

Bachelor in Environmental Technology and Management | Courses syllabus

1st curricular year

Biologia I / Biology I (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

a) To understand the diversity of living organisms through knowledge of the basic structures that constitute them (the cells) and the main mechanisms that make life possible. b) To understand and identify the diversity of animals belonging to the main phyla of invertebrates and vertebrates, based on their body plan.

Syllabus:

1. Cells: the units of Life's work: a) What are the characteristics of the cells that make them the fundamental units of life? b) What are the characteristics of prokaryotic cells? c) What are the characteristics of eukaryotic cells? d) How did eukaryotic cells originate? e) Study of the composition, function and location of the main cellular components; f) Heredity and evolution; g) Molecular Genetics.

2. Origin of animals and evolution of body plans. a) What are the basic characteristics of the animal body plans? b) Characterization of the main animal groups: protostomy and deuterostomy.

Bybliography:

- Alcantara, F., Cunha, M.A. e Almeida, M.A. 1996. Microbiologia– Práticas Laboratoriais. 1ª ed. Universidade de Aveiro. Aveiro.
- Azevedo, C. 2005. Biologia Celular e Molecular. 4ª ed. Lidel, Lisboa.
- Dorit, R. L.; Walker Jr., W. F. & Barnes, R. D. 1991. Zoology. Saunders College Publishing, Philadelphia.
- Ferrand de Almeida, N.; Ferrand de Almeida, P.; Gonçalves, H.; Sequeira, F.; Teixeira, J. & Ferrand de Almeida, F. 2001. Guia FAPAS Anfíbios e Répteis de Portugal. FAPAS. Porto.
- Gooders, J. & Harris, A. 2003. Guia de Campo das Aves de Portugal e da Europa. Temas e Debates. Lisboa.
- Hickman Jr., C. P.; Roberts, L. S.; Larson, A. 2001. Integrated Principles of Zoology. 11ª ed. McGraw-Hill Higher Education, New York.
- Macdonald, D. W. & Barrett, P. 1993. Guia FAPAS Mamíferos de Portugal e Europa. FAPAS. Porto.
- Mullarney, K.; Svensson, L; Zetterstrom, D. & Grant, P. J. 2003. Guia de Aves. Assírio & Alvim. Lisboa. 400 pp.
- Sadava, D., Heller, H.C., Orians, G.H., Purves, W.K. e Hills, D.M. 2006. Life: The Science of Biology. 8ª ed., Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts.
- Raven, P.H. e Johnson, G.B. 2002. Biology. 6ª ed., McGraw- Hill, Inc., New York.

Química e Bioquímica I / Chemistry and Biochemistry I (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

To know: the properties of the solutions; laws of the Chemical Equilibrium considering the different types of equilibrium: acid base, oxidation-reduction, poorly soluble salts and complexation; structure of the main classes of organic compounds; the nomenclature of the main classes of organic compounds; the physical properties of the organic compounds; the main functional groups of the organic biomolecules

Syllabus:

Interaction forces between molecules and sites of action. Properties of the solutions. Chemical Equilibrium: acid-base, oxidation-reduction, poorly soluble salts and complexation. Structure, nomenclature and physical properties of the organic compounds. Functional groups of the organic biomolecules

Bybliography:

- Atkins, P. W; Beran, J.A. - General Chemistry, Sci. Am. Books, 1992
- Allinger, N.L.; Stevens, C.L. - Organic Chemistry, Worth Publishers, Inc. 1998
- Stryer, L. - Biochemistry, The Molecular Basis of Cell Structure and Function, Worth Publishers, 1979
- Vidal, M.M.; Filipe O.; Costa, M.C. - Química no laboratório, 100Luz, 2ª Edição, 2010

Análise Matemática / Mathematical analysis (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

To master the basic concepts of differential and integral calculus and its applications; To identify and solve 1st order differential equations

Syllabus:

Derivatives; antiderivative; definite integrals; areas and volumes by applying definite integrals; improper integrals; differential equations of separable variables; linear differential equations; Bernoulli differential equations.

Bybliography:

Foulis, D.; Munem, M.- O Cálculo. Guanabara Dois, S.A.:Volume I, Cop. 1978.
Leithold - O Cálculo Com Geometria Analítica. Dinalivro, 1994.
Ross, S. - Differential Equations. McGraw-Hill, 1984.
Saraiva, M.A; Silva, M. - Primitivação. Edições ASA, 1995.
Swokowsski, E. W.; - Cálculo com Geometria Analítica. McGraw-Hill, 1983.

Física I / Physics I (1º semestre / Fall semester)**Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):**

Mechanical solids and Fluid mechanics

Syllabus:

Mechanical solids: Vector Calculus; Physical Quantities and Units; Newton's Laws; Kinematics; Work and Energy; Linear Impulse and Momentum; Mechanical Waves and Sound

Fluid mechanics: Fundamental Principle of Hydrostatic; Principles of Archimedes and Pascal; Equations of continuity and Bernoulli; Laws Poiseuille and Stokes

Bibliography:

CUTNELL, J. e K. JOHNSON – Physics. 4th edition. New York, John Wiley & Sons Inc. 1998.
YOUNG, H. e R. FREEDMAN – Física I-Mecânica. 1ª edição, São Paulo, Pearson/Wesley. 2003.
YOUNG, H. e R. FREEDMAN – Física II- Termodinâmica e Ondas. 1ª edição, São Paulo, Pearson/Wesley. 2003.
TIPLER, P. – Física. 3ª edição, Vol. 1, 2 e 3. Rio de Janeiro, Livros Técnicos e Científicos Editora S.A. 1995.
DEUS, J.; M. PIMENTA, A. NORONHA, T. PENNA, P. BROGUEIRA – Introdução à Física. Lisboa, McGrawHill. 1998.
ÍNDIAS, M. – Curso de Física. Vol I e II. Lisboa, McGrawHill. 1992.
RAMALHO, F.; G. F. NICOLAU, P.A. TOLEDO – Os Fundamentos da Física. 6ª edição, Vol. 2 e 3. São Paulo, Editora Moderna. 1997
EWEN, DALE; SCHURTER, NEILL; GUNDERSEN, P. ERIK – Applied Physics, 10ª Edition, Prentice Hall, 2012.

Língua Inglesa e Comunicação / English Language and Communication Skills (1º semestre / Fall semester)**Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):**

Uses the English language in oral and written expression as well as in reading and listening comprehension; Conducts bibliographic research on specific topics; Recognizes the specifics of scientific-technical discourse; Develops the ability to communicate in an academic context.

Syllabus:

- 1) Review of general vocabulary and main grammatical structures of the English language.
- 2) Bibliographic research on specific topics: - Writing texts of varying levels of difficulty;
- 3) The concept of English for Specific Purposes: the language at the service of the subject it conveys: - The technical-scientific discourse: characteristics and application; -Types of scientific-technical texts: laboratory protocol, technical report, research paper, critical review, scientific poster, monograph, etc.; - Exercises in reading and analysis of various types of texts;
- 4) Communication practices in an academic context: - The fundamentals of oral presentations; - Research: concept, types and procedures for locating and retrieving written and online information; - Structuring of reports and technical-scientific posters.

Bibliography:

Answers.com – Online Dictionary, Encyclopedia and much more. URL:http://www.answers.com_
BASTOS, Lilia da Rocha [et al.] – Manual para a elaboração de projetos e relatórios de pesquisa, teses, dissertações e monografias. 4ª ed. rev. e ampl. Rio de Janeiro: Guanabara Koogan, 1995.
DUDLEY-EVANS, T.; ST. JOHN, M. - Developments in English for Specific Purposes. Cambridge: Cambridge University Press, 1998 [2011].
MURPHY, Raymond – English Grammar in Use. Cambridge: Cambridge University Press, 2004.
NP 405-1.1994, Informação e documentação - Referências bibliográficas: documentos impressos. Instituto Português da Qualidade (IPQ).
NP 405-3.2000, Informação e documentação – Referências bibliográficas: documentos não publicados. IPQ.
NP405.4.2002, Informação e documentação – Referências bibliográficas: documentos electrónicos. IPQ.
SINCLAIR, J. M. – Collins English Dictionary. Millennium Edition. Glasgow: Harper Collins, 1998.

Introdução à Proteção Ambiental / Introduction to Environmental Protection (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Knowing the concept of sustainable development and current/future environmental challenges and their interconnections with the socioeconomic and political dimensions at a National, European and Worldwide scale
2. Knowing the environmental principles and values and the interrelation of environmental policies and law in promoting environmental quality. Knowing the main Portuguese environmental legislation and understanding and applying the environmental law.
3. Understanding and acting in conformity with professional and environmental ethics.
4. Knowing the main challenges of the sustainable management of natural resources in promoting environmental quality: environmental pollution, water resources and wastewater management, air quality and sound pollution, soil and solid wastes management, biodiversity and nature conservation, energy resources and management
5. Knowing the role of environmental management technologies and techniques in various domains of environmental protection
6. Knowing and using information systems in various domains of environmental protection
7. Knowing the role of environmental experts and of stakeholders in promoting sustainable development
8. Improving soft skills required to a professional activity in the environmental protection domain.

Syllabus:

Part 1 - Sustainable development and the current/future environmental challenges and their interconnections with the socioeconomic and political dimensions at a National, European and Worldwide scale. - Environmental principles and values, environmental policies and laws towards the promotion of environmental quality. The main Portuguese environmental legislation. - Professional and environmental ethics. - The main stakeholders in environmental protection. - The role of information systems in various domains of environmental protection.

Part 2 - Sustainable management of natural resources in promoting environmental quality: environmental pollution, water resources and wastewater management, air quality and sound pollution, soil and solid wastes management, biodiversity and nature conservation, energy resources and management
5. Environmental management technologies and techniques in various domains of environmental protection.

Bibliography:

A.J.D. Ferreira, M.A.R. Lopes, J.P.F. Morais, Environmental management and audit schemes implementation as an educational tool for sustainability, *Journal of Cleaner Production*, Volume 14, Issue 9, 2006, Pages 973-982, ISSN 0959-6526, <http://dx.doi.org/10.1016/j.jclepro.2006.01.003>.

G. T. Miller, S. Spoolman (2017). *Living in the Environment*. Brooks Cole, 19th Ed. ISBN-13: 978-1337094153

M. L. Davis, D. A. Cornwell (2012). *Introduction to Environmental Engineering*. McGraw-Hill Education, 5th Ed. ISBN-13: 978-0073401140

A. Rego, J. Braga (2014). *Ethics for Engineers*. Lidel, 3ª Ed. ISBN: 978-989-752-065-5

United Nations Environmental Programme (1987). *Our Common Future*. Oxford University Press
Portuguese environmental regulation.

A. Wulf. (2015). *The invention of nature - Alexander Von Humboldt adventures*. Círculo de Leitores. ISBN 978-989-644-341-2

D. L. Meadows, D. Meadows, J. R. (1973). *Limits to growth*. Dom Quixote. ISBN 9789722004398

D. L. Meadows, D. Meadows, J. R. *Beyond Limits*. Difel Ed. ISBN 9789727091645

D. Goleman (2009). *EcoIntelligence*. Temas e Debates. ISBN 978-989-644-078-7

R. Carson (2010). *Silent Spring*. Critica Bolsillo Ed. ISBN: 9788498921373

T. Jackson (2017). *Prosperity without growth - Foundations for the economy of tomorrow*. Routledge, 2nd Ed. ISBN 978-1-138-93541-9

Websites:

Portuguese Environmental Agency: www.apambiente.pt

European Environmental Agency: <https://www.eea.europa.eu/pt>

European Commission: http://ec.europa.eu/environment/index_en.htm

United Nations Environmental Agency: <http://www.unep.org/>

Portuguese Regulations Website on-line: www.dre.pt

Biologia II / Biology II (2º semestre / spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

a) To identify the structure and internal organization of vegetal bodies relating them with the function of different organs and with mechanisms of plant cells; b) To know how to identify plant species (full plants or small parts), based on morphological characteristics, using different resources such as dichotomous keys, Floras, e-Floras, Field guides, herbarium material, etc. c) To recognize/know native and exotic (particularly invasive) plant species with more interest in Portugal, including mainly trees and shrubs but also some herbaceous species with conservation interest or environmental applications; d) To develop curiosity for plant world.

Syllabus:

a) The structure, organization and function of the cellular components of the plant cell. Photosynthesis.

- b) Plant histology and anatomy: plant tissues and its characterization; primary and secondary growth; anatomy of roots, stems and leaves, and its relationship with physiology, on main taxonomical groups;
- c) Morphology of root, stem, leaf, inflorescence, flower and fruit;
- d) Classification, systematics and taxonomy principles; morphological characterization of major taxonomical groups;
- e) Characterization (taxonomy; morphology; comparisons/ contrasts to other species with which the plant may be easily confused; distribution; interest and utilization) of plant species with more interest in natural areas in Portugal, including species of: Betulaceae, Cistaceae, Ericaceae, Fabaceae, Fagaceae, Lamiaceae, Liliaceae, Rosaceae, Salicaceae, amongst others.

Bibliography:

- Bingre P, Aguiar C, Espírito-Santo D, Arsénio P & Monteiro-Henriques T [Coord.s Cient.] 2007. Guia de Campo – As árvores e os arbustos de Portugal continental. 462 pp. In vol. IX dea Sande Silva J [Coord. Ed.] (2007): Coleção Árvores e Florestas de Portugal. Jornal Público/ FLAD/LPN. Lisboa.
- Fernandes, R.B. 1972. Vocabulário de termos botânicos. Separata do Anuário da Sociedade Broteriana.
- Franco, J.A. & Afonso, M.L.R. 1971-2003. Nova Flora de Portugal (Continente e Açores). Escolar Editora. Lisboa. Portugal.
- Harris, J. & Harris, M. 1994. Plant identification terminology: an illustrated glossary. Spring Lake Publishing. Spring Lake, Utah.
- Lidon, F.J, Gomes H. & Abrantes A.C. 2001. Anatomia e morfologia externa das plantas superiores. Lidel. Lisboa.
- Raven, P.H., Evert, R.F. & Eichhorn, S.E. 1999. Biology of Plants. 6ª ed. W. H. Freeman and Company. NY.
- Sociedade Portuguesa de Botânica. 2012-2013. Flora-On: Flora de Portugal interactiva. disponível em <http://www.flora-on.pt>
- Castroviejo S et al. (Ed.) (1986-2012). Flora Iberica. Plantas vasculares de la Península Ibérica, e Islas Baleares. Real Jardín Botánico, CSIC. Madrid. (<http://www.floraiberica.es/>)
- Humphries, C.J.; Press, J.R. & Sutton, D.A. 1996. Árvores de Portugal e Europa. Guia Fapas. ISBN: 972-95951-27
- Izco, J.; et al. 1998. Botânica. 2ª Ed. Mc.GRAW-HILL Interamericana de España, S.AU.
- Marchante, E., Freitas, H. & Marchante, H. 2008. Guia Prático para a Identificação de Plantas Invasoras de Portugal Continental. Imprensa da Universidade de Coimbra. Coimbra. Pp. 183. ISBN: 978-989-8074-70-6
- Polunin. O. 1999. Árboles Y Arbustos De Europa. OMEGA. ISBN: 9788428207393

Física II / Physics II (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

Electrostatics; electro kinetic; electromagnetism; optics; thermodynamics; radiation

Syllabus:

Electrostatics, Electrokinetics and Electromagnetism: Strength and electric charge; Field and Electric Potential; DC and AC; Resistance, Capacitance, inductance and impedance; Ohm's Law; Joule effect and electric power; Kirchhoff's Laws; Magnetic Field and Magnetic Force; Electromagnetic induction. Faraday's Law and Lenz's Law; transformers; generators; Electromagnetic waves. Characterization, Energy and Polarization

Optics: Reflection, refraction, diffusion, dispersion and diffraction ; Mirrors and lenses; Optical instruments; Thermodynamics; Temperature and Heat; Heat transfer; Thermal properties; Laws of Thermodynamics

Radiation: Emission of Radiation; Law of radioactive decay

Bibliography:

- CUTNELL, J. e K. JOHNSON – Physics. 4th edition. New York, John Wiley & Sons Inc. 1998.
- YOUNG, H. e R. FREEDMAN – Física II- Termodinâmica e Ondas. 1ª edição, São Paulo, Pearson/Wesley. 2003.
- YOUNG, H. e R. FREEDMAN – Física III- Eletromagnetismo. 1ª edição, São Paulo, Pearson/Wesley. 2003.
- YOUNG, H. e R. FREEDMAN – Física IV- Ótica e Física Moderna. 1ª edição, São Paulo, Pearson/Wesley. 2003.
- TIPLER, P. – Física. 3ª edição, Vol. 1, 2 e 3. Rio de Janeiro, Livros Técnicos e Científicos Editora S.A. 1995.
- DEUS, J.; M. PIMENTA, A. NORONHA, T. PENA, P. BROGUEIRA – Introdução à Física. Lisboa, McGrawHill. 1998.
- ÍNDIAS, M. – Curso de Física. Vol I e II. Lisboa, McGrawHill. 1992.
- RAMALHO, F.; G. F. NICOLAU, P.A. TOLEDO – Os Fundamentos da Física. 6ª edição, Vol. 2 e 3. São Paulo, Editora Moderna. 1997.
- EWEN, DALE; SCHURTER, NEILL; GUNDERSEN, P. ERIK – Applied Physics, 10ª Edition, Prentice Hall, 2012.

Métodos numéricos e programação / Numerical Methods and Programming (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Knows the concepts of both matrix and determinant and their applications for solving linear systems; 2. Uses numerical analysis techniques, to find zeros of functions, uses polynomial interpolation and numerical integration; 3. Uses structured programming and object-oriented languages; 4. Uses the main office software tools.

3.3.5. Syllabus:

1.1. Matrices; 1.2. Determinants; 1.3. Linear systems.

2.1. Zeros of functions; 2.2. Polynomial interpolation; 2.3. Numerical integration.

3.1. Programming functions; 3.2. Programming procedures.

4.1. Word processing; 4.2. Spreadsheet; 4.3 Other information technology.

Bibliography:

Magalhães, Luís T. - Álgebra Linear como Introdução à Matemática Aplicada. Texto Editora, 1996.

Ruggiero, M.; Lopes, Vera Lúcia - Cálculo Numérico Aspectos Teóricos e Computacionais. McGraw-Hill, 1988.

Strang, Gilbert - Linear Algebra and its Applications. Harcourt Brace Jovanovich, Inc., 1988.

Química e Bioquímica II / Chemistry and Biochemistry II (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

The student knows the reactivity of the main functional groups of the organic compounds; Knows the structure of the main classes of natural compounds; - Understands the metabolism of carbohydrates, lipids and proteins; Understands the mechanism of the catalytic activity of the enzymes

Syllabus:

Reactions of the main classes of organic compounds. Structure and properties of the main classes of natural compounds. Biological functions of carbohydrates, lipids and proteins. Metabolism of carbohydrates, lipids and proteins. General structure of enzymes and their action mechanism.

Bibliography:

Lehninger - Principles of Biochemistry, Worth Publishers inc, 1987

Morison, R.; Boyd, R. - Química Orgânica, Fundação Calouste Gulbenkian, 1998

Metzler, D. E. - Biochemistry: The Chemical Reactions of Living Cells, Academic Press, 1977

Inglês Técnico e Comunicação /Technical English and Communication skills (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1) Applies the syntax and rhetoric of scientific discourse in the production of technical written and oral texts: Prepares thematic glossaries; Uses technical vocabulary. 2) Masters the lexicon of specific terminologies: Develops techniques for characterization, classification and definition; - Writes abstracts and summaries. 3) Uses advanced techniques of communication to produce technical-scientific works in audiovisual media: Designs and prepares technical-scientific papers and reports using quotes; Masters oral presentations. 4) Collects, selects, analyzes and produces information: Applies techniques of written and oral communication for the world of work (curriculum, application and presentation letters, etc.).

Syllabus:

1. dominates the lexicon of specific terminologies in English and Portuguese Languages. 2. uses the syntax and rhetoric of the technical-scientific discourse. 3. recognizes the specificities of functional writing for the labour world..

Bibliography:

COLLINS DICTIONARY (2017) - Disponível em: <https://collinsdictionary.com>

COLLINS DICTIONARIES (2011) - Collins English dictionary. 11th edition. Glasgow: Harper Collins. ISBN 978-00-743786-3.

ESTRELA, E; SOARES, M. A.; LEITÃO, M.J. (2007)- Saber escrever uma tese e outros textos. 5ªed. Lisboa: Dom Quixote. ISBN 978-972-20-3173-8.

MURPHY, Raymond (2004) -- English Grammar in Use. Cambridge: Cambridge University Press. ISBN 978-0-521-18906-4.

OXFORD LEARNER'S DICTIONARY (2017) - Disponível em [http:// www.oxfordlearnersdictionaries.com](http://www.oxfordlearnersdictionaries.com)

PORTUGAL (2009) - Ministério do Emprego e da Segurança Social. Departamento de Emprego. Direcção de Informação e Orientação Profissional. Como procurar emprego. Colecção Utente.

ROCHA, A.; ROHRICH, O. (2012) -Como procurar e conseguir emprego: guia prático do candidato. Lisboa: Pactor. ISBN 978-989-693-019-6.

SWALES, J.M., FEAK, C.B. (2011) - Academic writing for graduate students. 3rd.ed. USA: University of Michigan. ISBN 978-0-472-03475-8.

Geologia e Climatologia /Geology and Climatology (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

Knowledge of geological and climatic cycles and associated phenomena will allow an assessment of the natural resources and environment interactions. In this way, the student should purchase the necessary elements to identify environmental potentialities and minimize risks: 1. Know the internal structure of the Earth, the phenomena and the implications of plate tectonics, earthquakes and the type of volcanoes. 2. Know the great types of rocks: genesis and chemical and structural composition; 3. Identify the different types of relief and orogenesis; 4. Understand the solar radiation and the energy balance distribution of the earth's surface, and his variation throughout the year, according to the latitude factor; 5. Know the procedures of measuring the climatic parameters, the relation of average and extreme values with the correspondent's climate factors. 6. To elaborate the water balance of the soil according to the methodology of Thornthwaite and Matter. 7. Know the climates on a world scale and the theories and models that explain global climate change.

Syllabus:

Module I: Geological Processes: internal geodynamics, continental drift theory, plate tectonics; volcanism; external geodynamics, geomorphology, mineralogy, rock types, genesis and composition.

Module II: Climatological processes: solar radiation incidence and distribution, radiation and energy balances; measurement of climatic elements; average and extreme climatic elements and his relationship with the climate factors; Soil water balance according to Thornthwaite and Matter methodology; earth climates; models and theories of global warming.

Bibliography:

CARVALHO, A.. M. G. 1996. Morfogénese e Sedimentogénese, Universidade Aberta, Lisboa.
CARVALHO, A. M. G. 1997. Petrogénese e Orogénese, Universidade Aberta, Lisboa.
CARVALHO, A. M. G. 2008. Geologia Sedimentar. Editora Âncora, 2ª Edição.
CARVALHO, A. M. G. 2008. Introdução ao Estudo dos Minerais. Editora Âncora, 2ª Edição, 2008.
COSTA, J. B. 1985. Estudo e Classificação das Rochas por Exame Macroscópico, Fundação Calouste Gulbenkian, (6ªed.), Lisboa.
FEIO, M. 1991. Clima e Agricultura. Ministério da Agricultura, Pescas e Alimentação. Lisboa
MONTGOMERY, C. W. 1997. Environmental Geology, McGraw Hill.
NUNES, M. e FERREIRA, A. 2003. Elementos de Apoio à Disciplina de Climatologia. ESAC.
PEIXOTO, J.P. 1981. A Radiação Solar e o Ambiente. Comissão Nacional do Ambiente, Lisboa
RESTALLACK, J.B. 1996. Meteorologia. Instituto Nacional de Meteorologia e Geofísica, Lisboa..
DENCOURT, J.; PAQUET, J. 1986. Geologia: Objectos e Métodos. Livraria Almedina, Coimbra.
MONEY, D.C. 1990. Climate and Environmental Systems. London.

2nd curricular year

Ecologia Geral / Ecology (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1-Domination of ecosystem concept and their compounds particularly energy flow. 2 - Identification of ecological factors and establishment of their influence in life processes. 3-Obtain the knowledge about population dynamic interactions and evaluate their impact in ecosystems. 4 - Acquires the concept of community and understands their development.

Syllabus:

1 - Ecosystems organization and development: 1.1 Ecosystems generalities, 1.2 Characteristics of natural systems, 1.3 Energy flow, 1.4 Energy and material transfer, 1.5 Ecosystems evolution. 2. Ecosystems dynamic: 2.1 Life and Climate, 2.2 Life and Soil, 2.3 Biogeochemical cycles. 3. Relationships in ecosystems: 3.1 Interactions established, 3.2 Populations dynamic and consequences, 3.3 Man role in ecosystems.

Bibliography:

BEGON, M., TOWNSEND, C.R. & HARPER, J.L. - Ecology: from individuals to ecosystems. Cambridge: Blackwell Publishing Limited, 2005.
FAURIE, C., FERRA, C., MÉDORI, P., DEVAUX, J. & HEMPTINNE, J. - Ecologie. Approche scientifique et pratique. Lavoisier, 2002.
RICKLEFS, R. & MILLER, G. - Ecology. W.H. Freeman and Company, 2000.

Economia e Sociologia / Economy and Sociology (1º semestre / Fall semester)

(Awaiting information)

Estatística / Statistics (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1) Understand the language and notation statistics; 2) Covers the key concepts and the necessary methods for summarization and the interpretation of data; 3) develops and implements statistical tests and interprets the results; 4) Applies statistical techniques to support decision making. .

Syllabus:

1. Descriptive statistics in one dimension. Organization of data and its graphic representation.
2. Probability distributions.
3. Discrete and continuous one-dimensional random variables. Common distributions: discrete and continuous.
4. Confidence interval for a parameter of a population.
5. Hypothesis testing for a parameter of a population.
6. Nonparametric tests. Conditions of applicability.
7. Analysis of variance. Multiple comparison tests.
8. Simple linear regression

Bibliography:

- GUIMARÃES, Rui; Sarsfield Cabral, José -Estatística. Edição: 2. Verlag Dashofer, 2010. ISBN 9789896421083.
- LAUREANO, R. e Botelho, M. C., SPSS - O Meu Manual de Consulta Rápida, Edições Sílabo (2010).
- MOREIRA, A., Macedo, P., Costa, M. e Moutinho, V. - Exercícios de Estatística com recurso ao SPSS, Edições Sílabo (2011).
- MURTEIRA, Bento, et al. - Introdução à Estatística, McGraw-Hill, Lisboa (2015). ISBN 9789725924686
- REIS, Elisabeth, et al -Estatística Aplicada, vol. 1. Edição: 6. Edições Sílabo, 2015. ISBN 9789726188193.
- REIS, Elisabeth, et al -Estatística Aplicada, vol. 2. Edição: 5. Edições Sílabo, 2016. ISBN 9789726188414. .
- PESTANA, Dinis; Velosa Sílvia -Introdução À Probabilidade e À Estatística, Vol. I. Edição: 4. Lisboa: Fundação Calouste Gulbenkian, 2010. ISBN: 9789723111507.
- SILVESTRE, António - Análise de Dados e Estatística Descritiva. Edição: 1. Escolar Editora, 2007. ISBN 9789725922088.

Hidráulica e Hidrologia / Hydraulics and Hydrology (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Know basic concepts of hydrology and hydrological processes of precipitation, interception, infiltration, evaporation and evapotranspiration; 2. Knows the basic principles of hydrodynamics and liquid flows under pressure; 3. Know the hydraulic principles of flow with free surface and in porous media; 4. Know the principles of hydrological processes of surface runoff and groundwater flow. . .

Syllabus:

General information on the importance of Hydraulics and Hydrology.

General laws of hydraulics: Properties of liquids. Hydrostatic. Hydrokinematic. Hydrodynamics.

General study of liquid flows. Laws of resistance of uniform flows. Permanent flow under pressure, with free surface and in porous media.

Fundamental concepts of hydrology: Hydrological cycle and hydrological balance. Hydrographic basin. Concentration time. Return time and probability laws.

Study of hydrological processes: Precipitation. Interception and surface retention. Evaporation and evapotranspiration. Infiltration. Surface flow. Underground drainage. Use and management of water:

The role of water in society. Political-legal framework for water management

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- Azagra, M.A. ; Hevia, J.N. – Hidrologia Florestal, el ciclo hidrológico. Un. Valladolid, 1996.
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- Lencastre, A. – Hidráulica Geral. Edição do autor, Lisboa, 1991.
- Linsley, R.; Kohler, M.; Paulhus, J. - Hydrology for engineers. International Student Ed. Mc Graw Hill, Singapore, 3ª edição, 1982.

Musy, A.; Higy, C. – Hydrologie, une science de la nature. Presses PUR, Lausanne, 2004.
Novais-Barbosa, J. (1986) Mecânica dos Fluidos e Hidráulica Geral. Porto Editora, Porto.
Pinto, N. L. de S.; Holtz, A. C. T.; Martins, J. A.; Gomide, F. L. S. - Hidrologia básica. Editora Edgard
Blücher, São Paulo, 1976.
Viessman, W., Jr.; Lewis, G. L. - Introduction to hydrology. HarperCollins College Publishers, 4ª edição, 1996.

Pedologia / Pedology (1º semestre / Fall semester)

(Awaiting information)

SIG e Detecção Remota / GIS and Remote Sensing (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1 - Master the concepts and principles of Geographic Information Systems (GIS) and recognizes its role as a tool to support decision making in land management; 2 - Master the Remote Sensing (RS) methods of information analysis and processing; 3 - Uses the available tools and techniques (GIS and RS) in practical work and in a project development

Syllabus:

Module 1 - Data collection, information analysis and cartographic production;

Module 2 - Using GIS tools and digital image processing of remote sensing images to support the decision making process.

Bibliography:

Bossler, John D. (2001). Manual of Geospatial Science and Technology. Taylor & Francis, New York.
Burrough, P., McDonnell, R. (1998) Principles of Geographical Information Systems - Spatial Information Systems and Geostatistics. Oxford University Press, Oxford.
Cosme, António (2012) Projecto em Sistemas de Informação Geográfica. Lidel, Lisboa.
DeMers, Michael N. (2005) Fundamentals of Geographic Information Systems (3rd Edition). John Wiley & Sons, Inc., New York.
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Matos, João. (2007). Fundamentos de Informação Geográfica - 5ª Edição Atualizada e aumentada, Lidel, Lisboa
Tso, B., Mather, P. (2001) Classification Methods for Remotely Sensed Data, Taylor & Francis, New York.

Análises Físico-Químicas / Physic-Chemical Analyses (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Description of physic-chemical parameters for assessing the quality of an ecosystem and a supply water, the pollutant load and the quality of discharges and the fertilizer value of waste. 2. Knowledge of the theoretical fundamentals of the different analytical methods. 3. Knowledge of the analytical methodologies that can be used to control the quality of ecosystems, waters and effluents and a critical analysis of the results obtained. 4. Knowledge of the Portuguese laws.

Syllabus:

1. Environmental monitoring. Sampling: sampling patterns. Evaluation of analytical data.
2. Effect of the discharge of waste into the environment. Meaning of each of the physical-chemical parameters to be analyzed. Legislation applicable.
3. Theoretical fundamentals of the main analytical methods of water quality assessment: gravimetric, volumetric and instrumental methods - potentiometry, UV-Vis spectrophotometry, flame emission atomic absorption spectrophotometry and graphite chamber, flame emission spectrophotometry and ICP, gas chromatography (GC) and high pressure chromatography liquid (HPLC). Interference and methods of elimination. Equipments. Quantitative Analysis. Calibration curve method, standard addition method and internal standard method.
4. Evaluation of the analytical results of the different analytical parameters of both water and waste quality and comparison with the values of the legislation.

Bibliography:

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Sawyer, C.N.; McCarty, P.L. Chemistry for Environmental Engineering, 3ª ed., McGraw-Hill Book Comp., New York, 1978.
Day, R.A.; Underwood, A.L. Quantitative Analysis, Prentice-Hall Int., Inc., 1991.
Harris, D.C. Quantitative Chemical Analysis, W.H. Freeman and Company, 5ª ed. New York, 1998
Manahan, Stanley E. Environmental Chemistry - 10ª Ed. CRC Press New York 2017

Ecologia Aquática e Terrestre / Aquatic and Terrestrial Ecology (2^o semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1) To know the diversity and geographical distribution of terrestrial and aquatic ecosystems; 2) To know the natural, biotic and abiotic conditions of terrestrial and freshwater ecosystems; 3) Recognize the disturbance conditions of terrestrial and freshwater ecosystems; 4) Identify the causes of the ecological status of freshwater ecosystems and suggest measures for their ecological recovery.

Syllabus:

1. Terrestrial ecosystems: 1.1. Factors influencing terrestrial habitat: climatic and substrate dependent; 1.2. The great zoogeographic regions: Holartic, Ethiopian, Eastern, Neotropical, Australian, Antarctic; 1.3. Terrestrial flora and fauna; 1.4. Main terrestrial biomes (tundra, coniferous forest, deciduous forest, Mediterranean forest - chaparral, tropical forest, savannah, steppe and desert); 1.5. Stability of ecosystems and ecological succession; 1.6. Causes and effects of anthropogenic disturbances on terrestrial ecosystems.

2. Freshwater ecosystems: 2.1. The importance of water and aquatic ecosystems; 2.2. Water properties; 2.3. Types, characteristics and geographical distribution of freshwater ecosystems; 2.4. Geomorphology, biology, ecology and functioning of river ecosystems; 2.5. Causes and effects of anthropogenic disturbances on freshwater ecosystems and solutions for their ecological recovery.

Bibliography:

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- Brower, J. E., Zar, J. H. & von Ende, G. N. Field and laboratory methods for general ecology. New York: WCB McGraw-Hill, 1998.
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- Ferrand de Almeida, F. Ecologia: notas breves. Lisboa: Ministério da Educação e Investigação Científica, 1976. Instituto para a Conservação da Natureza. Plano Sectorial da Rede Natura 2000. Lisboa: ICN, 2006.
- Molles, M. C. Jr. Ecology: concepts and applications. New York: McGraw-Hill, 2002.
- Mackenzie, A., Ball, A. S. & Virdee S. R. Ecology. Oxford: BIOS Scientific Publishers, 2001.
- Pité, M. T. & Avelar, T. Ecologia das populações e das comunidades: uma abordagem evolutiva do estudo da biodiversidade. Lisboa: Fundação Calouste Gulbenkian, 1996.
- Tánago del Río, M.G. & Jalón Lastra, D.G. Restauración de ríos y riberas. Madrid: Fundación Conde del Valle de Salazar & Ediciones Mundi-Prensa, 2001.

Higiene e Segurança no Trabalho / Hygiene and safety at work (2^o semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

The objective of this course is to develop skills related to Safety and Health in the activity, namely, risk assessment, identification and use of protective equipment, knowledge of the applicable legislation and the elaboration of Safety Plans. It is intended that the student, after attending the course, develops skills that allow collaborating in the definition of the company's general policy on risk prevention with the planning and implementation of the corresponding management system, in the development of evaluation processes on occupational risks, in the design, programming and development of prevention and protection measures and in the technical coordination of safety and health activities. It is also intended the development of skills related to the implementation of a Occupational Health and Safety Management Certification.

Syllabus:

Fundamentals of Safety and Health, cost-benefit analysis of preventive actions, meaning and importance of prevention. National and Community Legislation and Regulation. Statistics on occupational accidents. Identification of work hazards caused by dust, gases and vapours, noise, vibrations and heat. Criteria for evaluation of work risks. Individual protection equipment. Safety signs. Prevention actions, concepts, types of actions and criteria for definition of prevention actions. Implementation and evaluation of prevention actions. Safety and Health Plans. Safety procedures sheets. Occupational Health and Safety Management Certification. General concepts, advantages and references Normative: OSHAS 18001 and NP 4397..

Bibliography:

- MIGUEL, A.S.S.R., 2000. Manual de Higiene e Segurança do Trabalho. Porto Editora, Porto, 505 p.
- Associação Empresarial de Portugal, 2004. Manual de formação: Higiene e Segurança no Trabalho. AEP, Portugal, 45 p.
- HARMS-RINGDAHL, L., 2001. Safety Analysis – Principles and Practice in Occupational Safety. Taylor & Francis, London, 289 p.
- MARTIN, C., 2007. Avaliação do risco em segurança, higiene e saúde no trabalho. Monitor, Lisboa, 326 p.
- SANTOS, G., 2013. Sistemas Integrados de Gestão, Qualidade, Ambiente e Segurança. Publindústria, Porto, 263 p.

Microbiologia Ambiental / Environmental microbiology (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. To know the taxonomic and metabolic diversity of the microbial world; 2. To know the variety of interactions among microorganisms and between them and their environment, i.e., air, soil, water and other organisms; 3. To recognize the importance of microbial activities in the ecosystems; 4. To describe the positive and negative effects of microorganisms on the human environment; 5. To know the use of microorganisms for solving environmental problems; 6. To carry out the evaluation of environmental microbial contamination.

Syllabus:

1. Historical perspective of environmental microbiology;
2. Basic notions of general microbiology;
3. Taxonomic and metabolic diversity of microorganisms;
4. Microbial interactions;
5. Microbial activities with ecological relevance;
6. Microbial community of water, soils and associated to vascular plants;
7. Microbial remediation and microbial products;
8. Contamination and quality;
9. Evaluation of microbial contamination: water, surfaces and air.

Bibliography:

- Alcântara, F., Cunha, M.Â. & Almeida, M.A. (1996). Microbiologia: práticas laboratoriais. Universidade de Aveiro, Aveiro.
- Cowan, M.K. (2012). Microbiology: a systems approach. 3rd edition. McGraw-Hill Book Company, Inc., Nova Iorque. [Available at http://highered.mheducation.com/sites/007352252x/student_view0/index.html]
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- Prescott, L.M., Klein, D.A. & Harley, J.P. (2002). Microbiology. 5ª edição. McGraw-Hill Book Company, Inc., Nova Iorque. [Available at http://highered.mheducation.com/sites/0072320419/student_view0/index.html].

Poluição Ambiental / Environmental Pollution (1º semestre / Fall semester)

(Awaiting information)

Tratamentos físico-químicos / Physicochemical treatments (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

To ensure a good quality of drinking water and to improve the quality of some wastewater, it is necessary to carry out different types of physical-chemical treatments. The objective of this course unit is to give students the following competencies: - Describe the nature of substances to be removed in physico-chemical treatments: dissolved substances, colloidal dispersions and substances in suspension.-Understand and describe the mechanisms involved in the different unit operations related to physical and chemical treatments.-Apply the theoretical concepts of physico-chemical treatments taught in the theoretical-practical classes and those related to laboratory analytical methods..

Syllabus:

1 Module 1. Theoretical concepts

1. INTRODUCTION: The importance of unit operations in the treatment of water and effluents.
2. EQUALIZATION AND HOMOGENIZATION: Evaluation of the degree of homogenization.
3. GRADING, SCRATCHING, SIZING. General principles of operation and applications.
4. MIXTURE and STIRRING: Concepts. Definition of linear flow and vortex. Classification of stirrers.
5. NEUTRALIZATION: Main chemical compounds used in the neutralization of wastewater and industrial effluents. Acid-base neutralization: potentiometric titration curve and calculation of the dosage. Neutralization with lime. Neutralization with lime mud.
6. SOFTNING: Definition of alkalinity and hardness. Calcium hardness and magnesium hardness. Meaning of Langmuir Index. Determination of the amount of chemicals to be used in the treatment: bar chart.
7. CHEMICAL OXIDATION / PRECIPITATION: Oxidation-reduction reactions and main oxidizing agents. Applications to industrial waste water.
8. OXYGEN TRANSFER: Transfer coefficient in clean water and waste water. Effect of temperature, mixing intensity, tank geometry and water characteristics. Ventilation systems: diffusers and mechanics (surface and submerged).
9. SEDIMENTATION / FLOATING: Description of the movement of particles within a fluid under the action of gravity. Types of sedimentation: discrete, flocculent, impeded and thickening. Discrete sedimentation: Stokes equation and notion of terminal velocity; calculation of the particle removal efficiency. Flocculent sedimentation: flocculent sedimentation test; calculation of the percentage of removal.
10. FILTRATION / DEHYDRATION: Filtering mechanisms. Karman-Kozenny equation. Mode of operation: constant pressure filtration and constant filtration rate filtration. Types of filters: filter press, cloth filters, vacuum filters, granular media filters (slow and fast sand filters) and membrane filters (microfiltration, ultrafiltration and nanofiltration).
11. ADSORPTION. IONIC EXCHANGE. REVERSE OSMOSIS. General principles of operation and applications.
12. COAGULATION-FLOCCULATION- Colloidal substances. Mechanisms of surface electric charge development. Colloidal stability. Concept of coagulant and flocculant. Mechanisms of destabilization of colloids - Double electric layer model (potential of Stern and Zeta). Coagulation using electrolytes (Fe and Al salts) and polyelectrolytes. Determination of the dose of coagulant required (Jar Test). Applications.
13. DISINFECTION - Disinfection Processes: The need to disinfect water for consumption and for waste water. Physical methods (heat and ultraviolet radiation) and chemicals (chlorine, ozone, etc.). Characteristics of a good disinfectant agent; mechanisms and factors that influence their action. Law of Chick. Disinfection using chlorine compounds: Chlorine depletion curve (breakpoint curve). Notion of free residual chlorine and chloramines and their ability to disinfect.

Module 2. Theoretical-practical classes

Tracing of sedimentation curves and analysis of suspended solids content, determination of IVL index; Determination of chlorine deficiency; Determination of residual chlorine and parameters; Analysis of free chlorine content and chloramines in drinking water; Comparison of different types of coagulants and evaluation of process efficiency; Removal of the hardness of a water; Determination of the amount of reagents required and the amount of precipitate (sludge) formed during the water softening process by chemical precipitation. Representation of the initial and final composition of a water in a bar diagram after being subjected to a softening process.

Bibliography:

T. J. CASEY, Unit Treatment Processes in Water and WasteWater engineering. John Wiley & Sons Inc. 1992.
PEPPER, I.I., GERBA, C.P. & BRUSSEAU, M.L. - Pollution science. Academic Press, 1996.
KARL R. IMHOFF. Manual de tratamento de águas residuais, Editor Edgard Blucher Ltda., São Paulo, 1988.

3rd curricular year

Certificação Ambiental e da Qualidade / Environmental and quality certification (1^o semestre / Fall semester)

(Awaiting information)

Efluentes Gasosos e Processos de Tratamento / Gaseous effluents and treatment processes (1^o semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

A → Recall and describe the main points of the legislation involved in the air quality management, as well as the pollutants involved and their main origins and effects. B → Solve and integrate gas problem calculations involved in air pollution management: convert, normalize and standardize concentrations; employ emission factors; determine flue-gas stack legal minimum height and effective height; relate weather conditions and

plume shape; describe an atmospheric dispersion model and its parameters. C → List and explain techniques and equipment used to monitor, prevent, reduce, disperse and remove air pollutants and propose and evaluate the best choices for a given source or installation: equipment for detection and quantification in effluents, indoor air or ambient air; abatement methods and depuration equipment. D → Calculate the efficiency rate of the main types of depuration equipment and design it by manipulating the design relevant parameters..

Syllabus:

MODULE 1 1.1 Air quality management legislation: nature, origin and effects of the pollutants involved; vocabulary. 1.2 Air quality management legislation: national and international, addressed by objectives; BAT and licensing for different polluters; management of environmental air quality, indoor and working atmospheres.

MODULE 2 2.1 Gas practice problems 2.2 Waste gas concentration, conversion, standardization and normalisation problems. 2.3 Emission factors utilization for emission assesment. 2.4 Minimum legal chimney height calculation and related building standards. 2.5 Examples of atmospheric dispersion modeling; parameters involved.

MODULE 3 3.1 Methods to avoid, reduce, disperse and remove air pollutants. 3.2 Techniques and equipments for the detection and monitoring of air pollutants, used during emission, in indoor air or in ambient air. 3.3 Techniques and equipments for waste gas depuration. 3.4 Depuration equipment efficiency calculation and optimization by manipulation of pertinent variables. 3.5 Choice of the most appropriate equipment for a given installation.

Bibliography:

- Beachler, D. S.; J.A. Janhke; G. T. Joseph e M.M. Peterson; 1983. Course SI 431. Air Pollution Control Systems for Selected Industries: Self-instructional Guidebook. APTI - U.S. Environmental Protection Agency.
- Godish, Thad, Wayne T. Davis, Joshua S. Fu; 2014. Air Quality (5.^a ed.). CRC Press; Boca Raton. BESAC P52 22850 (3.^a ed.)
- Kiely, Gerard; 1996. Environmental Engineering (international edition: 1998, 0071164243). McGraw-Hill Higher Education (International Edition). ISBN 0071164243 [Cap. 3, 8, 16, 21]. BESAC P50 20057.
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- SÍTIO PARA CONSULTA: Agência Europeia do Ambiente; s/d. Poluição atmosférica. União Europeia. Em-linha em <http://www.eea.europa.eu/pt/themes/air>
- SÍTIO PARA CONSULTA: APA; 2013. Políticas de Ambiente. Agência Portuguesa do Ambiente, I.P. Em-linha em <http://www.apambiente.pt/index.php?ref=16&subref=82>
- SÍTIO PARA CONSULTA: Direcção de Serviços de Ambiente; 2009-04-24. Ambiente. Comissão de Coordenação e Desenvolvimento Regional do Centro. Em-linha em https://www.ccdrc.pt/index.php?option=com_content&view=article&id=77&Itemid=33&lang=pt
- SÍTIO: União Europeia; s/d. Sínteses da legislação da UE - Poluição atmosférica. União Europeia. Em-linha em http://europa.eu/legislation_summaries/environment/air_pollution/index_pt.htm

Gestão de energia / Energy Management (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Knowing the basic concepts, principles and fundamental laws in energy
2. Knowing the relation between energy use and global environmental impacts
3. Knowing the political and legal framework of energy, climate change and low carbon initiatives at a national and international level
4. Knowing the principles, technologies and applicability of renewable and non-renewable energy resources
5. Knowing the methodology of energy management and to perform a simplified energy audit in real context (either industry or buildings)
6. Knowing relevant energy efficiency measures in different contexts
7. Knowing the national regulation on energy efficiency
8. Knowing the challenges to the transition to sustainable energy systems and sustainable mobility
9. Using soft skills required to a professional activity in the environmental protection domain.

Syllabus:

Part 1 1. Basic concepts, principles and fundamental laws in energy 2. Relation between energy use and global environmental impacts 3. Political and legal framework of energy, climate change and low carbon initiatives at a national and international level 4. Principles, technologies and applicability of renewable and non-renewable energy resources

Part 2 5. Energy management and energy audit methodologies in real context (either industry or buildings) 6. Energy efficiency measures in different contexts 7. National regulation on energy efficiency 8. Transition to sustainable energy systems and to sustainable mobility .

Bibliography:

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- Hinrichs, R.; Kleinbach, M. *Energy: its use and the environment*. Thomson.Brooks/Cole, 2006
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- Krarti, M. *Energy Audit of Building Systems – An Engineering Approach*. CRC Press, 2000
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- Legget J. (2014) *The Energy Of Nations - Risk blindness and the road of renaissance*. Routledge, ISBN - 978-0-415-85782-6
- Lopes, M.A.R.; Antunes, C.H.; Reis, A.; Martins, N. (2016). Estimating behavioural savings in dwellings using Building Energy Performance Simulations. *Building Research and Information*, 1-17. doi: 10.1080/09613218.2016.1140000
- Lopes, M. A. R., Antunes, C. H., & Martins, N. (2012). Energy behaviours as promoters of energy efficiency: A 21st century review. *Renewable and Sustainable Energy Reviews*, 16(6), 4095-4104. doi: 10.1016/j.rser.2012.03.034
- Relevant websites
- DGGE www.dgge.pt
 - ADENE www.adene.pt
 - ERSE www.erse.pt
 - European Commission – Energy – http://ec.europa.eu/energy/index_pt.html
 - International Energy Agency <https://www.iea.org/>
 - Intergovernmental Pannel on Climate Change <http://www.ipcc.ch/>

Resíduos Sólidos e Processos de Tratamento / Solid wastes and treatment processes (1º semestre / Fall semester)

(Awaiting information)

Tecnologias Limpas e MTD / Clean technologies and BAT (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1 - Knowing the main productive processes of the primary and secondary sectors in Portugal; 2 - Knowing the legal system of industrial licensing, the Responsible Industry System (SIR) and instruct an industrial licensing process; 3 - Knowing the PCIP regime and instruct an environmental licensing process; 4 - Knowing and applying the best available techniques and environmental technologies for various sectors of activity: industrial, agricultural and forestry production.

Syllabus:

1. Clean technologies in agricultural and forestry production: soil management, protection against erosion, nutrient management; management of water resources and management of biodiversity. Alternative technologies that minimize the environmental impacts of pesticide application, use of direct and indirect measures; the issue of Genetically Modified Organisms. Main sectors of industrial activity in Portugal: manufacturing processes; process diagrams; mass balance; environmental problems; optimization and efficiency.

2. Industrial licensing: importance; legal framework; licensing procedure

3. Environmental licensing: legal framework; environmental license; the Integrated Pollution Prevention and Control (IPPC) regime; Best Available Techniques (MTDs); BAT reference documents (BREF); European pollutant emission

register (EPER); European Register of Emissions and Pollutant Transfers (PRTR-E); environmental licensing procedure; technologies and environmental protection equipment under the PCIP regime.

4. Clean technologies in livestock production: soil management, nutrient management; management of water resources, energy management waste and effluents in livestock. Alternative strategies in intensive and extensive animal production.

Bibliography:

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Tratamentos Biológicos / Biological Treatments (1º semestre / Fall semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1. Description of the effects caused by the discharge of waste, in soil and in water resources, originated from the waste produced in different human activities, their degradation and the evaluation of the possibility of their biological treatment, in order to minimize environmental impacts; 2. Mastery of the principles of operation of different types of biological treatment (aerobic and anaerobic), the main factors influencing its functioning, the physical-chemical parameters of operation control and the main operations and maintenance interventions in the different treatment systems of liquid and solid waste. Sludge and its processing. Valorization of waste by application to the soil.

Syllabus:

1. Characteristics of different wastewater. Assessment of the need and possibility of biological treatment. Legal impositions for the discharge of effluents.

2. Principles and general scheme of treatment of urban wastewater. Degradation of organic matter by aerobic and anaerobic route. Comparison of processes.

3. Theoretical fundamentals of the main biological treatment systems of liquid effluents: different suspended biomass systems, fixed biofilm and fixed bed biomass (MBBR). Biological membrane systems (MBR). Further removal of nitrogen and phosphorus. "Bulking". Anaerobic digestion and septic tanks. Different types of lagoon.

4. Soil use as a scrubber system. Comparison of processes and criteria of its application in the treatment of residual water. Fertilizer value of a residue and physical-chemical characteristics of a residual water to be applied to the soil. Reuse of treated wastewater and environmental impacts

5. Sludge and its characteristics. Sludge processing. Valorization of sludge and its environmental impact. Legislation applicable.

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Análise de Sistemas Ambientais / Environmental Systems Modelling (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

Modelling environmental systems as a tool to (1) assess environmental impacts on natural/semi-natural and artificial contexts; and to (2) manage environmental systems.

Syllabus:

Part 1 1.1 Modelling environmental impacts: water pollution dispersion models (Streeter & Phelps), air pollution dispersion models (Gauss e Pasquill); noise dispersion models.

Part 2 2.1 Modelling concepts; 2.2 Systems dynamics; 2.3 Population dynamics models, biogeochemical models, environmental management models; 2.4 Modelling an environmental system in practice..

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Avaliação de Impactes Ambientais / Environmental impact assessment (2º semestre / Spring semester)

(Awaiting information)

Educação Ambiental / Environmental Education (2º semestre / Spring semester)

Intended learning outcomes of the curricular unit (knowledge, skills and competences to be developed by the students):

1) To know the concept of Environmental Education (EE) and its evolution. 2) To understand the importance of EE in citizens behaviour and its contribution to sustainable development. 3) To acquire technical and pedagogical skills necessary to carry out EE actions. 4) To plan and prepare EE actions..

Syllabus:

1. Education Concepts. General notions of formal and informal education.
2. Environmental Education (EE). The concept of EE and its historical and ideological evolution in Portugal and in the world. The role of EE in changing attitudes and behavior of the citizen and its contribution to sustainable development.
3. The profile and skills of the environmental educator: the technical training in the environment, the pedagogical training and the group activities.
4. EE actions: elaboration, implementation and evaluation of EE actions; design, implementation and evaluation of EE projects.

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- Fernandes, José de Almeida. Manual de Educação Ambiental, Comissão Nacional do Ambiente, Lisboa, 1983.

Planeamento Regional e Urbano / Regional and urban planning (2º semestre / Spring semester)

(Awaiting information)