ECTS Information Package: Degree Programme

Bachelor\'s degree in

CHEMICAL AND BIOCHEMICAL ENGINEERING

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A - General Description

Programme Title - Engenharia Química e Bioquímica

Qualification awarded - Bachelor\'s degree in Chemical and Biochemical Engineering

Level of qualification - First-Cycle degree, ISCED Level 5, EQF Level 6

Specific admission requirements

General

In order to be eligible to this bachelor's degree, students must hold the high-school diploma or legally equivalent qualification. Application can also be made through the following special entry routes:

- Students coming from the Portuguese education system through re-admission, degree change and transfer schemes;
- Holders of a Foundation Course Diploma (CET);
- Adults aged more than 23 who have passed tailor-made examinations intended to assess their ability to pursue higher education studies;
- Holders of Intermediary or Graduate degree diplomas;
- Students coming from foreign higher education.

Specific

To be accepted for entry in the Bachelor\'s degree in Chemical and Biochemical Engineering students must have passed the following access examinations: (16) Mathematics and (07) Physics and Chemistry with a minimum grade of 95 out of 200.

Without prejudice to the general admission requirements and based on IPT\'s internal regulations, the following applicants may be admitted to the Chemical and Biochemical programme subject to admission quotas:

- the applicants coming from the following regions: Aveiro, Braga, Castelo Branco, Coimbra, Évora, Guarda, Leiria, Lisboa, Portalegre, Porto, Santarém, Setúbal, Viana do Castelo and Viseu (40%);

- the applicants who have completed a CET course in Energy and Biofuels offered by IPT\'s School of Technology.

- the applicants who have completed level-4 Vocational Programs (20%).

Specific arrangements for recognition of prior learning (formal, non-formal and informal)

General
Procedures on the recognition of credits gained in previous learning are established in the regulations for the Recognition and Validation of Qualifications and Skills of ESTT-IPT available at http://webmanager.ipt.pt/mgallery/default.asp?obj=4535

Specific

Not Applicable

Qualification requirements and regulations:

180 ECTS credits distributed across 6 curricular semesters (3 years), each with 40 weeks of full-time study (20 weeks per semester). Total study hours per year: 1620 (1 ECTS credit = 27 total student work hours).

The course structure comprises 6 modules per semester as set out in the course curriculum published by Order No.10764/2011 dated 30 August.

Profile of the program:

The Chemical and Biochemical program is a bachelor's degree designed to provide higher education training in the particular field of chemistry. It is designed so as to allow easy access to the labour market as it places a strong emphasis on emerging areas in this field of knowledge. Being able to adapt to new processes and methods as well as solving concrete problems are the main objectives to be attained with this programme.

The program constantly seeks to establish links with economic activities through specific projects.

Thus and in order to strengthen these links and integrate the graduates in the labour market, the degree includes a Final Project in the third year that is developed in partnership with enterprises or organisations of the sector providing the students with the opportunity to actually contact with industry and services.

The degree's versatility allows the students' integration in several industry sectors namely pulp and paper, petrochemical, fibreboard, packaging, agri-food, ink industry and others. The course curriculum is organised so as to allow the performance of such activities as process control and monitoring, quality control and auditing, training and research.

Key learning outcomes:

The main objectives of the Chemical and Biochemical degree are:

- to deliver higher-level skilled technical staff to perform functions in the industry, services and public administration;

- create competences for activities related with project development and research.

Occupational profiles of graduates with examples:

The curricular structure allows the selection of the following competencies and professional profiles:

Chemical Processes

Pulp and Paper

Biotechnology

Agri-Food

which can be developed in industries and services in areas such as: chemistry, petrochemistry, pulp and paper, graphics, agri-food, leathers, pharmaceutical, biotechnology, polymers, cements and ceramics, consultancy, quality and control.

...and in the public administration: Laboratories, Training and Research, Certification and Auditing, Regulatory Authorities.

Access to further studies:
Graduates from this engineering program can further their studies at the Polytechnic of Tomar accessing the Master\'s degree in Chemical Technology offered by ESTT.

This degree in chemical and biochemical engineering allows access to other postgraduate and master\'s programs according to applicable admission regulations.

Course structure diagram with credits

Course Title	Year	Semester	Credits
Applied Computing	1	S1	4.5
General Chemistry	1	S1	5.5
Introduction to Chemical and Biochemical Engineering	1	S1	4
Linear Algebra	1	S1	5
Mathematical Analysis I	1	S1	6
Physics I	1	S1	5
Fluid Mechanics	1	S2	4
Inorganic Chemistry	1	S2	5.5
Mathematical Analysis II	1	S2	6
Organic Chemstry I	1	S2	5.5
Physics II	1	S2	4.5
Probabilities and Statistics	1	S2	4.5
Applied Numerical Methods	2	S1	4.5
Chemical Thermodynamics I	2	S1	5
Mass-Energy Balances	2	S1	5
Organic Chemistry II	2	S1	5.5
Physical Chemistry	2	S1	4.5
Solution Chemistry	2	S1	5.5
Biochemistry	2	S2	5.5
Chemical Analysis	2	S2	4.5
Chemical Reactors I	2	S2	4.5
Chemical Thermodynamics II	2	S2	5
Microbiology	2	S2	5.5
Transfer Phenomena	2	S2	5
Economics and Management	3	S1	4
Industrial Processes and Environment	3	S1	5
Instrumentation and Control	3	S1	5
Option I	3	S1	5.5
op: Genetic Engineering (Option) (*)	3	S1	5.5

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

Course structure diagram with credits (cont.)

Course Title	Year	Semester	Credits
op: Chemical Reactors II (Option) (*)	3	S1	5.5
Option II	3	S1	5.5
op: Enzyme Engineering (Option) (*)	3	S1	5.5
op: Raw Materials (Option) (*)	3	S1	5.5
op: Industrial Utilities (Option) (*)	3	S1	5.5
op: Pulp Technology (Option) (*)	3	S1	5.5
Separation Processes I	3	S1	5
Health and Safety	3	S2	3
Option III	3	S2	5.5
op: Separation Processes II (Option) (*)	3	S2	5.5
op: Chemical Processes (Option) (*)	3	S2	5.5
op: Biological Reactors (Option) (*)	3	S2	5.5
Option IV	3	S2	5.5
op: Separation Processes in Biotechnology (Option) (*)	3	S2	5.5
op: Paper Technology (Option) (*)	3	S2	5.5
op: Transformation Technologies (Option) (*)	3	S2	5.5
Project	3	S2	12
Quality Management	3	S2	4

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

Examination regulations, assessment and grading

General
General assessment rules are in line with the Portuguese law and described in the Academic Regulations of ESTT-IPT available at http://webmanager.ipt.pt/mgallery/default.asp?obj=4538.

The licenciado degree is awarded a final grade between 10 and 20 within a 0/20 scale as well as its equivalent in the European grading scale.

Specific

Not Applicable

Graduation requirements:
Completion of the course requires approval in all courses that comprise it, making a total 180 ECTS credits required, according to the general evaluation.

Mode of study:
Full- or part-time.

Program director or equivalente

Director: Natércia Maria Ferreira dos Santos
Erasmus coordinator: José Manuel Quelhas Antunes
ECTS coordinator: José Manuel Quelhas Antunes

B - Description of individual course units

Course unit title	Applied Computing
Course unit code	91846
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Nuno José Valente Lopes Madeira
Learning outcomes of the course unit	The students should acquire computer basics and inherent transactions, be able to carry out a computer project, to develop, use and apply Fortran language code, use the Excel spreadsheet and the Octave environment for nummeric calculations.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	Basic Concepts of Information Technology. How to develop an IT project: 1. Thinking / Perceiving the statement 2. Strategy and Planning (algorithms), 3. Development (C. Excel and Octave) 4. Exploration of the developed environment 5. Maintenance and continuous improvement. Develop code in C and use Octave subroutines.
Recommended or required Reading	- Damas, L.*Linguagem C*. .: FCA - Editora de Informática - Kernigan, B. e Ritchie, D. *The C Programming Language*. .: Prentice-Hall - Hanselman, D. e Littlefield, B. (2001). *Mastering Matlab 6 - A Comprehensive Tutorial and Reference*. New Jersey: Prentice-Hall - Eaton, J.*Gnu Octave Manual*. .: Network Theory
Planned learning activities and teaching methods	Lectures and teamwork.
Assessment Methods and criteria	Written tests Presentations Teamwork
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	General Chemistry
Course unit code	91843
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Valentim Maria Brunheta Nunes Marco António Mourão Cartaxo
Learning outcomes of the course unit	Learn basic and in-depth chemistry concepts that are relevant to other courses. Stimulate the study of chemistry and raise awareness to its significance in industry and society. Students should be able to solve basic chemistry problems and perform simple laboratory tasks.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1.Chemistry tools. Atoms, molecules and ions. Chemical reactions and stoichiometry. General principles of chemical reactivity; 2.The structure of atoms and molecules. Electron configuration and periodic relationships among the elements. Chemical bonding; 3. Physical states of matter. Gases.Intermolecular forces, liquids and solids. Physical properties of solutions; 4.Chemical equilibrium.
Recommended or required Reading	- Kotz, J. e Treichel, P. (2003). *Chemistry & Chemical Reactivity*. London: Thomson Books - Chang, R.(2013). *Química*. Lisboa: McGraw-Hill - Atkins, P.(1997). *Chemistry: Molecules, Matter and Change*. NY: Freeman&Co
Planned learning activities and teaching methods	Lectures and lab classes involving exercise solving.
Assessment Methods and criteria	Final written test or exam (75%) and laboratory reports (25%).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Introduction to Chemical and Biochemical Engineering
Course unit code	91845
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Rui da Costa Marques Sant`Ovaia Dina Maria Ribeiro Mateus
Learning outcomes of the course unit	Students should be aware of the significance of chemical and biological industries to a sustainable development; identify variables and classify different process types; interpret manufacturing diagrams and flowsheets.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of mathematics and chemistry.
Recommended optional programme componentes	Not applicable.
Course contentes	The main chemical industry sectors and products. Safety regulations for industry. The relationship between industry and environment. The implementation stages of an industrial project. Introduction to chemical and biochemical engineering. Units and measurements. Scientific notation. Manufacturing charts and block charts. Industrial applications.
Recommended or required Reading	- Mateus, D.(2014). *Apontamentos das aulas teóricas, Enunciados dos exercícios propostos e Tabelas de apoio* . (Vol. 1). Tomar: IPT - Felder, R. e Rousseau, R. (2005). *Elementary Principles of Chemical Processes*. US: John Wiley & Sons - Himmelblau, D. e Riggs, J. (2012). *Basic Principles and calculations in Chemical Engineering* . US: Prentice Hall - Lima, N. e Mota, M. (2003). *Biotecnologia - Fundamentos e Aplicações*. Lisboa: Lidel-Edições Técnicas
Planned learning activities and teaching methods	Lectures and pratical sessions focused on solving practical exercises. Field trips.
Assessment Methods and criteria	Preparation and presentation of a practical assignment (20%) and a final written test (80%). Minimum requirement: 10 marks in each assessment component.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Linear Algebra
Course unit code	91842
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Ana Cristina Becerra Nata dos Santos Carlos Filipe Perquilhas Baptista
Learning outcomes of the course unit	1. Acquisition of knowledge in Linear Algebra and Analytic Geometry mathematical areas. 2. Provide students with several algebraic tools that are necessary for modeling and solving problems related to engineering. 3. Development of logical, analytical and critical reasoning thinking skills.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of algebraic calculus.
Recommended optional programme componentes	Not applicable.
Course contentes	I. Matrices and Systems of Linear Equations; II. Determinants; III. Vetor Spaces; IV. Eigenvalues and Eigenvectors; V. Analytic Geometry.
Recommended or required Reading	- Nicholson, W.(1995). *Linear Algebra with Applications*. Boston: PWS Publishing Company - Ferreira, M. e Amaral, I. (2008). *Álgebra Linear: Matrizes e Determinantes*. (Vol. 1º). (pp. 1-240). Portugal: Edições Sílabo - Ferreira, M. e Amaral, I. (2009). *Álgebra Linear: Espaços Vectoriais e Geometria Analítica*. (Vol. 2º). (pp. 1-160). Portugal: Edições Sílabo - Leon, S.(2009). *Linear Algebra with Applications*. (pp. 1-552). USA: Pearson
Planned learning activities and teaching methods	Lectures and theoretical-practical classes involving presentation and illustration of the subject matter.
Assessment Methods and criteria	Continuous assessment: two written closed-book tests, each worthing 10 marks, and a minimum of 3 marks in each test. Exam assessment: one written closed-book test worthing 20 marks including all taught topics.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Analysis I
Course unit code	91841
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Luís Miguel Merca Fernandes Maria Manuela Morgado Fernandes Oliveira
Learning outcomes of the course unit	1- Provide the mathematical foundations required in other modules of the programme. 2- Provide skills to work with differential and integral calculus of functions of one real variable.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1- Preliminaries. 2- Real functions of a real variable. 3- Limits and continuity. 4- Differential calculus. 5- Integral calculus.
Recommended or required Reading	- Silva, J.(1999). *Princípios de Análise Matemática Aplicada*. (Vol. 1). (pp. 1-472). Lisboa: McGraw-Hill - Stewart, J.(2005). *Cálculo*. (Vol. 1). (pp. 1-684). São Paulo: Thomson Pioneira - Swokowsi, E.(1995). *Cálculo com Geometria Analítica*. (Vol. 1). (pp. 1-744). São Paulo: Makron Books - Howard, A.(2007). *Cálculo um novo horizonte*. (Vol. 1). (pp. 1-581). São Paulo: Bookman
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	Continuous assessment: two written tests. Exam assessment: one written test.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Physics I
Course unit code	91844
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Rosa Brígida Almeida Quadros Fernandes
Learning outcomes of the course unit	Students are expected to familarize themselves with the fundamental laws of dynamics and be able to think rationally, applying it to concrete physical situations, obtaining , analyzing and understanding the various results and their validity limits.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Algebra, analysis , elementary trigonometry and integral and differential vector calculus.
Recommended optional programme componentes	Linear algebra and analytical geometry, mathematical analysis I and II.
Course contentes	1- Units, dimensions, dimensional analysis, trigonometry, differential and integral vector algebra (taught in parallel with core subjec matter) 2- Forces, universal laws of attraction, Hooke, Archimedes, Coulomb and lorentz. Linear momentum and acceleration. Newton's laws. Principle of superposition. Momentum, kinetic energy, power and labor. 3 - Applications of classical dynamics
Recommended or required Reading	- Hewitt, P.(2002). *Física Conceitual*. .: Bookman - Alonso & Finn, ..(1972). *Física um curso universitário*. (Vol. I e II). .: Addison Wesley - Almeida, M. e Costa, M. (2004). *Fundamentos de Física*. Coimbra: Almedina
Planned learning activities and teaching methods	Students are encouraged to regularly study the course material (weekly homework), participate in class discussions and in group work. To avoid memory-based learning, they will be provided the necessary formulae.
Assessment Methods and criteria	Students engaged in ongoing assessment who solve an exercise per week and attend most classes will be able to take the intermediate test comprising all taught topics and to use the formulae.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Fluid Mechanics
Course unit code	918411
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Paula Alexandra Geraldes Portugal
Learning outcomes of the course unit	Develop skills to carry out calculations with Newton's law, basic law of hydrostatics, law of continuity of flows, equation of Bernoulli, continuous loss of energy, and power of pumps and turbines.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Background knowledge of physics, algebra and mathematical analysis.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Physical properties of fluids. 2 – Basic law of hydrostatics and its application to several systems. 3 – Interpretation and application of the law of continuity. 4 – From the general equations of flows to the Navier-Stokes equations and the Bernoulli equation and its applications. 5 – Concepts of energy and power of flows. Loss of energy. Pumps and Turbines.
Recommended or required Reading	- White, F.(2002). *Mecânica dos Fluidos*. Rio de Janeiro: McGraw-Hill - Darby, R.(2001). *Chemical Engineering Fluid Mechanics*. New-York: Marcel Dekker, Inc. - Fox, R. e Pritchard, P. e McDonald, A. (2010). *Introduction to Fluid Mechanics*. Asia: John Wiley and Sons - Quintela, A.(1981). *Hidráulica*. Lisboa: Fundação Calouste Gulbenkian
Planned learning activities and teaching methods	Theoretical sessions in which the concepts and laws of fluid mechanics are provided and theoretical-practical sessions where exercises are proposed and solved by the students under the lecturer’s supervision.
Assessment Methods and criteria	Continous assessment: Three written min-tests (classification is the arithmetic mean, minimum grade to be approved = 9,5 pts) Exam assessment: written exam with minimum classification of 9,5 pts.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Inorganic Chemistry
Course unit code	91849
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Valentim Maria Brunheta Nunes Marco António Mourão Cartaxo
Learning outcomes of the course unit	Basic and in-depth chemistry concepts that are relevant to other courses. Foster the study of chemistry and raise awareness to its significance in industry and society. Students should be able to solve basic problems of inorganic chemistry and perform laboratory tasks.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Theories of chemical bonding. Valence Bond Theory and Molecular Orbital Theory; Chemical bond in metals and semiconductors. 2.Electrochemistry. Redox reactions. Corrosion and electrolysis; 3.Metallurgy and the chemistry of metals. Non-metallic elements. Transition metal chemistry and coordination compounds. Crystal field theory; 4.Nuclear chemistry. Nuclear stability and radioactivity.
Recommended or required Reading	- Kotz, J. e Treichel, P. (2003). *Chemistry & Chemical Reactivity*. London: Thomson Books - Chang, R.(2005). *Química*. Lisboa: McGraw-Hill - Atkins, P.(1997). *Chemistry: Molecules, Matter and Change*. NY: Freeman&Co - Goldsby, K. e Chang, R. (2013). *Química*. Porto Alegre: McGraw-Hill
Planned learning activities and teaching methods	Lectures, tutorials and lab classes involving the performance of several laboratory tasks.
Assessment Methods and criteria	Final written test or exam (75%) and laboratory reports (25%).
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Analysis II
Course unit code	91847
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Maria Cristina Oliveira Da Costa
Learning outcomes of the course unit	1- To provide the mathematical foundations required in other modules of the programme. 2- To provide the students with skills to work with differential and integral calculus of functions of several real variables.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1- Numerical and Functions Series. 2- Real functions of several real variables. 3- Multiple Integrals.
Recommended or required Reading	- Azenha, A. e Jerónimo, M. (1995). *Cálculo Diferencial e Integral em R e Rn*. (Vol. 1). (pp. 1-610). Lisboa: Mac Graw-Hill - Zill, D. e Cullen, M. (2009). *Advanced Engineering Mathematics*. (Vol. 1). (pp. 1-1008). Sudbury: Jones & Bartlett Publishers - Swokowsi, E.(1995). *Cálculo com Geometria Analítica*. (Vol. 2). (pp. 1-744). São Paulo: Makron Books - Silva, J.(1999). *Princípios de Análise Matemática Aplicada*. (Vol. 1). (pp. 1-472). Lisboa: McGraw-Hill
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	Continuous assessment: two written tests. Exam assessment: one written test.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Organic Chemstry I
Course unit code	91848
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Cecília de Melo Correia Baptista Marco António Mourão Cartaxo
Learning outcomes of the course unit	An overview of the structure, bonding and reactions in organic molecules. Introduction to reaction mechanisms and its representation. Study of the main categories of monofunctional organic compounds.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of chemical properties and bonding.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Structure and bonding in organic molecules. 2 – Reactants and reactions in organic chemistry. Electronic approach of the reactions and intermediates. 3 – Hydrocarbons: structure, physical properties, nomenclature, reactivity and reactions. 4 – Other organic compounds: structure, physical properties,nomenclature, reactivity and reactions.
Recommended or required Reading	- Vollhardt, P. e Schore, N. (2005). *Organic Chemistry: Structure and Function*. New York: W.H.Freeman & Co Ltd - Tomé, A.(2010). *Introdução à nomenclatura dos compostos orgânicos*. Lisboa: Escolar Editora - Carey, F.(2007). *Organic Chemistry*. New York: McGraw-Hill International
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes.
Assessment Methods and criteria	A - 6 intermediate theoretical tests; B - laboratory assignments and written laboratory test; C - final theoretical examination. Final grade: (Ongoing assessment)- 0.6*A + 0.4*B or (Exam assessment) - 0.6*C + 0.4*B
Language of Instruction	Oriya | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Physics II
Course unit code	918410
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Rosa Brígida Almeida Quadros Fernandes
Learning outcomes of the course unit	Students should familiarize themselves with such concepts as linear momentum, energy and angular momentum and eletromagnetic and sound waves, acquire reasoning skills and be able to apply concepts to real situations, obtaining, analyzing and evaluating predictions.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Algebra, trigonometry, elementary analysis, vector calculus, knowledge and application of the three Newton's laws.
Recommended optional programme componentes	Linear algebra and analytic geometry, mathematical analysis I and II, Physics I.
Course contentes	1 - Principles of variation of linear moment, energy and angular momentum. Application to motions of projectiles,central movement and accelerated circular motion 2 - Oscillatory and wave motion. General characteristics of light and sound: velocity, refractive index, period, frequency, wavelength, electromagnetic spectrum and sound
Recommended or required Reading	- Alonso, M. e Finn, E. (1972). *Física, um curso universitário*. (Vol. I). (pp. 81-392). São Paulo, Brasil: Edgard Blucher
Planned learning activities and teaching methods	Theoretical-practical classes involving problem solving and laboratory experiments. Modellus simulations and video viewing for a better understanding of concepts and laws.
Assessment Methods and criteria	Two intermediate tests consisting of extended writing and multiple-choice questions and answers.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Probabilities and Statistics
Course unit code	918412
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Luis Miguel Lindinho da Cunha Mendes Grilo
Learning outcomes of the course unit	Provide the students with the basics of some key statistics techniques and methodologies, mainly quantitative, that will allow them to design and implement solutions to different problems under uncertainty conditions.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Background knowledge of Calculus and Algebra.
Recommended optional programme componentes	Occasionally exercises are solved with the aid of Excel spreadsheet and the statistical package SPSS.
Course contentes	1. Probability (axioms and theorems), 2. Discrete and continuous random variables; 3. Theoretical probability distributions (discrete and continuous); 4. Sampling(mean, variance and sample proportion) 5. Point and interval estimation parameters, 6. Parametric hypothesis tests (mean, variance and population proportion); 7. Correlation and simple linear regression.
Recommended or required Reading	- Cabral, J. e Guimarães, R. (2007). *Estatística*. Lisboa - Portugal: McGraw-Hill - Pedrosa, A. e Gama, S. (2004). *Introdução Computacional à Probabilidade e Estatística*. Porto - Portugal: Porto Editora - Grilo, L.(2013). *Probabilidades e Estatística. Conceitos Teórico-Práticos*. Instituto Politécnico de Tomar, Portugal: Instituto Politécnico de Tomar - Mann, P.(2001). *Introductory Statistics*. New York: John Wiley & Sons, Inc.
Planned learning activities and teaching methods	Lectures and practical classes.
Assessment Methods and criteria	Continuous assessment(two written tests); Exam assessment (one written test).
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Applied Numerical Methods
Course unit code	918418
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	João Manuel Mourão Patrício
Learning outcomes of the course unit	Students should familiarize themselves with the main concepts of Numerical Methods and Numerical Analysis, namely numerical algorithms for linear systems of equations, nonlinear equations and systems of nonlinear equations, polynomial interpolation, numerical integration and first order equations.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Intermediate knowledge of Mathematical Analysis I and II and Linear Algebra.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Error and stability 2 – Numerical methods for systems of linear equations 3 – Nonlinear equations and systems of nonlinear equations 4 – Polynomial interpolation 5 – Numerical integration 6 – Numerical methods for ordinary differential equations.
Recommended or required Reading	- Pina, H.(1995). *Métodos Numéricos*. .: McGraw-Hill - Burden, R. e Faires, J. (1993). *Numerical Analysis*. .: PWS Publishing Company - Heath, M.(2001). *Scientific Computing: an Introductory Survey*. .: McGraw-Hill - Patrício, J.(0). *Apontamentos de MNA*.Acedido em1 de julho de 2012 em e-learning.ipt.pt
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes.
Assessment Methods and criteria	Continuous assessment: two written tests and computer-aided projects. Exam assessment: one written test.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Chemical Thermodynamics I
Course unit code	918415
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Valentim Maria Brunheta Nunes
Learning outcomes of the course unit	Students should be familiar with the principles of Chemical Thermodynamics and be able to apply them to (solid, liquid or gaseous) systems with interest to Chemical Engineering. They should develop important calculus techniques in engineering.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1.Ideal and real gases; 2.Internal energy and the first law of thermodynamics. Thermochemisty; 3. Entropy and the second law of thermodynamics. Third law of thermodynamics; 4.The Helmoltz and Gibbs functions. Combining the first and second laws; 5.Chemical equilibrium; 6. Physical transformations in pure substances. 7. Ideal solutions. Raoult's and Henry´s Law. Phase diagrams.
Recommended or required Reading	- Atkins, P.(2001). *Physical Chemistry*. Oxford: Oxford University Press - Azevedo, E.(2011). *Termodinâmica Aplicada*. Lisboa: Escolar Editora
Planned learning activities and teaching methods	Lectures and tutorials involving problem-solving.
Assessment Methods and criteria	Final written exam (100%)
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mass-Energy Balances
Course unit code	918416
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Henrique Joaquim de Oliveira Pinho
Learning outcomes of the course unit	Develop skills to calculate mass and energy balances. Apply mass and energy balances to dimension and design equipment, optimize and evaluate processes and audit industrial units.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic Mathematics.
Recommended optional programme componentes	Chemical Processes.
Course contentes	1. Mass balances; Principles; Process variables; Mass balances with chemical reaction 2. Energy balances; Fundamentals, Energy balances with chemical reaction; Particular cases of mass and energy balances; Principles of integrated mass and energy; Introduction to mass and energy balances in staged processes; Computer-aided problem resolution.
Recommended or required Reading	- Felder, J.(2000). *Chemical Processes Principles*. London: Springer - Himmelblau, D.(2004). *Basic Principles and Calculations in Chemical Engineering*. New York: Prentice-Hall - Pinho, H.(0). *Documentos de apoio de BME*.Acedido em1 de janeiro de 2011 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	Written open-book test.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Organic Chemistry II
Course unit code	918413
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Cecília de Melo Correia Baptista
Learning outcomes of the course unit	Understand the stereochemistry principles. In-depth study of the structure and properties of heterocyclic and multifunctional compounds. Structural organic analysis. Identify the main groups of organic pollutants.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of the structure, properties and reactivity of monofunctional organic compounds.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Stereochemistry. Quirality, optical activity and configurations. 2 – Structure, properties and reactivity of multifunctional organic compounds and heterocycles. 3 – Structural analysis of organic compounds. 4 - Organic pollutants.
Recommended or required Reading	- Vollhardt, P. e Schore, N. (2005). *Organic Chemistry: Structure and Function*. New York: W.H.Freeman & Co Ltd - Tomé, A.(2010). *Introdução à nomenclatura dos compostos orgânicos*. Lisboa: Escolar Editora - Carey, F.(2007). *Organic Chemistry*. New York: McGraw-Hill International
Planned learning activities and teaching methods	Theoretical classes. Practical classes to solve applied problems. Laboratory classes focusing on the synthesis and analysis of multifunctional and heterocyclic compounds.
Assessment Methods and criteria	A - Laboratory written test; B - final theoretical test. Final grade - 0.4*A + 0.6*B
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Physical Chemistry
Course unit code	918417
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Marco António Mourão Cartaxo
Learning outcomes of the course unit	On completion of the course students should be able to understand the basic concepts of Physical Chemistry and solve related problems as a basis for more advanced courses.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Mathematical Analysis I. Mathematical Analysis II. Physics I. Physics II. General Chemistry.
Course contentes	1. Quantum Mechanics Introduction. Translational, vibrational and rotational movement. Atomic structure and atomic spectra. Rotational and vibrational spectroscopy. 2. Chemical Kinetics. The rate of chemical reactions. The Arrhenius equation. The kinetic theory of gases. Molecular dynamics. 3. Electrochemistry Electron transfer. Voltammetry. Electrolysis. Galvanic cells. Corrosion.
Recommended or required Reading	- Atkins, P.(1998). *Physical Chemistry* . Oxford: Oxford University Press
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	Written open-book mid-term test or exam.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Solution Chemistry
Course unit code	918414
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Maria Teresa da Luz Silveira
Learning outcomes of the course unit	Provide skills on matters related with conductometry and strengthen acquired knowledge of redox reactions,precipitation reactions and complexation reactions.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	General chemistry fundamentals.
Recommended optional programme componentes	Not applicable.
Course contentes	1 - Conductometry 2 - Redox reactions 3 – Precipitation reactions 4 – Complexometry and complex reactions
Recommended or required Reading	- Christian, D.(2013). *Analytical Chemistry*. New York: John Wiley & Sons - Harris, D.(2010). *Quantitative Chemical Analysis*. New York: W. H. Freeman and Company - , .(2001). *Metodos Instrumentais para Analise de Solucoes*. Lisboa: Fundacao Calouste Gulbenkian
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes.
Assessment Methods and criteria	Written tests and laboratory reports.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Biochemistry
Course unit code	918423
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Cecília de Melo Correia Baptista
Learning outcomes of the course unit	An overview of the structure, properties and metabolism of the biological molecules and its functions in living cells. The metabolism of these molecules: carbohydrates, proteins and lipids. Nucleic acids and informational nature of genetic processes.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of the structure and reactivity of organic compounds.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Biological molecules: structure, properties, isolation and characterization. Carbohydrates, lipids, proteins and nucleic acids. 2 – Enzymes. Thermodynamics of biological systems. Energy, ATP cycle and biosynthesis. 3 – Metabolism of the main biological molecules. Connections between the main metabolic pathways.
Recommended or required Reading	- Cox, M. e Nelson, D. (2008). *Lehninger Principles of Biochemistry*. New York: W.H. Freeman & Co - Voet, D. e Voet, J. (2011). *Biochemistry* . New York: John Wiley & Sons - Quintas, A. e Freire, A. e Halpern, M. (2008). *Bioquímica - Organização Molecular da Vida*. Lisboa: Lidel, Edições Técnicas
Planned learning activities and teaching methods	Lectures and laboratory classes.
Assessment Methods and criteria	A - Laboratory continuous assessment (laboratory essays -50% and written laboratory test - 50%). B - Final theoretical test. Final classification - 0.4*A + 0.6*B
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Chemical Analysis
Course unit code	918419
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Maria Teresa da Luz Silveira
Learning outcomes of the course unit	Students should be able to identify the instrumental methods involving absorption, dispersion and emission of energy, as well as use them in quantitative analysis. They should be able to apply solvent extraction and chromatography techniques.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of electromagnetic spectrum and radioactivity measuring units.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Vis and UV spectrophotometry 2 – Turbidimetry and nephelometry 3 – Emission flame photometry 4 – Atomic absorption spectrometry 5 – Solvent extraction 6 - Chromatography: classification analysis by chromatography; methods and chromatographic techniques.
Recommended or required Reading	- Rouessac, A. e Rouessac, F. (2007). *Chemical Analysis: Modern Instrumentation Methods and Techniques*. New York: Wiley - Crouch, S. e Holler, F. e Skoog, A. (2006). *Principles of Instrumental Analysis*. New York: Brooks/Cole
Planned learning activities and teaching methods	Lectures exploring subject matter, theoretical-practical classes and laboratory sessions to apply skills acquired.
Assessment Methods and criteria	Written tests and reports on performed laboratory work.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Chemical Reactors I
Course unit code	918424
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	José Manuel Quelhas Antunes
Learning outcomes of the course unit	Develop skills in the analysis and design of chemical reactors through mass and energy balances.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of chemical kinetics and thermodynamics.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Introduction: classification, characterization and selection of ideal chemical reactors. 2 – Methods of experimental determination of the kinetics of chemical reactions. 3 – Continuous stir reactors. 4 – Discontinuous and semi-discontinuous reactors. 5 – Tubular reactors. 6 – Sequential continuous reactors
Recommended or required Reading	- Fogler, H.(1986). *Elements of Chemical Reaction Engineering*. New Jersey: Prentice-Hall - Levenspiel, O.(1999). *Chemical Reaction Engineering*. New York: John Wiley
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	A written test during the regular examination period.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Chemical Thermodynamics II
Course unit code	918422
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Valentim Maria Brunheta Nunes
Learning outcomes of the course unit	In-depth study of Chemical Thermodynamics. Introduction to Statistical Thermodynamics. Students should be able to apply the principles of thermodynamics to solid, liquid and gaseous systems with interest for Chemical Engineering.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of Chemical Thermodynamics I
Recommended optional programme componentes	Not applicable.
Course contentes	1.Real solutions. Excess functions. Liquid-liquid equilibrium and immiscibility in liquid phase. Theories of solutions; 2.Liquid-vapour equilibrium. 3. Ternary systems; 4. Statistical thermodynamics. Maxwell-Boltzmann distribution. Perfect monoatomic gas. Diatomic and polyatomic gases. The third law of thermodynamics; 5. Solids. Heat capacity. The Einstein model.
Recommended or required Reading	- Maczek, A.(2006). *Statistical Thermodynamics*. Oxford: Oxford University Press - Winnick, J.(1997). *Chemical Engineering Thermodynamics*. New York: Wiley - Azevedo, E.(2011). *Termodinâmica Aplicada*. Lisboa: Escolar Editora
Planned learning activities and teaching methods	Lectures and Tutorials involving problem-solving.
Assessment Methods and criteria	Final written exam (100%)
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Microbiology
Course unit code	918420
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Cecília de Melo Correia Baptista
Learning outcomes of the course unit	The students must recognize: the microbial diversity and classification; microbial procaryotic and eucaryotic cell organization, morphology and growth patterns; microbial interactions and role in living systems and biotechnological production.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Knowledge of the structure and properties of biological molecules.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – A survey and classification of life at the cellular level. 2 – Morphology, ultrastructure and characteristics of bacteria, fungi, and protists. Viruses: structure, morphology and replication. 3 – Microbial nutrition, growth, control, metabolism and reproduction. 4 – Applied microbiology. Characterization of different microbial environments. Industrial microbiology.
Recommended or required Reading	- Ferreira, W. e Sousa, J. e Lima, N. (2010). *Microbiologia*. Lisboa: Lidel - Edições Técnicas - Willey, J. e Sherwood, L. e Woolverton, C. (2008). *Prescott, Harley and Klein's Microbiology*. New York: McGraw-Hill - Tortora, G. e Funke, B. e Case, C. (2008). *Microbiologia*. S. Paulo: Artmed Editora
Planned learning activities and teaching methods	Lectures and laboratory classes.
Assessment Methods and criteria	A - Laboratory ongoing assessment (laboratorial essays -50% and laboratorial written test - 50%). B - Final theoretical test. Final classification - 0.4*A + 0.6*B
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Transfer Phenomena
Course unit code	918421
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Dina Maria Ribeiro Mateus
Learning outcomes of the course unit	Students should be able to: interpret the behaviour of thermal systems and solve practical problems; calculate insulation thickness; design heat transfer equipments; understand fundamental mass transfer concepts, namely those necessary for the design of mass transfer equipments.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Knowledge of differential and integral calculus.
Recommended optional programme componentes	Separation Processes II, Separation processes in biotechnology, Industrial utilities.
Course contentes	Fourier's law. Steady-state heat conduction. Thermal insulation, fins. Unsteady-state heat conduction. Interphase transport, heat transfer coefficients. Radiation heat transfer. Heat exchangers. Mechanisms of mass transport. Fick's law, diffusivity. Steady-state molecular diffusion. Unsteady state diffusion molecular diffusion. Interphase mass transport,coefficients. Analogies.
Recommended or required Reading	- Mateus, D.(2009). *Fundamentos de Transferência de calor*. Tomar: IPT - Welty, Wicks, Wilson, Rorrer., J.(2008). *Fundamentals of Momentum, Heat and Mass Transfer*. New York: John Wiley & Sons, Inc. - Bird, Stewart, Lightfoot. , R.(2002). *Transport Phenomena*. New York: John Wiley & Sons, Inc. - Mateus, D.(0). *Sebentas de Transferência de Massa*.Acedido em2 de fevereiro de 2012 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	During the theoretical lectures the main concepts are explained and exemplified. In coordination with the evolution of the lectures, the resolution and discussion of exercises and case studies by the students is proposed in the practical classes.
Assessment Methods and criteria	Preparation of a practical assignment (20%) and a final written test (80 %, with minimum mark of 10 out of 20 in each component.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Economics and Management
Course unit code	918426
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Henrique Joaquim de Oliveira Pinho
Learning outcomes of the course unit	Students are expected to acquire the fundamental concepts of economics and business administration, develop market analysis techniques applied to industrial processes and prepare investment projects.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Introduction: basic principles of economy; Microeconomics and macroeconomics fundamentals; Corporate structure and management concepts; 2. Management functions: sales and marketing; operations; material resources and stocks; human resources; financial planning; 3. Corporate planning: strategic management and strategic planning; 5. Design and economical evaluation of industrial plants; 6. R&D
Recommended or required Reading	- Neves, J.(1997). *Introdução à Economia*. Lisboa: Ed. Verbo - Sousa, A.(1999). *Introdução à Gestão: Uma abordagem sistémica.*. Lisboa: Edições Verbo - Marques, A.(2006). *Concepção e análise de projectos de investimento.*. Lisboa: Edições Sílabo - Pinho, H.(0). *Material de apoio de EG*.Acedido em1 de janeiro de 2010 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Theoretical-practical classes: course content presentation followed by open discussion on proposed case studies; problem solving.
Assessment Methods and criteria	Ongoing assessment: Group work (30%)and written test(70%) Exam assessment: written exam Minimum of 9 marks (out of 20) in both components.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Industrial Processes and Environment
Course unit code	918428
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Rui da Costa Marques Sant`Ovaia
Learning outcomes of the course unit	Students should be able to evaluate the environmental impacts of industrial processes.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of statistics, analytical chemistry, mass and energy balances.
Recommended optional programme componentes	Not applicable.
Course contentes	Legislation, regulation and ethics. Hydrology. Wastewater treatment. Air pollution. Treatment systems. Introduction to "Noise Pollution". Solid waste management. Hazardous wastes. Incineration.
Recommended or required Reading	- Cornwell, D. e Davis, M. (1991). *Introduction to Environmental Engineering*. New York: McGraw-Hill - Tchobanoglous, G. e Rowe, D. e Peavy, H. (1985). *Environmental Engineering*. New York: McGraw-Hill
Planned learning activities and teaching methods	Lectures and laboratory classes.
Assessment Methods and criteria	Continuous assessement including problem solving. Final examination.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Instrumentation and Control
Course unit code	918427
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Provide such concepts as. automatic control of the variables of a chemical engineering process, variable control dial, sensors and actuators properties, the various types od controllers specially PID and process and layout diagrams of an industrial plant.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Fundamentals of Chemistry, Physics and Mathematics.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Introduction to Process Control. 2. Signal Conditioning Circuits. 3. Pneumatic Elements. 4. Sensors. 5. Final Elements of Control.
Recommended or required Reading	- Johnson, C.(1990). *Controlo de Processos - Tecnologia da Instrumentação*. Lisboa: Fundação Calouste Gulbenkian - Da Silva, G.(2004). *Instrumentação Industrial*. Setubal: IPS-EST - Seborg, D. e Edgar, T. e Mellichamp, D. (2003). *Process Dynamics and Control*. New York: J. Wiley & Sons - Stephanopoulos, G.(1984). *Chemical Process Control - An Introduction to Theory and Practice*. New York: Prentice-Hall Inc.
Planned learning activities and teaching methods	Lectures introduce the topics of study and present theoretical fundamentals. Theoretical-practical sessions are intended to further develop the theoretical concepts with the support of real cases and exercise-solving as well as field trips.
Assessment Methods and criteria	Written closed-book assessment (first or second assessment season) with a minimum pass mark of 9.5 (out of 20).
Language of Instruction	Portuguese | **Mentoring in** French
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Chemical Reactors II (Option) (*)
Course unit code	918429
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	José Manuel Quelhas Antunes
Learning outcomes of the course unit	Develop skills of analysis of real reactors through the residential distribution theory and understand the impact of catalysis in transformation processes through the study of catalytic reactors.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Knowledge of ideal chemical reactors, chemical kinetics and thermodynamics.
Recommended optional programme componentes	Not applicable.
Course contentes	1 – Introduction: revision on ideal chemical reactors and experimental determination of reaction kinetics. 2 – Distribution of residential times – characteristics, experimental determination and modelling of real reactors. 3 – Catalysers and catalytic reactors. Catalysis; catalyser diffusion, convection and reaction; modelling of fixed-bed catalytic reactors
Recommended or required Reading	- Fogler, H.(1986). *Elements of Chemical Reaction Engineering*. New Jersey: Prentice-Hall - Levenspiel, O.(1999). *Chemical Reaction Engineering*. New York: John Wiley
Planned learning activities and teaching methods	Lectures, tutorials, laboratory classes, case studies.
Assessment Methods and criteria	Final mark is the weighted average of an individual essay(continuous assessment) or a written exam and laboratory reports.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Genetic Engineering (Option) (*)
Course unit code	918431
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Dina Maria Ribeiro Mateus
Learning outcomes of the course unit	Students must acquire knowledge in the area of genetic engineering, through the learning of the fundamental concepts of molecular biology, genetics, and the applications of recombinant DNA technology. They should gain expertise in the use of relevant molecular techniques.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of biochemistry and cellular biology.
Recommended optional programme componentes	Enzyme Engineering, Bioreactors, Separation Processes in Biotechnology.
Course contentes	DNA structure, replication, restriction, repair and recombination. Transcription. Genetic code and decoding. Genome and its expression. Regulation of genetic expression. Recombined DNA technology. Relevant enzyms in cloning. Coling vectors. Typical cloning example. Genetic Instability in rDNA cells. Genetic methodology analysis. Gene library.
Recommended or required Reading	- Videira, A.(2001). *Engenharia Genética – Princípios e Aplicações (Princípios básicos - Cap I a VIII)*, . Lisboa: Lidel-Edições Técnicas - Mota, M. e Lima, N. (2003). *Biotecnologia – Fundamentos e Aplicações (Genética aplicada- Cap VI e VII)*. Lisboa: Lidel-Edições Técnicas - Rehm, H.(1993). *Biotechnology – Genetic Fundamentals and Genetic Engineering*. (Vol. 2). New York: VCH Publishers INC - Mateus, D.(0). *Sebenta de Engenharia Genética*.Acedido em2 de fevereiro de 2012 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Theoretical lectures, tutorials, laboratory classes, case study.
Assessment Methods and criteria	Final written test, presentation and discussion of a practical assignment and laboratory reports.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Enzyme Engineering (Option) (*)
Course unit code	918432
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Dina Maria Ribeiro Mateus
Learning outcomes of the course unit	Students should acquire skills in the areas of enzymology, enzyme kinetics, immobilization of biocatalysts and mass transfer in biological systems, which enable the development and application of techniques for the design and operation of reactors involving enzymes.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of Organic and Biochemistry.
Recommended optional programme componentes	Genetic Engineering, Bioreactors, Separation Processes in Biotechnology.
Course contentes	Structure and function of enzymes. Classification and nomenclature. Large-scale production. Enzyme kinetics, inhibition, stability and deactivation. Kinetics in immobilised enzyme systems. Biocatalysis in non-conventional media. Design of ideal, and non-ideal, enzyme immobilised reactors. Bio-catalysis in non-conventional media. Medical and industrial use of free and immobilised enzymes.
Recommended or required Reading	- Cabral, J. e Aires Barros, M. e Gama, M. (2003). *Engenharia Enzimática*. Lisboa: Lidel-Edições Técnicas - Shuler, M. e Kargi, F. (2001). *Bioprocess Engineering – Basic Concepts*. London: Pearson Educatión - Mota, M. e LIma, N. (2003). *Biotecnologia – Fundamentos e Aplicações*. Lisboa: Lidel-Edições Técnicas - Mateus, D.(0). *Sebentas de Engenharia Enzimática*.Acedido em1 de fevereiro de 2012 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Theoretical lectures, tutorials, laboratory classes, case studies.
Assessment Methods and criteria	Final written test, preparation and presentation of a practical assignment and lab reports. Minimum pass mark: 10 (out of 20)in every assessment component.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Industrial Utilities (Option) (*)
Course unit code	918430
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Isabel Maria Duarte Pinheiro Nogueira Paula Alexandra Geraldes Portugal
Learning outcomes of the course unit	Students should be able to understand and meet the demands of the heavy industry regarding essential industrial utilities: electric power, thermal energy,pneumatics and refrigeration.
Mode of delivery	b-learning
Prerequisites and co-requisites	Fundamentals of Chemistry, Physics and Mathematics.
Recommended optional programme componentes	Not applicable.
Course contentes	1. The electric power (AC) 2. Thermal Energy 3. Energy Pneumatic 4. Refrigeration and Cooling Systems 5. Ventilation
Recommended or required Reading	- Juanico, F.(1992). *Geradores de Calor*. Lisboa: Ecemei - Ganapathy, V.(2003). *Industrial Boilers and Heat Recovery Steam Generators - Design, Applications and Calculations*. New-York and Basel: Marcel Dekker, Inc. - Novais, J.(2008). *Ar comprimido industrial*. Lisboa: Fundação Calouste Gulbenkian - McQuiston, F. e Parker, J. e Spitler, J. (2005). *Heating, Ventilating and Air Conditioning - Analysis and Design*. USA: John Wiley and Sons
Planned learning activities and teaching methods	Lectures are designed to introduce the study topics and present theoretical fundamentals. Theoretical-practical sessions are intended to develop the theoretical concepts with the support of real-world cases and exercise-solving.
Assessment Methods and criteria	Written examination (first attempt or re-sit) with a minimum pass mark of 9.5/20.
Language of Instruction	English | **Mentoring in** French
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Pulp Technology (Option) (*)
Course unit code	918434
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Manuel Alberto Nogueira Henriques Rosa
Learning outcomes of the course unit	Students should be able to understand the stages of kraft cooking and bleaching and sulfite cooking and familiarise themselves with the fundamentals of chemical recovery in the pulp plant and the typical quality control tests.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1-Generalities; 2-Production, reception and preparation of the wood; 3-Types of processes for paper pulp production; 4-Kraft process; 5-Important variables of the Kraft liquor; 6-Kraft cooking; 7-The sulfite process; 8-Knots separation and washing; 9-Bleaching; 10-Final treatments; 11-Quality control; 12-Recovery boiler.
Recommended or required Reading	- Garcia, J. e Llucià, T. (1984). *Blanqueo de pastas en la industria papelera*. .: Univ. Politécnica de Catalunya - Gulliehsen, J. e Fogelholm, C. (1999). *Chemical Pulping*. .: Fopet Oy, Finland - Reeve, D. e Dence, C. (1996). *Pulp Bleaching - Principles and Practice*. Atlanta: Tappi Press - Rydholm, S.(1985). *Pulping Processes*. Malabar: Robert Krieger Publishing
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes.
Assessment Methods and criteria	Ongoing assessment: theoretical and practical test with minimum passing score of 10 out of 20. This mark exempts students from final examination.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Raw Materials (Option) (*)
Course unit code	918433
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Natércia Maria Ferreira dos Santos
Learning outcomes of the course unit	Be able to characterise fibrous and non-fibrous materials and to become familiar with refining equipment. Be aware of the influence of refining and their operational conditions in the final characteristics of paper.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of Chemistry and Physics
Recommended optional programme componentes	Not applicable.
Course contentes	Introduction to materials science. Structure of materials. Physical and mechanical properties of fibrous materials. Refining and influential factors. Effects of refining operation on fibres. Influence of refining in the physical and mechanical properties of paper. Properties of nonfibrous materials.
Recommended or required Reading	- Biermann, C.(1996). *Handbook of Pulping and Papermaking*. S. Diego: Academic Press - Paulapuro, H.(2000). *Papermaking Part1, Stock Preparation and Wet End*. Helsinquia: Fapet Oy - Soderbjelm, L. e Levlin, J. (1999). *Pulp and Paper Testing*. Helsinquia: Fapet Oy
Planned learning activities and teaching methods	Lectures and laboratory classes.
Assessment Methods and criteria	Theoretical component: written test. Practical component: laboratory coursework and reports. Final grade is the average of the two components. Minimum passing score: 10/20 in both assessment components.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Separation Processes I
Course unit code	918425
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Paula Alexandra Geraldes Portugal
Learning outcomes of the course unit	Students must be able to interpret and use thermodynamic and operation data to perform mass and enthalpic balances, and use analytical methods, numerical methods and graphical methods, in equipment design to perform simple distillation, flash distillation and fractional distillation.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of fluids mechanics, thermodynamics, transport phenomena and mass-energy balances.
Recommended optional programme componentes	Not applicable.
Course contentes	1 - Distillation principles - liquid-vapour equilibrium. 2 - Calculations in batch distillation – Rayleigh's equation. 3 - Calculations in flash distillation. 4 - Fractionating distillation columns and other equipment. 5 - Design calculations in fractionating distillation – reflux ratio – number of stages – operating lines - side streams – multiple feeds.
Recommended or required Reading	- Richardson, R. e Coulson, J. (1968). *Tecnologia Química*. Lisboa: Fundação Calouste Gulbenkian - Rose, L.(1987). *Distillation Design in practice*. London: Elsevier - Seader, J. e Henley, E. (2006). *Separation Process Principles*. USA: John Wiley and Sons - Perry, J.(2007). *Chemical Engineer's Handbook*. USA: McGraw-Hill Book Company
Planned learning activities and teaching methods	Theoretical sessions involving discussion on chemical-physical principles and the design methods and theoretical-practical sessions involving exercise solving with the lecturer's support.
Assessment Methods and criteria	Assessment includes written tests and theoretical-practical exercises.
Language of Instruction	English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Health and Safety
Course unit code	918436
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	3
Name of Lecturer(s)	Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Students should develop fundamental Health and Safety skills in chemical and biochemical processes. Emphasis is placed on the hazard and risk analysis and prevention methods of the chemical and environmental accidents.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Fundamentals of chemical, physics and instrumentation.
Recommended optional programme componentes	Not applicable.
Course contentes	1. General and Industrial Accidents. 2. Hazard Study. 3. Study of chemical exposure and risk. 4. Prevention of chemical risk. 5. Individual and collective equipment protection 6. Domino effect 7. Atmospheric dispersion elements. 8. Gas and vapor hazards 9. Dust explosion hazards.
Recommended or required Reading	- Martel, B.(2002). *Guide du Risque Chimique*. Paris: Dunod - Laurent, A.(2003). *Sécurité des procédés chimiques*. Paris: Editions TEC & DOC - Miguel, A.(2012). *Manual de Higiene e Segurança do Trabalho* . Porto: Porto Editora
Planned learning activities and teaching methods	Theoretical-practical sessions intended to further develop theoretical concepts with the support of real-world cases and exercise-solving as well as field trips.
Assessment Methods and criteria	Written examination (first attempt or re-sit) with a minimum pass mark of 9.5 out of 20.
Language of Instruction	Portuguese | **Mentoring in** French
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Biological Reactors (Option) (*)
Course unit code	918441
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Dina Maria Ribeiro Mateus
Learning outcomes of the course unit	Be able to search and gather laboratory data concerning the global kinetics of the microbial process in order to be able to select the type of fermenter and the operation mode to be used and to design the vessel and respective mixing aeration and cooling devices.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of microbiology, biochemistry, reactors and mass and heat transfer calculations.
Recommended optional programme componentes	Genetic Engineering, Enzyme Engineering, Separation Processes in Biotechnology.
Course contentes	Stoichiometry and kinetics of microbial growth. Design and analysis of biological reactors: batch reactor, continuous-flow stirred-tank, fed-batch, CSTR with recycle and wall growth, plugflow reactor with recycle, bubble-column, fluidized-bed, trickle-bed, CSTRs in series, association CSTR-PFR. Oxygen-limited fermentations. Heat balance, sterilisation. Scale-up. Case studies.
Recommended or required Reading	- Doran, P.(2012). *Bioprocess Engineering Principles*. London: Academic Press - Kristiansen , B. e Ratledge , C. (2006). *Basic Biotechnology*. London: Cambridge University Press - Fonseca, M. e Teixeira, J. (2007). *Reactores Biológicos - Fundamentos e Aplicações*. Lisboa: LIDEL edições técnicas - Mateus, D.(0). *Sebentas de Reactores Biológicos*.Acedido em1 de fevereiro de 2012 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes.
Assessment Methods and criteria	Final written test and lab reports. A minimum mark of 10 out of 20 in each component is required to pass.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Chemical Processes (Option) (*)
Course unit code	918439
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Henrique Joaquim de Oliveira Pinho
Learning outcomes of the course unit	Students should be able to perform advanced material and energy balances in complex processes, solve mass balances in multiphasic and staged operations, and use adequate methods to measure and analyse thermophysical and thermochemical properties, use computer tools to calculate mass-energy balances.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of chemical thermodynamics and stoichiometry calculations, and full use of mass and energy computations.
Recommended optional programme componentes	Separation Processes II.
Course contentes	1. Termophysical and thermochemical previsiom methods; 2. Mass balances in multiphasic operations; Solid-liquid extraction: solids washing and leaching; Liquid-liquid extraction: imiscible and partially miscible systems. 3. Energy balances in processes with mixture and solution. 4. Simultaneous solving of energy and material balances; Computer design and calculation of energy and mass balances
Recommended or required Reading	- Felder, R. e Rousseau, R. (2000). *Elementary Principles of Chemical Processes*. New York: Wiley - Himmelblau, D.(1996). *Basic Principles and Calculations in Chemical Engineering*. London: Prentice-Hall - McCabe, W. e Smith, J. e Harriot, P. (2005). *Unit Operations of Chemical Engineering*. .: McGraw-Hill - Pinho, H.*Teaching material*.Acedido em0 de --- de 0 em www.estt.ipt.****
Planned learning activities and teaching methods	Lectures involving theory presentation. Practical classes involving exercise solving and discussion.
Assessment Methods and criteria	Written open-book examination (75%). A practical assignment including public presentation (25%), requiring a minimum mark of 9/20 in each assessment component.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Separation Processes II (Option) (*)
Course unit code	918438
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Paula Alexandra Geraldes Portugal
Learning outcomes of the course unit	Students must be able to determine the basic equipment design parameters in particles/droplets separation processes from fluids (classification, centrifugation, sedimentation and filtration). They must be able to evaluate the hydrodynamic effects of the fluid flow through particle beds.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of fluid mechanics and mass and energy balances.
Recommended optional programme componentes	Not applicable.
Course contentes	Study of the movement of particles in fluids – drag coefficient and law of Stokes. Description and design of equipment of: -Gravitational classification; -Sedimentation; -Centrifugation; -Fixed beds and fluidized beds of particles; -Filtration.
Recommended or required Reading	- Foust, .(1982). *Princípios das Operações Unitárias*. Rio de Janeiro: LTC - Perry, J.(2007). *Chemical Engineers Handbook*. New-York: McGraw-Hill Book Company - Academic Press, .(2000). *Encyclopedia of Separation Science*. London: Academic Press - McCabe, W. e Smith, J. e Harriott, P. (2001). *Unit Operations of Chemical Engineering* . Singapore: McGraw-Hill Book Company
Planned learning activities and teaching methods	Description of mechanical equipments with the help of datashow resources. Presentation of theoretical concepts and exercise solving. Exercises are based on real-world cases.
Assessment Methods and criteria	Assessment includes written tests (continuous assessment or exams) and involves theoretical questions and practical questions involving the design of equipment.
Language of Instruction	English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Paper Technology (Option) (*)
Course unit code	918442
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Natércia Maria Ferreira dos Santos
Learning outcomes of the course unit	Students are expected to familiarise themselves with paper manufacturing processes, paper chemistry and the operations involved in paper production as well as understand paper chemistry.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basic knowledge of chemistry, physics, material and energy balances and raw materials.
Recommended optional programme componentes	Not applicable.
Course contentes	1 - The historical context of papermaking. 2 - Raw materials - Characteristics and processing. 3 - Stock Preparation and wet-end operations. 4 - Refining / beating. 5 - Paper Machine 6 - Paper Chemistry (wet-end chemistry)
Recommended or required Reading	- Paulapuro, H.(2000). *Papermaking Part1, Stock Preparation and Wet End*. Helsinquia: Fapet Oy - Neimo, L.(2000). *Papermaking Chemistry*. Atlanta: Tappi Press - Karlsson, M.(2000). *Papermaking, Part 2 – Drying*. Atlanta: Tappi Press
Planned learning activities and teaching methods	lectures and laboratory classes.
Assessment Methods and criteria	Theoretical component: written test. Practical component: laboratory coursework and reports. Final grade is the average of the two components. A minimum mark of 10/20 in both components is required to pass.
Language of Instruction	Portuguese | **Mentoring in** French
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Separation Processes in Biotechnology (Option) (*)
Course unit code	918440
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Henrique Joaquim de Oliveira Pinho
Learning outcomes of the course unit	Students should develop basic skills in the separation and purification of biological products: they should be able to propose the possible separation sequences, identify the main design parameters and master the "scale up" principles.
Mode of delivery	b-learning
Prerequisites and co-requisites	Knowledge of basic algebra, numerical methods and chemical thermodynamics.
Recommended optional programme componentes	Biological reactors; Enzyme engineering; Genetic engineering.
Course contentes	Introduction. Fundamentals concerning the processes of separation of biological products. Separation of cellular material. Cell rupture. Soluble product separation. Purification technics. Examples of industrial application.
Recommended or required Reading	- Aires-Barros, M. e Cabral, J. (2003). *Biosseparações in Biotecnologia - Fundamentos e Aplicações, N.Lima e M.Mota eds.*. Lisboa: Lidel - Forciniti, D.(2008). *Industrial Bioseparations*. : Blakwell - Pinho, H.*Material de apoio de PSB*.Acedido em0 de --- de 0 em www.e-learning.ipt.pt
Planned learning activities and teaching methods	Lectures and tutorials.
Assessment Methods and criteria	Written test with a minimum mark of 9/20 (70% of final grade). Team assignment with a minimum mark of 9/20 (30% of final grade). Optional individual assignments up to 25% of the grade obtained in the written test.
Language of Instruction	Portuguese | **Mentoring in** English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Transformation Technologies (Option) (*)
Course unit code	918443
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Rui da Costa Marques Sant`Ovaia
Learning outcomes of the course unit	Students should develop skills to work in the paper processing sector; identify and control production processes.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of paper technology and quality control.
Recommended optional programme componentes	Not applicable.
Course contentes	1-Surface paper treatments: sizing, coating and calendering. 2-Multiply paperboard. Formers. Plybonding. 3-Corrugated board. Manufacture. Board properties. Boxes Project. 4- Printing process. Ink-paper relationship.
Recommended or required Reading	- Several, -.(1998). *Paper-making Science and technology*. Helsinquia: Fapet Oy - Smook, G.(1989). *Handbook of pulp and paper technologists*. New York: TAPPI
Planned learning activities and teaching methods	Lectures and laboratory sessions.
Assessment Methods and criteria	Continuous assessement and final examination test.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Project
Course unit code	918437
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	12
Name of Lecturer(s)	Rui da Costa Marques Sant`Ovaia
Learning outcomes of the course unit	Provide the ability to draw up and interpret industrial process projects.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Basics of "Transfer Phenomena", "Mass and Energy Balances" and "Unit operations".
Recommended optional programme componentes	Not applicable.
Course contentes	Project Design Charts. Nomenclature. Fluid mechanics and unit operations (revision). Building materials and equipments. Cost and investment evaluation. Project control.
Recommended or required Reading	- Coulson, J. e Richardson, J. (1995). *Chemical Engineering*. (Vol. 6). London: Pergamon Press - Several , .*Chemical Engineers Handbook*. New York: McGraw-Hill (Perry) - Hicks, L. e Chopey, A. (1997). *Handbook of Chemical Engineering Calculations*. New York: McGraw-Hill
Planned learning activities and teaching methods	Lectures and supervised assignments.
Assessment Methods and criteria	Continuous assessment and final project (public presentation).
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Quality Management
Course unit code	918435
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Natércia Maria Ferreira dos Santos
Learning outcomes of the course unit	Students should acquire skills to develop and implement quality control and assurance systems, to analyze quality costs and implement statistical control systems.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Knowledge of basic statistics.
Recommended optional programme componentes	Not applicable.
Course contentes	1 - Introduction - The historical context of Quality. 2 - Quality management systems. Standards of quality assurance. 3 - Certification. Standard ISO 9000. Accreditation of entities. ISO 17025. 4 - Audits. Standard ISO 19011. 5 - Quality Cost Analysis. 6 - Implementation and analysis of statistical process control.
Recommended or required Reading	- Pires, A.(2007). *QUALIDADE – Sistemas de Gestão da Qualidade*. Lisboa: Edições Sílabo - Hoyle, D.(2005). *ISO 9000 QUALITY SYSTEMS HANDBOOK*. Oxford: Butterworth-Heinemann
Planned learning activities and teaching methods	Lectures. Theoretical-practical classes: case studies and problem solving.
Assessment Methods and criteria	Theoretical component: written test. Theoretical-practical component: literature review report. Final grade is the average of the two components. A minimum score of 10 (out of 20) in each component is required to pass.
Language of Instruction	Portuguese | **Mentoring in** French
Work placement(s)	Not applicable.