Assessment – eBook, Edition: 2; Copyright: 201 , Kendall Hunt, Pages: 532; ISBN 9781465229373  Ian Lerche,Walter Glaesser: Environmental Risk Assessment: Quantitative Measures, Anthropogenic Influences, Human Impact, Springer Science & Business Media, 2007, 343 pages; ISBN: 9783540297093 | | | |

**Sustainable Energy Management, Green Energy Specialisation**

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| ***Title of the course:***  **The source of renewable energies I. (The application of solar and geothermal energy)** | ***NEPTUN-code:***  RKWMF1ABNF | | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 5  ***Exam type****:* e |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -***  RKXEL1EBNF, RKXKM2ABNF | | |
| ***Curriculum:*** | | | | |
| The educational objective of the course is to introduce students to solar and geothermal energy technologies, presenting their potential, advantages, disadvantages, and limitations. In addition, the history of solar energy utilisation, passive and active methods of utilisation will be presented. The operating principles and types of solar collectors and solar panels, their efficiency and payback period are described. The energy analysis of a specific domestic solar panel, domestic, small power plant as a function of the variation of different parameters is presented. Within the framework of the course, the students will learn about the physical and geological characteristics of geothermal energy sources, the generation and the surface transport of geothermal heat. Geothermal energy applications are covered: thermal water, electricity generation (steam turbines), geothermal heat pumps.  The environmental impacts, the problem of disposal of thermal water (purification or reinjection) and the domestic potential (spas, agriculture, etc.) are presented. | | | | |
| ***Professional competencies:*** | | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the concepts and tools of economics and environmental economics, project, and environment management in environment protection.  Knowledge of the basics of energy management, options for energy production, their advantages, and disadvantages, as well as the concept and feasibility options of sustainable development.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Able to take part in environment expertise, advisory, and decision preparation work.  Monitoring regulatory, technical, technological, and administrative changes related to the special field and enforcing them in their professional work. | | | | |
| ***Literature:*** | | | | |
| Michaelides, Efstathios E. Stathis: Alternative Energy Sources, ISBN 978-3-642-20951-2  Yunus A. Cengel: Fundamentals and Applications of Renewable Energy, McGraw-Hill Education, 2019, ISBN: 1260455300  John Tabak: Solar and Geothermal Energy, Infobase Publishing, 2009, ISBN: 9780816070862  Elizabeth Raum: Water and Geothermal Energy, Heinemann-Raintree, 2008. pp. 32. | | | | |

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| ***Title of the course:***  **The source of renewable energies II. (The application of wind power, water energy and hydrogen cell)** | ***NEPTUN-code:***  RKWMF2ABNF | | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 5  ***Exam type****: e* |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  RKXEL1EBNF,RKXKM2ABNF | | |
| ***Curriculum:*** | | | | |
| The educational objective of the course is to introduce students to wind, hydroelectric and hydrogen cell technologies, showing their potential, advantages, disadvantages, and limitations. In particular, the history of wind turbines, their types (horizontal, vertical axis), wind turbine parts and their operation will be introduced. Students will learn about the calculation of the efficiency and payback time of wind turbines. The second part of the course introduces the history of hydropower (water wheel irrigation systems, water mills, etc.), the types of water wheels and water turbines. Students will be given an explanation of the tidal phenomenon through some examples (estuarine tidal power plants e.g., Severn, England). The course will also cover the principles of hydrogen cells and the attempts of car manufacturers to replace the former petrol and diesel cars. | | | | |
| ***Professional competencies:*** | | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the concepts and tools of economics and environmental economics, project, and environment management in environment protection.  Knowledge of the basics of energy management, options for energy production, their advantages, and disadvantages, as well as the concept and feasibility options of sustainable development.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Able to take part in environment expertise, advisory, and decision preparation work.  Efforts to improve knowledge by on-going self-education and continuously update their knowledge of the world.  Monitoring regulatory, technical, technological, and administrative changes related to the special field and enforcing them in their professional work. | | | | |
| ***Literature:*** | | | | |
| Michaelides, Efstathios E. Stathis: Alternative Energy Sources, ISBN 978-3-642-20951-2  Robert Gasch, Jochen Twele: Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer Science & Business Media, 2011. okt. 12. - 548 pp.  Arnold, Guy: Wind, Water and Solar Power: New Energy Possibilities (Facts on), Hachette Children's Group, ISBN: 0749603682  Tony L. Burton- Nick Jenkins- Ervin Bossanyi - David Sharpe - Michael Graham: Wind Energy Handbook, ISBN: 978-1-119-45109-9, Wiley, 2021  Sherry Neuwirth Payne: Wind and Water Energy, Heinemann/Raintree, 1983, ISBN: ‎ 978-0817214180  Elizabeth Raum: Water and Geothermal Energy, Heinemann-Raintree, 2008. pp. 32.  Edited by Detlef Stolten: Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications, 2010. Wiley VCN, ISBN: 978-3-527-32711-9 | | | | |

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| ***Title of the course:***  **Biomass production and recovery** | ***NEPTUN-code:***  RKWMU1EBNF | | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 6  ***Exam type****:* tm |
| ***Course leader:***  Csaba Ágoston, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  - | | |
| ***Curriculum:*** | | | | |
| During the semester all biomass raw materials that are used energetically in domestic and / or foreign biomass power plants will be presented.  One of these is herbaceous and woody plants grown specifically for biomass use. These raw materials cover not only the basic aspects of cultivation, but also other environmental technology linkages such as brownfield revitalization, phytoremediation, etc.  Wastes that can be used as biomass feedstock, waste from the biological industries, and rdf and srf from the fraction of municipal waste sorting, as feedstock for biomass and / or power plant boilers, or from so-called municipal waste. Raw materials for the "dry" biogas process will be presented in the second half of the semester. The standards, legal requirements and technical aspects of these materials as well as the technological and organizational aspects of production will also be introduced during the course.  In addition to the main mechanical / mechanical parameters of each type of biomass firing equipment, the course material is detailed along with the main material groups. | | | | |
| ***Professional competencies:*** | | | | |
| Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Knowledge of the basics of energy management, options for energy production, their advantages, and disadvantages, as well as the concept and feasibility options of sustainable development.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances. | | | | |
| ***Literature:*** | | | | |
| Erik Dahlquist: Biomass as Energy Source: Resources, Systems and Applications, March 31, 2017 by CRC Press, ISBN 9781138073227 | | | | |

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| ***Title of the course:***  **Alternative energy usage in practice I. (System of energetics - transport and residential application)** | ***NEPTUN-code:***  RKWAE1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 6  ***Exam type****:* tm |
| *Course leader:*  Konrád Lájer Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The purpose of the subject is to introduce alternative energy conversion drives used in transport. (LPG, CNG, hydrogen, electric drives). During the semester, students conduct an environmental risk assessment of each drive. They will learn the interactive control options that coordinate transport systems (eg public transport alternatives; 'self-driving vehicles'; 'smart' roads). It also describes the principles of operation of additional transport related infrastructures. (Street lighting ("Smart" lighting, traffic control).  Within the framework of the course, the modern energy management capabilities of household appliances and the benefits of networked equipment (eg IOT [Internet of Things] application technology) are introduced.  The course has the task of developing attitudes as well as learning about economics calculations used in practice. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the concepts and tools of economics and environmental economics, project and environment management in environment protection.  Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.  Knowledge of the basics of energy management, options for energy production, their advantages and disadvantages, as well as the concept and feasibility options of sustainable development.  Able to participate in project and proposal implementation and audit tasks based on their knowledge.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances. | | | |
| ***Literature:*** | | | |
| Eds.: Management Association, Renewable and Alternative Energy: Concepts, Methodologies, Tools, and Applications, IGI Global, 2016, ISBN13: 9781522516712  Ali Sayigh: Comprehensive Renewable Energy, 1st Edition, Imprint: Elsevier, Published Date: 2nd May 2012, Page Count: 4422, eBook ISBN: 9780080878737, Hardcover ISBN: 9780080878720  Michaelides, Efstathios E. Stathis: Alternative Energy Sources, Springer Press, 2012, Buy eBook, ISBN: 978-3-642-20951-2 | | | |

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| ***Title of the course:***  **Alternative energy usage in practice II. (System of energetics -Building energy)** | ***NEPTUN-code:***  RKWAE2EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 5  ***Exam type****:* e |
| ***Course leader:***  Konrád Lájer Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  - | |
| ***Curriculum:*** | | | |
| The subject addresses one of the burning issues of our time, sustainability, through a complex approach. Learning about the disciplines of human ecology, building ecology and building biology is an important part of developing an ecological approach. The central theme of the subject is the human-home-environment relationship, how the built environment affects the natural environment and human health. It analyses the impact of the current civilisation crisis on nature and society. It presents the emergence of sustainable development and construction as a response to the environmental, social and economic crisis. It presents the building as an ecosystem within the framework of sustainable architecture and its typical problems, drawing parallels with the functioning of natural systems. In this context, it details the technical content and functioning of buildings, the climatic conditions of interiors, building energetics, building materials and structures. In this context, it discusses the possibilities of ecological design and building rehabilitation, including the principles of passive and other low-energy houses, and focuses on houses built using environmentally friendly technologies (earth and straw construction, timber buildings). | | | |
| ***Professional competencies:*** | | | |
| Knowledge of major environmental technologies, equipment and structures associated with each technology, including the functioning and operation thereof.  Knowledge of the basics of energy management, options for energy production, their advantages and disadvantages, as well as the concept and feasibility options of sustainable development.  Able to perform public administrative and authority tasks related to environment protection after getting acquainted with the duty assigned to them. | | | |
| ***Literature:*** | | | |
| Eds.: Management Association, Renewable and Alternative Energy: Concepts, Methodologies, Tools, and Applications, IGI Global, 2016, ISBN13: 9781522516712  Ali Sayigh: Comprehensive Renewable Energy, 1st Edition, Imprint: Elsevier, Published Date: 2nd May 2012, Page Count: 4422, eBook ISBN: 9780080878737, Hardcover ISBN: 9780080878720  Michaelides, Efstathios E. Stathis: Alternative Energy Sources, Springer Press, 2012, Buy eBook, ISBN: 978-3-642-20951-2 | | | |

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| ***Title of the course:***  **Knowledge of sustainability, environmental ethics** | **NEPTUN-code:**  RKWFK1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+0 | ***Credit:*** 4  ***Exam type****:* e |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| The course aims to provide an introduction to sustainability concepts and challenges, introducing the Sustainable Development Goals (SDGs). It explores the major threats to the way of life of future generations, such as climate change, ecosystem degradation, health and nutrition, pollution and resource depletion, with a focus on sustainability challenges and solutions, including food supply, water use, energy use, waste management, biodiversity loss and the impacts of urbanisation. It also aims to raise awareness of the importance of moving from linear to circular systems and maximising life-cycle resource use. This will include an introduction to sustainable engineering design methods for the reuse, repair, remanufacture and recycling of products based on the principles of the circular economy. Case studies will be presented to highlight the optimal use of available resources. The termly assignments carried out in the projects will also aim to provide a guide to action for an environmentally conscious lifestyle.  In the second part of the course, the principles of environmental ethics will be introduced in relation to the principles of sustainability. We will study the moral relationship of man to his natural (non-human) environment and the value and moral status of this relationship. Through case studies, the course will focus attention on responsible behaviour towards the environment. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of learning, knowledge acquisition and data collection methods, their ethical limitations and problem-solving techniques in the environmental field.  Comprehensive knowledge of the basic characteristics and interrelationships of environmental elements and systems and the pollutants that affect them.  Knowledge of the properties of environmental elements and their interactions.  Ability to apply a holistic approach to environmental tasks  environmental issues.  Demonstrates responsible behaviour towards the environment.  Multidisciplinary knowledge enables them to participate creatively in engineering work and to adapt to constantly changing requirements. | | | |
| ***Literature:*** | | | |
| Thompson Allen: The Oxford Handbook of Environmental Ethics, Oxford University Press Inc, 2019, ISBN: 9780190933388  Mackenzie Davis: Principles of Environmental Engineering & Science, McGraw-Hill Education, 2019, ISBN: 9781260548020  Emma Hutchinson - Sari Kovats: Environment, Health and Sustainable Development, Open University Press, 2017, ISBN:9780335245376  M.H. Fulekar - Bhawana Pathak - R K Kale: Environment and Sustainable Development, Springer Nature, 2014, ISBN: 978-8132211655  Brennan, Andrew – Lo, Yeuk Sze: Environmental Ethics, Standard Encyclopedia of Philosophy, 2002.,http://plato.stanford.edu/entries/ethics-environmental/#Bib | | | |

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| ***Title of the course:***  **Complex environmental engineering project work** | ***NEPTUN-code:***  RKWPR1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  0+0+3 | ***Credit:*** 5  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXKE1ABNF, RKXKE2ABNF, RKXKE3ABNF, RKXKZRABNF, RKXKA1ABNF | |
| ***Curriculum:*** | | | |
| The aim of the course is to enable students to apply the theoretical knowledge acquired in the vocational subjects and the theoretical knowledge acquired in the current semester in practice, by participating in field work and visits to factories. Sampling and measurements in the field and in the laboratory will provide students with experience that they can build on when solving problems in the future. The main aim of the course is to complement the high level theoretical scientific training by creating a competence-based environmental engineering education. During the semester, students will carry out research on a specific environmental problem in small groups (max. 4 students), guiding the workflow from problem identification to solution. At the end of the semester, they present their work to a professional committee, prepare a written report (detailed description of the work carried out) and an oral report (presentation to a professional committee), and prepare a portfolio. The field work also provides an opportunity for environmental education, thus shaping the students' ecological thinking and environmental awareness. The project work and research carried out by the students prepares the choice of the thesis topic. The research tasks and works can be continued as an independent thesis. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments, and limitations thereof, as well as methods for the evaluation of data measured.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Taking responsibility towards society for their decisions made in the scope of environment protection.  Cooperation with qualified experts from other special areas (primarily economic and legal) in the course of completing professional tasks. | | | |
| ***Literature:*** | | | |
| e-learning system’s curriculums | | | |

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| ***Title of course:***  **Basics of EHS (Environmental, Health and Safety)** | ***NEPTUN-code:***  RKWBT1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type:*** tm |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The goals of the course are to make the prospective engineers know with work conditions that is safe and not harmful for the health in order to be able diagnosing dangers and apply measures for risks reduction based on their knowledge. The participants’ rights and duty in triparty reconciliation. The concept of accidents and work accidents, the importance of investigation of work accidents. The goals, methodology and application of risk analysis of occupational safety and health (EHS). The role of ergonomics in EHS. The safe formation of work tools, dangers of maintenance, optimizing work environment in accordance with executed activity. Safety regulations for dangerous materials. Defensive capabilities of individual protective equipment that is used for reduction residual dangers of collective protection. Security technology of electricity, protection against electric shocks. Material handling and storage, security technology of pressure vessels. Concept and task of fire protection. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of requirements and methods for health and safety, fire protection, safety engineering and remediation as related to the field of environment protection.  Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith***.*** | | | |
| ***Literature:*** | | | |
| Gayle Woodside: Environmental, Health, and Safety Portable Handbook, ISBN: 978-0070718487  EHS directives  Forney Susan Zummo: Environmental Risk Communication, Taylor & Francis Ltd, 2021, ISBN: 9780367469771  Framework Directive 89/391/EEC | | | |

**Sustainable land development, water management specialisation:**

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| ***Title of the course:***  **Knowledge of land and urban development** | ***NEPTUN-code:***  RKWGT1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit:*** 5  ***Exam type****:* e |
| ***Course leader:***  Krisztina Demény Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The subject synthesises the knowledge learned in the basic subjects of industry, agriculture, services, and the impact of urbanisation on the environment. It analyses the environmental impact of economic activity and the positive trends in technological development and the need for sustainable use of natural resources. It deals with the concept of sustainable development, the interpretation and feasibility of sustainability in relation to urban planning and development. Describes the concepts, aims and tasks of spatial and urban development, including basic knowledge of urban development. It describes the stages of development of settlements with the most important influencing factors, the historical development of settlement development, the practices used today at international and national level, and the main financial, legal, etc. instruments of those involved in settlement development. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the general and specific mathematics, nature and social science policies, rules and coherencies, which are needed to cultivate the environmental protection field.  Knowledge of the definitions of economy, environmental economy, project and environmental management, their devices in the field of environmental protection.  Students will be able to assume administrative responsibilities and execute official tasks.  They take responsibility for the made decisions in the field of environmental protection against society.  During the execution professional work, the students cooperate other (primarily economic and legal) profession’s trained specialists.  They keep under review and endorse the legal, technical, technological, and administrative changes during their professional work. | | | |
| ***Literature:*** | | | |
| Tamás Csapó – András Balogh (2013): Development of the Settlement Network in the Central European Countries (Past, Present and Future), Springer  Rajiv R. Thakur, Ashok K. Dutt, Sudhir K. Thakur, George M. Pomeroy (2020): Urban and Regional Planning and Development (20th Century Forms and 21st Century Transformations), Springer  Eddie N. Laboy-Nieves, Fred C. Schaffner, Ahmed Abdelhadi, Mattheus F.A. Goosen: Environmental Management, Sustainable Development and Human Health, 2008 by CRC Press, ISBN 9780415469630  Human Settlement Development - Volume I Editor Saskia Sassen ISBN 978-1-84826-044-3  Sustainable Preservation Practices for Managing Storage Environments Funding provided by the National Endowment for the Humanities, Division of Preservation and Access, Education & Training Grant Program | | | |

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| **Title of the course: Hydrology and hydraulics** | ***NEPTUN-code:***  RKWHH1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type****:e* |
| ***Course leader:***  Lóránt Szabó Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  RKXKE1ABNF; RKXFT1ABNF | |
| ***Curriculum:*** | | | |
| The hydrographical conditions of the country, the natural water provision and the variability of water resources based on location and time. Domestic water management practices, the environmental effects which influence the natural waters. The hydrological basics of the water resource management. The water balance. The main elements of the hydrological cycle: rainfall, evaporation, infiltration, procession; measurement, adaptation and forecast of the previously mentioned factors. The hydrology of the diffuse and concentrated pollution in natural waters (assembling of the catchment, mixing and pollution spread). Stream laws, under pressure flow and the gravitational flow. Statics of the fluids – communicating vessels, Pascal’s thesis. Fluid pressure on plane surfaces. The dynamical basics of movement of the fluids, flow line, streamline, humid coupon, fluid output, middle speed, hydraulic radius, continuity. Bernoulli’s equation and equation of continuity, speed measurement with Pitot tube. Laminal and turbulent flow, the Reynolds number. The oozing low of Darcy. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of water appearance forms, the characteristic of these in our country and their proportion. The students will be able to enumerate the elements of the water balance, also able to apply the water balance equation. Knowledge of the elements of the hydrological cycle and the principles of their measurement. The students will learn the main sources of pollutions in the natural waters, also the main processes of the spread of these pollutants.  Knowledge of applying the energy equations for ideal and real fluids in simple calculation examples.  The students will know the characteristics of the laminal and turbulent water flows and will be able to interpret and characterize the local and frictional energy losses. They will determine the pressure loss in a simple pipe system, furthermore the speed of the water and the water flow. | | | |
| ***Literature:*** | | | |
| Prof. Dawei Han: Concise Hidrology, 2010, DaweiHan&bookboon.com (download free eBooks at bookboon.com)  Raymond A. S., John W. J.: Physics for Scientists and Engineers with Modern Physics, 2004 6th and 9th edition  Prasuhn, Alan L. Fundamentals of Hydraulic Engineering. Holt, Rinehart, and Winston: New York, 1987.  Cassidy, John J., Chaudhry, M. Hanif, and Roberson, John A. "Hydraulic Engineering", John Wiley & Sons, 1998  E. John Finnemore, Joseph Franzini "Fluid Mechanics with Engineering Applications", McGraw-Hill,2002  Lóránt Szabó: Physics for students of engineering (electronic book)  Further reading can be used: Vincent J. Zipparro, Hans Hasen (Eds), Davis' Handbook of Applied Hydraulics, Mcgraw-Hill, 4th Edition (1992) | | | |

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| ***Title of the course:***  **Spatial water planning, protection, and regulation of the aquatic environment** | ***NEPTUN-code:***  RKWVJ1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 4  ***Exam type****:* e |
| ***Course leader:***  Zoltán Juvancz Prof. | ***Position:***  Professor Emeritus | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| Types of water habitats. The types and treatment of river stream regulation. Types of still waters (natural and artificial), and its protection and treatment possibilities. Type of founts, fens, swamps and reeds, its protection and treatment. The domestic water habitats reconstruction in significance of nature protection and its condition on international aspect.  The protection and usage of the superficial and groundwaters and its legal control. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the forms and peculiarity of the water habitats, their demands and possibilities.  Knowledge of the treatment and utilization of the water habitats, their environmental aspects, the ongoing processes, the roe of nature protection to preserve water habitats.  The students will be able to interpretate and apply independent the legalisation of the specialization, furthermore they will know the legal requirements of water protection.  They will become committed to the environment and nature protection, and also to the sustainable resource utilization. | | | |
| ***Literature:*** | | | |
| P. S. Maitland, N. C. Morgan (1997): Conservation Management of Freshwater Habitats (Lakes, rivers and wetlands), Springer Netherlands  Hurford, Clive, Schneider, Michael, Cowx, Ian (Eds.) (2010): Conservation Monitoring in Freshwater Habitats (A Practical Guide and Case Studies), Springer  Paul Mac Berthouex, Linfield C. Brown (2013): Pollution, Prevention and Control: Part I. Human health and Environmental Quality, Paul Mac Berthouex, Linfield C. Brown&bookboon.com  Michael Kidd, Loretta Ferus, Tumai Murando and Alejandro Iza (2019): Water and the Law: Towards Sustainability (IUCN Academy of Environmental Law series) .pdf, E-book | | | |

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| ***Title of the course:***  **Watershed and stormwater management** | ***NEPTUN-code:***  RKWCG1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0 | ***Credit*:** 5  ***Exam type****:e* |
| ***Course leader:***  Rita Kendrovics Boda Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXKE1ABNF | |
| ***Curriculum:*** | | | |
| „Water Framework Directive” and „River Basin Plan”. The effect of urbanization on the hydrological circular process and its connection with the natural circular process. Flow, covert areas, and greeneries effects in the life of settlements. Water demands (social, ecological, and natural demands). Drinking water demand, usage demand, immediate and indirect demands, virtual demand. Moisture proportion. The quality and quantity characterisation of the flow. Moisture economy. The effects of climate change on the settlement hydrological circular process. | | | |
| ***Professional competencies:*** | | | |
| The students know the catchment-economy and the definition of the integrated water management and its principles, furthermore they know the main domestic water economy tasks.  Knowledge of the settlement’s main hydrological parameters, the possible effect of the climate change on the water management and the condition of the rainwater drainage in the inner-city areas.  The knowledge of the possible technological solutions of the rainwater drainage and the quality of the rainwater, furthermore the recovery regulations.  The students will be able to cooperate other professions trained experts in their own field. They keep under review and endorse the legal, technical, technological, and administrative changes during their professional work. | | | |
| ***Literature:*** | | | |
| Walter Lükenga: Water Resource Management, free download from bookboon.com  Watershed Hydrology Management and Modelling  David A. Lloyd Owen (2018): Smart Water Technologies and Techniques: Data Capture and Analysis for Sustainable Water Management, WILEY Blackwell,  Walter Leal Filho (2012): Climate Change and the Sustainable Use of Water Resources, Springer-Verlab Berlin Heidelberg  Stormwater Management Guide https://info.buildingsolutions.com/hubfs/Stormwater-Management-Guide.pdf  Hlavínek, Petr, Zelenáková, Martina (2015): Storm Water Management, Springer | | | |

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| ***Title of the course:***  **Water utility distribution and urban drainage** | ***NEPTUN-code:***  RKWVH1EBNE | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 5  ***Exam type***: tm |
| ***Course leader:***  Rita Kendrovics Boda Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  ***-*** | |
| ***Curriculum:*** | | | |
| The tasks of the drainages and its orders are also conventional and improved systems. Municipal and regional drainage. The EU directives connected to sewerage, the Water Framework Directive and the Settlement Wastewater Directive, wastewater agglomerations. The drainage systems in settlements and industrial plants and their effects on the wastewater treatment. The connection of the drainage and the wastewater treatments. The effects of climate change on the sewerage systems. The design and the parts of drainage systems. Typical operating conditions. The scaling of the drainage systems, the integrated drainage and drainage management. The operational questions of drinking water supply. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the important characteristic of the piped public utilities, their connections taxonomy and design basic knowledge in the water supply sector.  Knowledge of the design and operation aspects of the settlement public utilities.  Knowledge of the domestic and international directives related to sewerage.  The students will have the basic knowledge needed for carry out integrated water management. | | | |
| ***Literature:*** | | | |
| Subhash Verma, Varinder Kanwer, Siby John (2015): Water supply Engineering, VIKAS Publishing Hous  Rangwala: Water Supply and Sanitary Engineering, e-book, free download  Mihret Dananto Ulsido (2013): Water Supply and Urban Drainage Engineering, LAMBERT Academic Publishing  Ernest W.Steel, Terence J.McGhee: Water supply and sewerage, book free download by EasyEngineering.net | | | |

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| ***Title of the course:***  **Wastewater and sewage sludge management and recycling** | ***NEPTUN-code:***  RKWSZ1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+1+0 | ***Credit*:** 5  ***Exam type****:*tm |
| ***Course leader:***  Imre Biczó Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge:***  RKXKM1ABNF | |
| ***Curriculum:*** | | | |
| The recycling of the used water. The European and domestical requirements of the wastewater treatment. The undrained areas wastewater emplacement, local and individual installations.  The recycling of wastewater slit – biogas recycling and agricultural recovery. The possibility of using wastewater slit, the European and domestic regulations and conditions of the possible placements. The choice of slit treatment in the light of the placement and utilization. The wager and treatment of the settlement fluid wastes. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of the main technologies for environmental protection and recycling, the devices within the given field of technology, how to operate and maintain them.  Knowledge of exploring the deficiencies of the applied technologies, the risks of the procedures and launch the making of the decreasing policies.  To know the domestic and international regulations for this field of science, their connections and the main elements of the regional water management. | | | |
| ***Literature:*** | | | |
| Donald L. Rowe, Isam Mohammed Abdel-Magid (1995): Handbook of Waste Water Reclamation and Reuse, CRC Press\Lewis Publishers  Paul Bishop (1995): Municipal Sewage Sludge: Management, Processing and Disposal, Publisher CRC Press  EPA:Preparing Sewage Sludge For Land Application Or Surface Disposal, free download as ebook  Juan M. Lema, Sonia Suarez Martinez (2017): Innovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment, ebook: www.iwaponline.com | | | |

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| ***Title of the course:***  **Knowledge of sustainability, environmental ethics** | **NEPTUN-code:**  RKWFK1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  2+0+0 | ***Credit:*** 4  ***Exam type****:* e |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| The educational aim of the subject is to integrate environmental awareness into everyday activities and to show opportunities and methods for sustainability. To identify opportunities to consciously shape needs according to environmental expectations. Optimal use of available resources. Developing individual and community environmental awareness and orienting others towards environmental awareness. Students will learn about the principles of sustainability, and the semester assignments will help them to acquire the key competences of sustainability education. An important part of the course is to familiarise students with the environmental dependency of humans and human societies, the environmental, economic, and social problems that result from our environmental dependency and the ways to address them. The course addresses the moral problems of right human action towards living beings/nature within the disciplinary boundaries of bioethics. It introduces the economic, social, ethical, and ecological problems of globalisation; it describes the different theoretical orientations of ecophilosophy and eco-ethics (anthropocentric, pathocentric, biocentric and ecocentric ethics). It describes the basic principles of environmental ethics. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of learning, knowledge acquisition and data collection methods, their ethical limitations and problem-solving techniques in the environmental field.  Comprehensive knowledge of the basic characteristics and interrelationships of environmental elements and systems and the pollutants that affect them.  Knowledge of the properties of environmental elements and their interactions.  Ability to apply a holistic approach to environmental tasks  environmental issues.  Demonstrates responsible behaviour towards the environment.  Multidisciplinary knowledge enables them to participate creatively in engineering work and to adapt to constantly changing requirements. | | | |
| ***Literature:*** | | | |
| Thompson Allen: The Oxford Handbook of Environmental Ethics, Oxford University Press Inc, 2019, ISBN: 9780190933388  Mackenzie Davis: Principles of Environmental Engineering & Science, McGraw-Hill Education, 2019, ISBN: 9781260548020  Emma Hutchinson - Sari Kovats: Environment, Health and Sustainable Development, Open University Press, 2017, ISBN:9780335245376  M.H. Fulekar - Bhawana Pathak - R K Kale: Environment and Sustainable Development, Springer Nature, 2014, ISBN: 978-8132211655 | | | |

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| ***Title of the course:***  **Complex environmental engineering project work** | ***NEPTUN-code:***  RKWPR1ABNF | ***Weekly teaching hours:*** *l+cw+lw*  0+0+3 | ***Credit:*** 4  ***Exam type****:* tm |
| ***Course leader:***  Rita Kendrovics-Boda, Ph.D. | ***Position:***  associate professor | ***Required preliminary knowledge:***  RKXKE1ABNF, RKXKE2ABNF, RKXKE3ABNF, RKXKZRABNF, RKXKA1ABNF | |
| ***Curriculum:*** | | | |
| The aim of the course is to enable students to apply the theoretical knowledge acquired in the vocational subjects and the theoretical knowledge acquired in the current semester in practice, by participating in field work and visits to factories. Sampling and measurements in the field and in the laboratory will provide students with experience that they can build on when solving problems in the future. The main aim of the course is to complement the high level theoretical scientific training by creating a competence-based environmental engineering education. During the semester, students will carry out research on a specific environmental problem in small groups (max. 4 students), guiding the workflow from problem identification to solution. At the end of the semester, they present their work to a professional committee, prepare a written report (detailed description of the work carried out) and an oral report (presentation to a professional committee), and prepare a portfolio. The field work also provides an opportunity for environmental education, thus shaping the students' ecological thinking and environmental awareness. The project work and research carried out by the students prepares the choice of the thesis topic. The research tasks and works can be continued as an independent thesis. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of general and specific mathematical, natural, and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection.  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations, and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Knowledge of the main methods to examine the quantity and quality features of environmental elements and systems, their typical measuring instruments, and limitations thereof, as well as methods for the evaluation of data measured.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Open to professional cooperation with specialists related to their profession but involved in other areas.  Taking responsibility towards society for their decisions made in the scope of environment protection.  Cooperation with qualified experts from other special areas (primarily economic and legal) in the course of completing professional tasks. | | | |
| ***Literature:*** | | | |
| e-learning system’s curriculums | | | |

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| ***Title of course:***  **Basics of EHS (Environmental, Health and Safety)** | ***NEPTUN-code:***  RKWBT1EBNF | ***Weekly teaching hours:*** *l+cw+lw*  1+2+0 | ***Credit*:** 4  ***Exam type:*** tm |
| ***Course leader:***  Lóránt Szabó, Ph.D. | ***Position:***  senior lecturer | ***Required preliminary knowledge: -*** | |
| ***Curriculum:*** | | | |
| The goals of the course are to make the prospective engineers know with work conditions that is safe and not harmful for the health in order to be able diagnosing dangers and apply measures for risks reduction based on their knowledge. The participants’ rights and duty in triparty reconciliation. The concept of accidents and work accidents, the importance of investigation of work accidents. The goals, methodology and application of risk analysis of occupational safety and health (EHS). The role of ergonomics in EHS. The safe formation of work tools, dangers of maintenance, optimizing work environment in accordance with executed activity. Safety regulations for dangerous materials. Defensive capabilities of individual protective equipment that is used for reduction residual dangers of collective protection. Security technology of electricity, protection against electric shocks. Material handling and storage, security technology of pressure vessels. Concept and task of fire protection. | | | |
| ***Professional competencies:*** | | | |
| Knowledge of requirements and methods for health and safety, fire protection, safety engineering and remediation as related to the field of environment protection.  Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Able to reveal deficiencies in the technologies applied and process risks and to initiate mitigation measures after getting familiarized with the technology concerned.  Efforts to solve tasks and make management decisions by being aware of the opinions of the colleagues supervised, possibly in cooperation therewith***.*** | | | |
| ***Literature:*** | | | |
| Gayle Woodside: Environmental, Health, and Safety Portable Handbook, ISBN: 978-0070718487  EHS directives  Forney Susan Zummo: Environmental Risk Communication, Taylor & Francis Ltd, 2021, ISBN: 9780367469771  Framework Directive 89/391/EEC | | | |

**Criteria required**

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| ***Title of the course:***  **Mentoring** | **NEPTUN-code:**  RKIPTKEBNF | ***Weekly teaching hours:*** *l+cw+lw*  0+1+0 | ***Credit:*** 0  ***Exam type****:* s |
| ***Course leader:***  Norbert Berecz | ***Position:***  assistant lecturer | ***Required preliminary knowledge:*** *-* | |
| ***Curriculum:*** | | | |
| The aim of the patronage teaching system is to help first-year students integrate into university education and support them in continuing their studies successfully. Ongoing contact with students helps to solve problems that arise during their studies. The aim of the sessions and discussions is to introduce the structure of the University, the main departments, the life of the student organisations and, above all, to help students find their way around the regulations. | | | |
| ***Professional competencies:*** | | | |
| Know the relationship between individual, pair and group learning and the functioning of learning communities.  Ability to participate in the management of a learning organisation in a supportive and guided way.  Ability to independently develop a self-critical plan based on the knowledge required for a career,  skills and attitudes, based on the learning outcomes of the occupation.  He/she is ready to continuously seek supportive resources, to develop his/her professional responsibility and knowledge.  Ability to work on a project basis, with a collaborative approach based on the division of labour  ability to work in a collaborative environment, sees individual contributions to shared success.  Open to research-based problem solving. | | | |
| ***Literature:*** | | | |
| Rules and Regulation | | | |