

Bachelor in Biotechnology | Courses syllabus

1st curricular year

Biologia / Biology (annual)

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

Introduction of to the broad diversity of living organisms. It is intended that students acquire skills in the following areas of biology: organization of the living world, from the DNA structure, the energy flow in the biosphere to the classical aspects of morphology and systematic, including the understanding of the living beings diversity as a result of the evolution process.

Syllabus:

CELLULAR AND MOLECULAR BIOLOGY: 1. Methods of study. Microscopy; 2. The cellular theory and diversity; 3. A comparative study of prokaryotic and eukaryotic cells; 4. Heredity and Evolution; 5. Molecular Genetics.

MICROBIOLOGY: 1. Taxonomy and systematics; 2. Nutrition and growth; 3. Factors affecting microbial growth; 4.

Methods of study; 5. Applied Microbiology. BOTANY: 1. Plant Histology and Anatomy; 2. Morphology of phanerogams; 3. Plant systematic of Phanerogams.

1. Understands the ultrastructure, organization and physiology of prokaryotic and eukaryotic cells and the methods of study of cellular biology. 2. Understand the molecular basis of life. 3. Understands the structure, classification, reproduction, nutrition and physiology of microorganisms and basic factors affecting microbial growth. 4. Knows the role of microorganisms at various levels, particularly in terrestrial, aquatic and aerial ecosystems. 5. Identifies the internal structure and organization of the plant body and relates it to the function of different organs. 6. Knows the plant diversity taking into particular account the morphological characteristics of the major taxonomic groups of vascular plants and taxonomic categories.

Bibliography:

Azevedo, C, Sunkel, C. 2012. Biologia Celular e Molecular. 5ª Edição, Lidel - Edições Técnicas, Lisboa, 629 p. ISBN 978-972-757-692-0

Lidon, F.J.C, Gomes H.P. e Abrantes A.C.S. Anatomia e morfologia externa das plantas superiores. Lidel. Lisboa. 2001.

Franco, J.A. e Afonso, M.L.R. Nova Flora de Portugal (Continente e Açores). Escolar Editora. Lisboa. Portugal. 1971-2003.

Pelczar, M., Chan, E. e Krieg, N. Microbiology: Concepts and Applications. McGraw-Hill Book Company. New York. 1993.

Purves, W.K., Sadava, D., Orians, G.H. e Heller, H.C. Life: The Science of Biology. 7ª ed., Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts. 2004.

Química e Bioquímica / Chemistry and Biochemistry (annual)

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

1. Knows the properties of the solutions. 2. Understands the laws of the Chemical Equilibrium considering the different types of equilibrium: acidbase, oxidationreduction, poorly soluble salts and complexation 3. Knows the structure and the nomenclature of the main classes of organic compounds. 4. Understands the physical and chemical properties of the organic compounds. 5. Knows the structure of the main classes of natural compounds. 6. Understands the metabolism of carbohydrates, lipids and proteins. 7. Understands the mechanism of the catalytic activity of the enzymes

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. 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:

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

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

Lehninger Principles of Biochemistry, Worth Publishers inc, 1987.

Matemática e Informática / Mathematics and Informatics (annual)

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

1. Masters the basic concepts of differential and integral calculus and its applications; 2. Identifies and solves 1st order differential equations; 3. Knows the concepts of both matrix and determinant and their applications for solving linear systems; 4. Uses numerical analysis techniques, to find zeros of functions, uses polynomial interpolation and numerical integration; 5. Knows the fundamentals of information systems; 6. Masters the fundamental concepts of databases organization; 7. Uses structured programming and object oriented languages; 8. Uses the main office software tools

Syllabus:

1.1. derivatives; 1.2. antiderivative; 1.3. definite integrals; 1.4. areas and volumes by applying definite integrals; 1.5. improper integrals; 2.1. differential equations of separable variables; 2.2. linear differential equations; 2.3. Bernoulli differential equations. 3.1. matrices; 3.2. determinants; 3.3. linear systems; 4.1. zeros of functions; 4.2. polynomial interpolation; 4.3. numerical integration. 5.1. Systems handling information. 6.1. Introduction to Database. 7.1. Programming functions; 7.2. Programming procedures. 8.1. Word processing; 8.2. Spreadsheet; 8.3 Other information technology.

Bybliography:

Foulis, D.; Munem, M.O Cálculo. Guanabara Dois, S.A.:Volume I, Cop. 1978.
Leithold O Cálculo Com Geometria Analítica. Dinalivro, 1994.
Magalhães, Luís T. Álgebra Linear como Introdução à Matemática Aplicada. Texto Editora, 1996.
Ross, S. Differential Equations. McGrawHill, 1984.
Ruggiero, M.; Lopes, Vera Lúcia Cálculo Numérico Aspectos Teóricos e Computacionais. McGrawHill, 1988.
Saraiva, M.A; Silva, M. Primitivação. Edições ASA, 1995.
Strang, Gilbert Linear Algebra and its Applications. Harcourt Brace Jovanovich, Inc., 1988.
Swokowsski, E. W.; Cálculo com Geometria Analítica. McGrawHill, 1983.

Física / Physics (annual)

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

Mechanical solids. Fluid Mechanics. Electrostatics. Electro kinetic. Electromagnetism. Optics. Thermodynamics. Radiation

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. Electrostatics, Electro kinetics 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

Bybliography:

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 (annual)

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

Recognize the specificities of the technical-scientific speech in the two languages involved in the course unit; gather analyze and select information; identify and use the syntax and rhetoric of the technical-scientific speech in the production of written texts, in a creative form; identify and use the adequate grammar resources; deliver and explain orally problems and issues of the scientific field; gather, process use and produce information.

Syllabus:

Reading and understanding of scientific texts; production of contents in visual aids; development of technical vocabulary; theme glossary elaboration; text elaboration according to the communication context; morphological, syntactical and

semantic approach in the two languages involved; syntheses and summary writing; general notions of research; scientific report structuring and elaboration; Literature elaboration; critical Literature research on given themes; techniques of communication in assignment elaboration; delivery and defense of assignments; presentation and defense of supervised assignments; oral and written techniques adequate to the marketplace.

Bibliography:

Answers.com – Online Dictionary, Encyclopedia and much more - online.

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: Editora Guanabara Koogan, cop. 1995. ISBN 85-277-0314-9. 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. NP 405.4.2002, Informação e documentação – Referências bibliográficas: documentos electrónicos IPQ.

MURPHY, Raymond – English Grammar in Use. Cambridge: Cambridge University Press, 2012.

WIMMER, Franz – Dicionário Ilustrado Michaelis. São Paulo: Editora Melhoramentos, 2001. 2 volumes: Português – Inglês e Inglês – Português.

Introdução à Biotecnologia / Introduction to Biotechnology (1º semestre / Fall semester)

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

Understand the relevance and applications of biotechnology in the food and agricultural production, animal husbandry and forestry.

Syllabus:

1.(1) introduction to the systems of agricultural and forestry production;(2) the particular species: forestry vs. agriculture; (3) the genetic variability of the forest: importance of adaptation, origin and provenance;(4) the objectives and techniques applied in plant breeding;(5) applications of biotechnology. 2.(1) introduction to animal production systems, (2) the livestock species and breeds; (3) the mechanisms of heredity, genetic variability and hereditopathy, (4) the objectives and techniques used in animal breeding, (5) the applications of biotechnology. 3.(1) introduction to the problem of food distribution to the world population, (2) the role of biotechnology in the food industry as a way to address nutritional deficiencies, (3) biotechnology applied in food preservation, (4) the sources of enzymes and their application in the food industry.

Bibliography:

Arbez, M. European trends in Conservation of forest genetic resources. In Proceedings of quality of forest reproductive material in the field of the application of European Community Rules. 9-10 December. Terrasson, D. (ed). Cemagref: 161-171. 1995.

Bhalgat, Mahesh, K., Ridley, W. P., Felsot, A. S. and Seiber J. N. (2003). Agricultural Biotechnology. Challenges and Prospects. ACS Washington, DC, USA, pp. 218.

Chahal, C.S. & Gosal, S.S. Principles and procedures of plant breeding. Biotechnological and conventional approaches. Alpha Science International, Harrow, UK, 2006.

Chawla, H.S. Introduction to Plant Biotechnology. Science Publishers, Inc. Plymouth, UK, 2004.

Slater, A., Scott, N. and Fowler, M. Plant Biotechnology. Oxford University Press, UK. 2004.

Oficinas Tecnológicas I / Technological Workshop I (2º semestre / Spring semester)

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

First contact with particular aspects related to biotechnological processes in general as well as with aspects related to the food industry in particular.

Syllabus:

Biotechnological processes, mass balances; practical aspects and processes related to food processing, particularly dairy products.

Bibliography:

Varnam, A. H., Sutherland, J. P. Leche y Productos Lácteos: Tecnología, Química y Microbiología. Zaragoza: Editorial Acibia, 1994.

Alfa Laval A. B. Dairy Handbook. Dairy and Food Engineering. Sweden: Lund, 1980.

Doran, P. M. Bioprocess Engineering Principles. London: Academic Press, 2004.

Shuler, M. L., Kargi, F. Bioprocess Engineering. Basic Concepts. New Jersey: Prentice Hall PTR, 2002.

2nd curricular year

Análise Instrumental / Instrumental Analysis (1º semestre / Fall semester)

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

Biotechnology uses intensively experimental analytical techniques in their activities. A description of the most important techniques capable of obtaining qualitative and quantitative information is discussed, together with practical demonstration of theoretical concepts. This course gives to the student learning the techniques from the sampling and preservation of biological samples, the main elementary analytical techniques and the more complex techniques as spectroscopic methods and chromatographic techniques.

Syllabus:

Elementary analytical techniques. Analysis and presentation of results. Sampling. Preservation of elemental analytical samples. Techniques: drying, milling, solvent extraction, calcination gravimetric, volumetric, use of electrodes, refractometer, polarimetry, conductometry, turbidimetry. Threshold for detection, quantification limit, precision and accuracy, linearity and range, repeatability, calibration lines. Analysis and presentation of results. Spectroscopic methods. Qualitative and quantitative analysis. Chromatographic methods: HPLC and GC. Qualitative analysis, quantitative and preparative. Immunochemical methods. Volumetric determination of sugars (Lane method), a jam determination of sucrose by polarimetry; determination of total sugars by means of Brix (refractometer); Quantitative determination of protein in a biological sample by the Biuret method; sugar analysis using HPLC, Use of the GC determination of methanol.

Bibliography:

METHODS OF ANALYSIS FOR FUNCTIONAL FOODS AND NUTRACEUTICALS; ed. W. Jeffrey Hurst. Boca Raton: CRC Press, 2002;
ANALYSIS OF FOOD CONSTITUENTS; ed. by J.-L. Multon. English edition. New York: Wiley-VCH, 1997. (Analysis and Control Methods for Foods and Agricultural Products);
OFFICIAL METHODS OF ANALYSIS OF AOAC INTERNATIONAL; ed. by Patrícia Cunniff. 16th ed. Gaithersburg, Maryland: AOAC International, 1997.
Métodos Instrumentais em Análise Química, Ewing Galen Wood, Ed. SP, São Paulo, 1977.
Compilation of E. P. A.'s Sampling and analysis methods. KEITH Lawrence H; Chelsea, MI: Levis Publishers, Inc., cop. 1992.
Chemical instrumentation: a systematic approach / STROBEL Howard; second edition. Reading, Massachusetts: Addison-Wesley Publishing Company, 1973.

Estatística / Statistics (1º semestre / Fall semester)

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

1. Understands 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. 2. Probability distributions. 3. Discrete and continuous random variables. Common discrete and continuous distributions. 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. Simple linear regression. Multiple linear regression.

Bibliography:

R. Guimarães e J. Sarsfield Cabral, "Estatística", McGraw-Hill, Lisboa (2007), 2ª ed.
Murteira, C.S. Silva, J.A. Silva e C. Pimenta, "Introdução à Estatística", McGraw-Hill, Lisboa (2001)

Genética / Genetics (1º semestre / Fall semester)

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

1. To know the cytological and molecular basis of cell and the mechanisms and structures involved in the phenomena of heredity, including heredopatology and phenotypic variability, 2. to know the principles of Mendel, different intergenic relationships, patterns of normal and special transmission (including phenomena "Inprinting") and related heredopatology; 3) to know the postulate of Hardy-Weinberg and principles of quantitative approach applied to plant and animal breeding. 4) to understand the applicability in the production animal and vegetal.

Syllabus:

I - Cytogenetics and Molecular Genetics (30%): 1) organization and cytological nuclear eukaryotes and prokaryotes, 2) hereditary transmission through sex, occurrence of Crossing-over, aberrations (deletions, inversions, translocations) and chromosomal abnormalities (polysomy and polyploidy); 3) genetic variability resulting from polymorphisms (including

SNPs) and epigenetics. II - Mendel and patterns of transmission (40%): 1) principles, intergenic relationships and special cases of inheritance (including 'Inprinting '), 2) characteristics of plants and animals (including humans) and their pattern of transmission, 3) exercises . III - Population Genetics and Quantitative (30%): 1) Postulate of Hardy-Weinberg and applications, 2) polygenic and phenotypic variability, components, heritability and Breeding Value, types and methods of selection and crossing, inbreeding and heterosis.

Bibliography:

FALCONER DS, MACKAY TFC. - Introduction to quantitative genetics. Essex: Prentice Hall, 1996.
GARDNER EJ ; SIMMONS MJ, SNUSTAD DP. Principles of genetics. 8ed. New York: John Wiley & Sons, Inc., 1991.
HEDRICK P.W. Genetics of populations. 2ed. Sudbury: Jones and Bartlett Publishers, 2000.
KANG M.S. Handbook of formulas and software for plant geneticists and breeders. New York: Food Products Press, cop. 2003.
HERTL D.L., JONES E.W. Genetics: principles and analysis. 4ed. Sudbury, Massachusetts: Jones and Bartlett Publishers, 1998.
INRA. Eléments de génétique quantitative et application aux populations animales. Paris: INRA, 1992. (Productions animales. Numéro hors série. Génétique quantitative)
GRIFFITHS AJF, MILLER JH, SUZUKI DT, LEWONTIN RC, GELBART WM. An introduction to genetic analysis. 7ed. New York: W. H. Freeman, 2000
LEWIN B. Genes VII. Oxford: Oxford University Press, 2000
LEWIS R. Human genetics: concepts and applications. 2ed. Dubuque, IA: WCB Wm. C. Brown Publishers, C. 1997

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

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

1. Knows the flow of genetic information and the way it process the regulation of gene expression; 2. Explains the mutational mechanisms and recombinant generating genetic diversity

Syllabus:

I- Introduction to Molecular Biology . 1.1. The structure of nucleic acids. 1.2. Flow of genetic information. 2. Replication and DNA repair . 3. The multifunctionality of the transcriptome : 3.1 . rRNA , tRNA , mRNA and small RNA . 4. Organization of prokaryotic vs eukaryotic genes . 5 . Transcription in prokaryotic / eukaryotic . 6. Translation mechanisms 7. Regulation of gene expression : induction , repression and transcriptional attenuation. 8. Techniques for nucleic acid manipulation and analysis of the genome : DNA restriction , agarose gel electrophoresis , transformation , PCR, hybridization , sequencing , DNA typing . 9. Concepts of bioinformatics . II-1. Gene mutations. 1.1. Types of mutation. 1.2. Mutagenic agents. 1.3. Selection of mutants. 1.4. Repair mechanisms. 2. Recombination in prokaryotic: transformation, transduction, conjugation. 3. Mobile genetic elements. Practice: DNA extraction and analysis; digestion of DNA; restriction maps; transformation; PCR

Bibliography:

Arraiano, C.M. & Fialho, A.M. O mundo do RNA. 1ª Ed. Lidel, Lisboa. 2007.
Azevedo, C. & Sunkel, C.E. Biologia Celular e Molecular. 5ª Ed. Lidel, Lisboa. 2012.
Brown, T.A., Gene Cloning and DNA Analysis: An Introduction. 5th Ed. Blackwell Science Inc, London. 2006.
Green, M.R. & Sambrook, J. Molecular Cloning. A Laboratory Manual. 4th Ed. Cold Spring Harbor Laboratory, New York. 2012.
Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C., Gelbart, W.M., Suzuki, D.T. & Miller, J.H. Introduction to Genetic Analysis. 8th Ed. W.H. Freeman and Company, New York. 2005.
Krebs, J.E., Goldstein, E.S. & Kilpatrick, S.T. Lewin's Genes X. 10th Ed. Jones and Bartlett Publishers. Boston, 2011
Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, S.L. & Darnell, J., Molecular Cell Biology. 5th Ed. W.H. Freeman and Company, USA. 2004.

Anatomia Fisiologia e Nutrição / Anatomy, Physiology and Nutrition (1º semestre / Fall semester)

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

1. The student should know the anatomical structure of the exterior of an animal, the skeletal system and the structural relationship with various organs of the body. 2. Know the microscopic structure of tissues and organs and their functions. 3. Know the location, macroscopic and microscopic structure and functions of different endocrine glands. 4. Know the location, macroscopic and microscopic structure and function of different systems of the animal body.

Syllabus:

1. Exterior body parts of the animal. Skeletal organization of different species of animals. Anatomic location and structure of different organs in the body and their relation to the skeletal system. Embryogenesis of different animal species. General concepts of histology. Macroscopic and microscopic anatomy and physiology of muscular system, circulatory and lymphatic system, the respiratory system and the nervous system. 2. Location, macroscopic and microscopic structure and function of some endocrine glands. Macroscopic and microscopic anatomy and physiology of the urinary system. Macroscopic and microscopic anatomy and physiology of the reproductive and galactopoietic system.

Macroscopic and microscopic anatomy and physiology of the digestive system of different animal species. Structure and function of different constituents of plants and animals and the effect of specific dietary factors on the ruminal microflora

Bibliography:

- BARONE R., Anatomie comparée des mammifères domestique. Paris: Vigot, 1980
CLAYTON H.M.[et al.]. Atlas colorido de anatomia aplicada dos grandes animais. São Paulo: Editora Manole Ltda., 1997
FRANDSON R.D., WILKE, L.W., FAILS, A.D. Anatomia e fisiologia dos animais de fazenda. 6ª ed. Rio de Janeiro: Guanabara Koogan, 2005.
HAFEZ, B. e HAFEZ, E.S.E. _ Reproduction in Farm Animals, 7th edition. USA: Lippincott Williams and Wilkins, 2000.
JARRIGE, R. ; RUCKEBUSCH, Y. ; DEMARQUILLY, C. ; FARCE, M.H. E JOURNET, M. – Nutrition des ruminants domestiques. Paris: INRA éditions, 1995.
MCCRACKEN T.O., KAINER R.A., SPURGEON T.L. Spurgeon atlas colorido de anatomia de grandes animais: fundamentos. Rio de Janeiro, Guanabara Koogan, 2004
MCDONALD, P.; EDWARDS, R.A.; GREENHALGH, J.F.D. E MORGAN, C.A. – Animal Nutrition, 6ª Ed. Edimburgh: Prentice Hall, 2002.
KARDONG K.V. Vertebrates: comparative anatomy, function, evolution. 2ed. Boston: McGraw Hill, 1997

Oficinas Tecnológicas II / Technological Workshop II (1º semestre / Fall semester)

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

Technical relevant areas in Biotechnology use with and/or involving experimental demonstration and from the standpoint of construction techniques. Topics to be addressed may vary throughout the development and evolution of the course, depending on the skills acquired and also of social relevance and updating of the course.

Syllabus:

1. Information search. Use of databases. Use of VPN networks. 2. Immobilization of enzymes and / or microorganisms. Application to the preparation of beta-glucosidase immobilized: removal test of lactose in milk. Monitoring by HPLC. 3. Phosphorescence, fluorescence and luminescence. Applications: Dynamic Phototherapy; Flow cytometry. 4. MS and its potential. MALDI-MS. Structural identification by GC-LC-MS. Applications. Extraction techniques in solid phase: SPE and SPME. Application: Determination of the profile of volatile compounds in odors. 5. gel electrophoresis: applications: profile of proteins in serum. 6. capillary electrophoresis. Preparation of capillary GC and CE. Contributions to the advancement of biotechnology: characterization of populations of microorganisms; recent developments. 7. Technical Control and Automation: LabView. Application to control fermentation

Bibliography:

- Separation processes in the food and biotechnology industries: principles and application / ed. by A. S. Grandison and M. J. Lewis. Cambridge: Woodhead Publishing Limited, 1996. (Woodhead publishing series in food science and technology
DEMAIN Arnold L. ; Manual of industrial microbiology and biotechnology. Washington: American Society for Microbiology, 1986

Engenharia Bioquímica / Biochemical Engineering (2º semestre / Spring semester)

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

Biochemical engineering applied to industry in an integrative perspective of biochemical phenomena associated. It is intended that student recognizes the role of a biotechnologist as an active agent in the production and transformation of bioproducts. 1 Recognizes the bioproducts (food, food additives, drugs, cosmetics and chemicals) and explains the transformations. Be aware of the benefits of a compound produced by fermentation. 3 Uses correctly the terminology and concepts associated with bioprocesses. Performs quantitative and qualitative evaluation of biomass, substrate and fermentation products. 4 Choose the most appropriate bioreactor and operating conditions to obtain a specific product. 5 Identifies upstream and downstream methodologies. 6 Be aware of the limits of application of the acquired concepts, and improves its knowledge in more complex cases.

Syllabus:

1 Stoichiometry of the cellular growth. 2 Microbial kinetics: product formation and substrate consumption. 3 Evaluation of microbial growth kinetic parameters and biomass production yield. 4 Introduction to bioreactors (batch, fed-batch and continuous). 5 Simple material balances applied to bioreactors. 6 Mass transfer applied to the preliminary design of bioreactors. 7 Introduction to biological systems modelling and prediction and evolution of state variables. 8 Cell immobilization systems. Advantages and disadvantages. 9 Case studies: production of lactic acid (solid state fermentation), ethanol (batch fermentation), colorants (beta-carotene in continuous bioreactor), biodiesel (alternative fuels production by direct use of raw materials or industrial reuse of vegetable oils) and bioplastics (PHA PHBs).

Bibliography:

- Fonseca MM, Teixeira JA (2007) Reactores Biológicos - Fundamentos e Aplicações, Lidel - edições técnicas, lda., Lisboa
McNeil B and Harvey LM (2008) Practical Fermentation Technology, John Wiley & Sons, Ltd. England

Najafpour GD (2007) Biochemical Engineering and Biotechnology, 1st ed, Elsevier, The Netherlands Hutkins RW (2006) Microbiology and Technology of Fermented Foods, 1st ed, Blackwell Publishing, Iowa Doran PM (2004) Bioprocess Engineering Principles. Elsevier - Academic Press.
Shuler ML, Kargi F (2001) Bioprocess Engineering – Basic Processes, 2nd ed, Prentice Hall, New York
Lee J (2001) Biochemical Engineering, Department of Chemical Engineering of Washington State University Pullman, WA
Stansbury PF, Whitaker A and Hall SJ (1995) Principles of Fermentation Technology, 2nd ed, Hutterword Heinemann, London
Bailey JE (1986). Biochemical Engineering Fundamentals, McGraw Hill.

Engenharia Genética / Genetic Engineering (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 relevant techniques in recombinant DNA technology and its insertion and expression in bacteria and yeast. 2. Apply the techniques of computational analysis of the nucleotide sequences and amino acid sequences used in vitro and specific amplification of DNA fragments by PCR. 3. To understand the applications of genetic engineering in different areas of society and legislation regulating the use of GMOs.

Syllabus:

1: Manipulating genes and PCR applications. 2. Modified organisms. Techniques of gene manipulation; Strategies used in the cloning of DNA; Laboratory media used for gene manipulation and DNA cloning. Specific DNA amplification chain reaction (PCR) and its applications. Selection, evaluation and analysis of the recombinants

Bibliography:

Avise, John, C. (2004). The Hope, Hype and Reality of Genetic Engineering. Oxford University Press, USA, pp 242.
Brown, T.A. (2006) Gene Cloning & DNA Analysis. An Introduction. 5th. Ed. Blackwell Publishing, UK, pp 386.
Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Crop Biotechnology. 2nd ED. Jones and Bartlett Publishers, USA, pp 562.
Khachatourians, G.G., McHughen, A., Scorza, R., Nip, W. and Hui, Y.H. (2002). Transgenic Plants and Crops. Marcel Dekker, Inc., New York, USA, pp. 876.
Malacinski, G.M. (2005). Fundamentos de Biologia Molecular. 4ª Ed. Guanabara Koogan S.A., Brasil, pp. 439. Neal, C. Stewart, Jr. (2004). Genetically Modified Planet. Environmental impacts of genetically engineered plants. Oxford University Press, USA, pp 240.
Nicholl, D.S. (2005). An Introduction to Genetic Engineering. 2nd Ed. Cambridge University Press, UK, pp. 292.
Slater, A., Scott, N. and Flower, M. (2004). Plant Biotechnology. The genetic manipulation of plants. Oxford University Press.

Microbiologia Aplicada / Applied Microbiology (2º semestre / Spring semester)

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

Origin, incidence, growth and control of microorganisms, with the change of the substrate, producing, preserving and microbiological safety of various products. The aim is to make the student able to perform tasks related to the control of microbiological quality and the development of methodologies, leading to new products in the food, pharmaceutical or environmental areas, or optimize those already existing.

Syllabus:

Microorganisms and culture media for industrial use: groups and sources of microorganisms of interest in biotechnology, desirable features, security, isolation, selection and breeding of strains, starter cultures, sterilization of equipment; sterilization of fermentation media: kinetics of thermal destruction ; Applications: antibiotic production, vaccine production, production of vitamins, fermented foods bioremediation. Practical application laboratory pilot scale: inhibition assay; Getting yogurt and kefir; Production of mushrooms, Antibiotic Production, Production of enzymes (amylase); Laboratory production of beer.

Bibliography:

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Walter Borzani, Willibado Schmidell, Urgel de Almeida Lima, Eugénio Aquarone Coord (2001). Biotecnología Industrial, Volume 1 Fundamentos, 1ª Edição, Editora Edgard Blucher LTDA
Walter Borzani, Willibado Schmidell, Urgel de Almeida Lima, Eugénio Aquarone Coord (2001). Biotecnología Industrial, Volume 3 Processos Fermentativos e Enzimáticos, 1ª Edição, Editora Edgard Blucher LTDA.

Imunologia / Immunology (2º semestre / Spring semester)

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

1) To explain the nature and the etiology of the disease: interaction among host, agent and environment; 2) To describe the organs and elements acting in the immunological system; 3) To explain the immunological responses elicited by the different kinds of antigens; 4) To execute sampling in animals; 5. To execute serological techniques of diagnosis.

Syllabus:

Section A: 1) Mechanisms of disease; 2) Lymphoid organs: primary and secondary organs; 3) Innate immunity: barriers and non specific mechanisms - inflammation and cells of phagocytosis, complement, NK, dendritic cells; opsonins and cell receptors; MHC; 5) Adaptative immunity: T and B cells; 6) Immunoglobulins and cytokines. Section B: 7) Antigenic processing and presentation. 8) Integration of the immunological response elicited by different antigens. 9) Immunity transfer. 10) Execution of the techniques: agglutination, ELISA, indirect immunofluorescence, immunoblotting. 11) The bases of the techniques and the interpretation of the results. 12) Evaluation of a diagnostic technique: determination of the cut-off; sensibility, specificity.

Bibliography principal:

AROSA, F., CARDOSO, E.M., PACHECO, FC. Fundamentos de Imunologia. LIDEL, 2007. ISBN 978-972-757-396-7.
TIZARD Ian R. Veterinary immunology: an introduction. 6th ed. Philadelphia: W. C. Saunders Company, Cop. 2000. ISBN 0-7216-8218-9.

Cultura de Células / Cell Culture (2º semestre / Spring semester)

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

Techniques applied to vegetal cell culture of higher plants and its relevance in commercial and research applications, such as in the conservation of genetic resources, in breeding and in genetic manipulation. Techniques applied to vegetal cell culture and their applications, such as in the increasing of the genetic variability and in the conservation and assessment of the plant germplasm. Techniques applied to animal cell cultures and their applications, such as in research, in health and in animal general improvement

Syllabus:

1: The vegetal cell culture and research applications in breeding and conservation of genetic resources. 2: The animal cell culture and research applications in health and in animal general improvement.

Bibliography:

Canhoto, J.M. 2010 Biotecnologia vegetal, da clonagem de plantas à transformação genética. Imprensa da Universidade de Coimbra.
Chawla, H.S. 2009 Introduction to plant biotechnology, 3rd ed. Science Publis., Inc., New Hampshire.
Freshney R. Ian. 2005 Culture of Animal Cells: A Manual of Basic Technique, 5th ed., Published by John Wiley & sons Inc, Hoboken, New Jersey USA.
George, E.F. and De Klerk, G.-J. 2008 The components of plant tissue culture media I : macro and micro-nutrients. In: Plant propagation by tissue culture, 3rd ed. (eds. George, E.F., Hall, M.A. and De Klerk, G.J.), pp. 65-114. Springer, Dordrecht.
Machakova, I., Zazimalova, E. and George, E.F. 2008 Plant growth regulators I: Introduction; auxins, their analogues and inhibitors. In: Plant propagation by tissue culture, 3rd ed. (eds. George, E.F., Hall, M.A. and De Klerk, G.J.), pp. 175-204. Springer, Dordrecht

Produção Agrícola e Animal / Agricultural and Animal Production (2º semestre / Spring semester)

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

1. Meets the bases and the agricultural systems that allow a study of the factors that influence crop production; 2. Knows how to act on the factors that can favorably modify crop production through technologies that allow to act in these areas; 3. Knows the major production systems of livestock species, breeds and their functional skills; 4. Comprises forms of intervention on the main technical and economic indicators used in animal production.

Syllabus:

1. Interactions between soil, plants, animals and man, sensitizing students to the need to conserve exhaustible natural resources. 2. Main factors of production and the main technologies used in agriculture aimed at the sustainability of agricultural production and environmental protection. 3. Importance of animal production and the different types of breeds of harvested species; 4. Classes of elements of research on plant production systems.

Bibliography:

AMARO, P. & BAGGIOLINI, M. (Ed.) (1982). Introdução à protecção integrada. FAO/DGPPA, Lisboa, 276p.
LAMPKIN, N. (1990). Organic Farming. Farming Press Books, Ipswich, 701 p.

- MORENO, J.L. (1996). La materia orgánica en los agrosistemas. Ministério de Agricultura Pesca y Alimentation & Ediciones Mundi-Prensa, Madrid, 174 p.
- MUSTIN, M. (1987). Le Compost - gestion de la matière organique. Editions François, 954 p.
- SOLTNER, D. (1989). Les bases de la production végétale. Collection Sciences et Techiques Agricoles, 17^a edicion, Angers, 468 p.
- CONFEDERAÇÃO DOS AGRICULTORES DE PORTUGAL Recomendações de bem-estar animal / Confederação dos Agricultores de Portugal. Lisboa: CAP: DGV, 2006
- FRASER A. F. Farm animal behaviour and welfare / A. F. Fraser. 3th ed. London: Baillière Tindall, 1990. Manipulations et interventions sur le bétail. Ovins et caprins. Tome 1. INRA. Ed Foucher.1987.
- BARRET, J. P. (1992). Zootechnie Générale. Collection "Agriculture D'aujourd'hui: Sciences, Techniques.

3rd curricular year

Operações Unitárias em Biotecnologia / Unit Operations in Biotechnology (1^o semestre / Fall semester)

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

In a biotechnological industrial process, the fermentation broth is subjected to downstream processing in order to concentrate and purify the target compounds. Downstream processing involves mostly physical transformations, being extremely important to the success of the whole production process. The main goal is teaching the basic principles of some of the most common unit operations applied in downstream processing of biotechnological products. The course aims at developing the ability to design appropriate equipment and determine suitable operational conditions. On the personal level it also allows to develop self-learning skills and independent thinking.

Syllabus:

1. Introduction to biotechnological processes. Industrial biotechnology: importance, applications and products in the market. 2. Role and importance of downstream processing in biotechnological processes. Problems and requirements of the target products purification. 3. Downstream processing steps: cell removal, primary isolation, purification, final isolation. Unit operations commonly applied in each step. 4. Separation of insoluble compounds: filtration and centrifugation. Equipment available. Theoretical concepts and calculation of operational conditions. 5. Cell rupture: mechanical and non-mechanical methods. Details of the most common methods and equipment. 6. Separation of soluble compounds: extraction and adsorption. Extraction column – ideal stage concept. Adsorption isotherms. Available equipment. Calculation of operational conditions.

Bibliography:

- Doran P.M., 2004. Bioprocess Engineering Principles. Academic Press.
- Shuler M.L., Kargi F., 2002. Bioprocess Engineering. Basic Concepts. Prentice Hall PTR.
- Foust A.S., Wenzel L.A., Clump C.W., Maus L., Andersen L.B., 1982. Princípio das Operações Unitárias. Editora Guanabara Dois.
- Perry R.H., Green D.W. (Eds.), 1997. Chemical Engineer's Handbook. McGraw-Hill.

Gestão Empresarial e Empreendedorismo / Enterprise Management and Entrepreneurship (1^o semestre / Fall semester)

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

Mastering the business concepts and principles for their management; distinguished legal and economic forms of companies and links the concepts of human behavior and the types of structures; It identifies and it applies the principles of stocks management. It knows the production planning systems. Diagnose the financial situation of a company and proposes measures to overcome possible weaknesses identified. Know the marketing techniques to advertise and promote their products and their activity. Possess technical and analytical skills for identifying and developing new business with visibility and growth potential. To master the theoretical tools and analytical methodology that allows investigating the problems of entrepreneurship in its multiple facets. Understand the fundamentals of the Business Plan and the moral values of the business

Syllabus:

Companies. Organizational Structures. Organizational Behavior. Management of Material Resources: basic variables of management and stock control - the ABC system and economic order quantity "Wilson lot-sized formula". Method undiscounted and discounted in quantity. Management production: choice of production process, production planning. Method PERT / CPM and philosophy "just-in-time". Management of Financial Resources: financial function and financial analysis, document-based financial analysis, methods and techniques of analysis - the method of ratios, equilibrium analysis of financial profitability. Commercial Management: Strategic Marketing, Marketing Mix and the importance of market research. Entrepreneurship: ideas and business opportunities, funding sources, procedures for business creation, business plan and criteria for evaluating investments. Ethics and Ethics in the Company

Bibliography:

- ABECASSIS, FERNANDO. Análise Económica e Financeira de Projectos. Lisboa: Fundação Calouste Gulbenkian, 3ª ed., 1991.
- BERNARDI, L. Manual de Empreendedorismo e Gestão: Fundamentos, Estratégias e Dinâmica. Editora Atlas, 2003.
- CHIAVENATO, I. Introdução à Teoria Geral da Empresa. Editora McGraw Hill, 3ª ed., 1993.
- BREALEY, Richard A.; Stewart C. Myers. Princípios de finanças empresariais. 5ª ed. Lisboa: Editora McGraw-Hill de Portugal, 1999.
- KOTLER, P., KARTAJAYA, H., SETIWAN, I. Marketing 3.0. Do produto e do consumidor até ao espírito humano. Actual Editora, 2011.
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- COURTOIS, A., PILET, M., MARTIN, C. Gestão da Produção. LIDEL, 5ª ed., 2007.
- NEVES, J. C. Análise Financeira: Técnicas Fundamentais. Edição actualizada Texto Editora, 12º ed,2000.

Biologia Animal / Animal Biotechnology (1º semestre / Fall semester)

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

1. To know biotechnological techniques usable in animal production as a whole, which help to increase income, increasing the digestibility of foods, accelerating animal growth and milk production, among others, including fishery.
2. To know biotechnological techniques available in the area of animal health and animal breeding and its direct and indirect applications in animal breeding and genetic resources conservation

Syllabus:

1. Molecular techniques.
2. Biotechnology in Animal Nutrition; transgenic animals (bioreactors and xenotransplantation).
3. Biotechnology in Animal Reproduction and Breeding.
4. Biotechnology in Animal Pharmacology and Toxicology.

Bibliography:

- AVISE J.C., - The hope hype, & reality of genetic engineering: remarkable stories from agriculture, industry, medicine, and the environment. Oxford: University Press, 2004.
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- HOUEBINE L-M., - Les animaux transgéniques. Paris: Tec&Doc: EM Inter, 1998. (Genie genetique). HOWE C. - Gene cloning and manipulation. Cambridge: University Press, 1995.
- LIMA N. e MOTA M., Biologia – fundamentos e aplicações. Lisboa, Editora LIDEL. 2003.
- LUCOTTE G. - Introduction to molecular cloning techniques. New York: VCH Publishers, Inc., 1993.
- MACKENZIE A. A. Biotechnology applications in animal health and production. Scientific and Technical Review, Volume 24 (1), April 2005

Biologia Vegetal / Plant Biotechnology (1º semestre / Fall semester)

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

1. Know the techniques applied in plant biotechnology and its applications in breeding and conservation of genetic resources.
2. Learn how to modify plants to produce proteins and biologically active metabolites.

Syllabus:

1. (1) Basic settings review of biotechnology and plant vegetative propagation, (2) preservation of cells, tissues and vegetative organs, (3) the use of molecular markers as tools in biotechnology and (4) genetic factors affecting stability .
2. (1) resistance to pests and diseases, (2) tolerance to abiotic stress, (3) modification of plant architecture, (4) control of gene expression in transgenic plants, (5) production of recombinant proteins, (6) transgenic plants and biosafety.

Bibliography:

- Chahal, C.S. & Gosal, S.S. Principles and procedures of plant breeding. Biotechnological and conventional approaches. Alpha Science International, Harrow, UK, 2006.
- Chawla, H.S. Introduction to Plant Biotechnology. Science Publishers, Inc. Plymouth, UK, 2004.
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- Li, Y. & Pei, Y. Plant Biotechnology in Ornamental Horticulture. Haworth Press, New York, USA, 2006. Pierik, R.L.M. In vitro Culture of Higher Plants. Springer. 1997.
- Slater, A., Scott, N. and Fowler, M. Plant Biotechnology. Oxford University Press, UK.2004.
- Trigiano, R. & Gray, D. Plant development and Biotechnology. CRC Press, London, UK, 200.

Tecnologia das Fermentações e Enzimática / Fermentation and Enzyme Technology (1º semestre / Fall semester)

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

Understand the theoretical and practical principles related to Enzyme Technology and Fermentation Technology. Be able to apply knowledge and use laboratory resources to complete tasks and solve problems using logical, intuitive and creative thinking, manual dexterity with the use of methods, materials and tools (fitness) Demonstrate the ability to use knowledge, skills and personal skills in contexts of study in professional and personal development (competence).

Syllabus:

I: Fundamentals of Enzyme Technology. 1.1. The kinetics of the reactions catalyzed by enzymes. 1.2. The use of enzymes in the laboratory and in industry, 1.3. The mechanisms of enzyme action; 1.4. Consideration critical in the preparation and use of immobilized enzymes. 1.5. Kinetics of immobilized enzymes, special application to fermentation processes; 1.6. Current applications of enzymatic technologies. II: Fundamentals of Fermentation Technology. 2.1. The kinetics of the reactions catalyzed by micro-organisms. 2.2. Food and pharmaceutical obtained by fermentation processes; 2.3. Fermenters for different operations, measurement and control of fermentation processes; 2.4. Current applications of the technology of fermentation; 2.5. Examples of industrial fermentation processes.

Bibliography:

Cabral, J.M.S., Aires-Barros, M.R., Engenharia Enzimática, Ed. Lidel. 2007. ISBN: 972-757-272-3
Lima, N., Mota, M., Biotecnologia, Ed. Lidel. 2003. ISBN: 972-757-197-2
Fonseca, M.M. Teixeira, J.A. Reactores Biológicos, Ed. Lidel. 2007. ISBN: 972-757-366-5
Chaplin M.F., Bucke, C. Enzyme Technology. Cambridge University Press, 1990.
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Stanbury PP and Whitaker, A.. Principles of Fermentation Technology., Pergamon Press, Oxford UK. 1984
Steinkraus, K.H.. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York. 1983.

Biotecnologia Ambiental e Alimentar / Environmental and Food Biotechnology (1º semestre / Fall semester)

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

1. Describes the environment impacts of the wastewater discharge and evaluates the possibility of its treatment by biological pathway. 2. Knows the operating principles of different of biological treatment (aerobic and anaerobic), factors that influence its operation and control parameters of these wastewater treatment processes. 3. Performs analytical methodology of some physicochemical parameters for assessing the quality of an effluent, the efficiency of a treatment system and compliance. 4. Describes the techniques used in food preservation. 5. Estimates the shelf life time of food from various kinetic data. 6. Provides the water activity of a mixture of food. 6. Calculates thermal treatment necessary to ensure the safety of food.

Syllabus:

c1. Sources of pollution. Characteristics of different wastewaters and by-products valorisation. Principles and the general scheme of treatment. c2. Principles of degradation of organic matter (C, N, P and S) aerobically and anaerobically. Comparison of processes. Environmental impacts. Legal requirements. c3. Theoretical principals of the main of wastewater biological treatments: aerobic and anaerobic – suspended biomass and fixed biofilm. Applying concepts in practical classes - determination of physical-chemical and operating parameters. c4. Techniques of food preservation: heat treatment, cold storage preservation, conservation by reducing water activity, other preservation techniques. c5. Prediction of shelf life time of food products. c6. Estimation of water activity of a mixture. c7. Kinetics of thermal death of microorganisms.

Bibliography:

FONSECA, M. M., TEIXEIRA, J. A. , Reactores Biológicos- Fundamentos e Aplicações, Lidel, 2006.
CASEY, T. A., Unit treatment processes in water and Wastewater Engineering, John Wiley & Sons, New York, 1997.
METCALF & EDDY, Wastewater Engineering- Treatment and Reuse, 4ª Ed., McGraw Hill, 2003.
COSTA, M. L. & SOARES, M., Guia de Trabalhos Práticos, 2007.
CASP, A., ABRIL, J. Procesos de conservación de alimentos. Ediciones Mundi Prens, 1999.
HELDMAN, D.R., HARTEL, R. W. - Principles of Food Processing, Chapman & Hall, 1997.
BRENNAN, G. Food Processing Handbook. Wiley-Vch Verlag GmbH & Co., 2006.

Organização e Análise de Projecto / Project Planning, Monitoring and Evaluation (2º semestre / Spring semester)

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

1. Plan, budget and schedule a project; 2. Know the main techniques for monitoring and control projects in various stages of their life cycle.

Syllabus:

1. Introduction: 1.1 Project definition. 1.2. Project life cycle. 1.3. Preliminary studies. 1.4. Choosing between alternative projects: Cost-Benefit Analysis and Multicriteria Evaluation. 2. Logical Framework Analysis. 3. Managing a project: 3.1. The project manager. 3.2. The project organizational structure. 3.3. Key aspects to consider in setting up a project team. 3.4. The inclusion of the project in the organization's strategic goals. 4. Methodologies for monitoring and control projects.

Bibliography:

BRAND, J – Direcção e Gestão de Projectos. Coimbra: Lidel, 1998.

MENTEL, J. et al. – Core concepts of Project Management. New Jersey: John Wiley & Sons, 2005.

ROLDÃO, V. – Gestão de Projectos: Abordagem Instrumental ao Planeamento, Organização e Controlo. Lisboa: Monitor, 2005.

SPINNER, M. – Project Management: Principles and Practices. New Jersey: Prentice-Hall, 1997.

Sociologia das Organizações / Sociology of Organizations (2º semestre / Spring semester)

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

1. Meet general principles regarding the type, structure and management of organizations, in particular with regard to human resources; 2. Characterize individual processes and group dynamics; 3. Know the main sociological approaches to the labour and the organizations; 4. Framing the Portuguese reality in current debates about labour and organizations; 5. Discuss issues of ethics and social responsibility in the context of food engineering.

Syllabus:

The firm as an organization: context, structure and internal organization. Recruitment, selection and training of personnel; career management. b) The individual processes: perception, motivation and learning processes. The group behavior: leadership, teamwork and interpersonal communication. Formal and informal relationships in the working groups. Conflict management. c) The classical school organizations theories and further developments. Bureaucracy and its dysfunctions. Socio-technical approaches and contingency. d) Impacts of the processes of modernization and globalization of the economy. The labour flexibility. Power and culture in organizations. Labour relations: collective, emerging conflicts, negotiation and conciliation. Sources and relations of power and counter-power in organizations. e) Business ethics and professional ethics. Individual strategies and organizational strategies. Market and social responsibility. The third sector in Portugal

Bibliography:

ABRAMOVICI, N.-B. e outros (1989), Gestão de Recursos Humanos. Editorial presença, Lisboa. BERNOUX, Philippe (s.d.), A Sociologia das Organizações. Rés-Editora, Porto.

BILHIM, João Abreu de Faria (2001), Teoria Organizacional. Estruturas e Pessoas. Universidade Técnica de Lisboa / Instituto Superior de Ciências Sociais e Políticas, Lisboa.

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KOVÁCS, Ilona e CASTILHO, Juan José (1998), Novos modelos de produção: trabalho e pessoas, Celta editora, Oeiras

Fisiologia e Produtividade Vegetal / Plant Physiology and Productivity (2º semestre / Spring semester)

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

1. To understand the water-plant-atmosphere relationships; 2. To understand carbon balance and plant productivity; 3. To understand the dynamics and kinetics of growth and development in plant productivity

Syllabus:

1. Water flow in the continuum soil-plant-atmosphere; 2 . Water relations of plant cells and tissues; 3. Sweating; 4. Water deficits and plant growth; 5 . Saving water in the plant and plant productivity. 6. Photochemistry and assimilation of CO₂; 7. Structure of the photosynthetic system; 8. photorespiration; 9. Intrinsic and extrinsic factors affecting the photosynthetic process; 10. Interaction between carbon metabolism and nitrogen and the impact on plant productivity; 11. Synthesis, regulation, accumulation and translocation of assimilates; 12. Respiratory metabolism; 13. Respiration and energy plant; 14. Diurnal course of physiological processes due to environmental variations. 15. Mechanisms and levels of control of plant development; 16. Plant hormones and growth regulators; 17. Differentiation, breeding and production; 18. Quantitative analysis of growth; 19. Productivity rates and output limitations.

Bibliography:

Azcon-Bieto, J.; Talon, M. 1993. Fisiologia y Bioquímica Vegetal. Interamericana, McGraw Hill. Nova Iorque.

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Lambers, H.; Chapin, F.; Pon, T. 2009. Plant physiological ecology, 2ed. Springer, Berlin, 640 pp.
Nobel, P. 2005. Physicochemical and environmental plant physiology, 3ed. Elsevier Academic Press, Burlington.
Overman, A.; Scholtz, R. 2002. Mathematical models of crop growth and yield. New York. Marcel Dekker, 344 pp.
Pessaraki, M. 2005. Handbook of photosynthesis. CRC – Taylor & Francis, Boca Raton, 952 pp.
Roger, M. 2010. Handbook of plant ecophysiology techniques. Dordrecht

Fisiologia Celular e Bioenergética / Cell Physiology and Bioenergetics (2º semestre / Spring semester)

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

1. To understand cell membrane transport mechanisms; 2. To understand cell communication mechanisms and to differentiate between 1st first messengers action mechanisms and 2nd second messengers cell response; 3. To compare and understand different anabolic and catabolic pathways; 4. To integrate the different metabolic pathways.

Syllabus:

A. Cell physiology. 1. Membrane Transport: 1.1. Passive Transport [- Partition Coeficients; - Ionic Channels; - Membrane Potential (Nernst equation); - Glucose carriers(GLUTs)]; 1.2. Primary and Secondary ActiveTransport [- ATPases (classification, functions and pathologies); - Ionofors (classification, experimental aplications); - Cellular uptake of macromolecules: endocytosis 2. Cell signalling: [- Cell communication; - Especificidade do receptor; - Hormone and neurotransmitter classification; - 2nd cell mensagers; - Apoptotic Cascade. B. Bioenergetics. 3. Hydrocarbons metabolism: glycolysis; Krebs cycle; - oxidative phosphorylation; - Pentose-phosphate pathway; - Calvin-Benson pathway. 4. Fatty acids catabolism: Beta-oxidation.

Bibliography:

Berg, J.M., Tymoczko, J.L. and Stryer, L. (2008) "Biochemistry" (6th Ed) W.H. Freeman & Co (New York, USA).
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