UNIVERSITY "POLITEHNICA" OF BUCHAREST

FACULTY OF ENGINEERING IN FOREIGN LANGUAGES

CHEMICAL ENGINEERING in ENGLISH LANGUAGE, 2021-2022

CONTENT OF THE LECTURES FROM THE STUDY PLAN

14 Weeks/semester

Legend: "E/V" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" = Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P"=Project

From the optional subjects, only one of the two will be taught, depending on students' choice. The facultative subjects will be taught only if a sufficient number of students choose them, to form the group.

I Year, 1st Semester

Codul disciplinei	F/D/ S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.F.1.O.001.EC	F	O	1	1	Calculus I	E	3	1			5
UPB.12.F.1.O.002.EC	F	O	1	1	Linear Algebra	E	2	1			4
UPB.12.F.1.O.032.EC	F	O	1	1	Inorganic Chemistry I	E	3	2			5
UPB.12.D.1.O.034.EC	F	O	1	1	Analytical Chemistry I	E	2		3		4
UPB.12.T.1.O.021.EC	F	O	1	1	Introduction to Information Technology	E	1		2		3
UPB.12.T.1.O.023.EC	F	O	1	1	Engineering Graphics I	V	1		1		3
UPB.12.U.1.O.001.EC	C	O	1	1	Professionnal communication	V		2			2
UPB.12.U.1.O.002.EC	C	O	1	1	European Culture and Civilisation I	V	1	1			2
UPB.12.U.1.A.002.EC	C	A	1	1	Physical education I	V		2			2
UPB.12.C.1.L.005.EC	C	L	1	1	English for Engineering Academic Study 1	V	1	1			2
UPB.12.U.1.L.003.EC	C	L	1	1	Limba si cultura romana (pentru straini)	V		2			2

CALCULUS 1

Calculus 1 continues the theory of functions of one single variable (from the college); in the first part it contains: real and complex numbers, sequences and series of numbers, sequences and series of functions. In the second part, the differential calculus of functions of several variables is presented: partial derivatives, the differential, extrema and conditional extrema, implicit functions.

LINEAR ALGEBRA

The course aims to enable good understanding and handling of the main linear and affine quadratic - based algebraic and geometric objects, and present them in direct relation with other sciences.

It provides basic knowledge of linear (vector) spaces and linear mappings, orthogonality (including the Gram Schmidt process, norming, orthonormal bases), spectral theory of linear operators (including eigenvalues, eigenvectors, the diagonal and the Jordan forms), orthogonal curvilinear coordinates, quadratic forms, free vectors and their main operations (including scalar, cross, mixed and double cross products), quadratic objects in 2D (conics), and linear & quadratic objects in 3D (including straight line, plane, and quadrics).

It emphasizes the relevance and consequences of the linear/quadratic character of the specific objects towards their efficient use in real-life models.

INORGANIC CHEMISTRY I

This discipline insists on understanding the relationship between the atomic structure and the trends in properties of the elements from the Periodic System and the influence of chemical bonding on physical and chemical properties of compounds. It also considers the basic notions, concepts and theories in the field of inorganic chemistry in order to explain the properties of elements and their compounds, especially for halogens, noble gases and hydrogen. This discipline insists on the identification and application of fundamental theories, models and methods to establish the relationship between the structure and chemical reactivity of inorganic compounds, which leads on a deep understanding of chemical processes.

ANALYTICAL CHEMISTRY I

Analytical chemistry I deals with the basics of qualitative and quantitative analysis of materials and substances, starting with understanding chemical equilibriums in homogeneous systems, advancing towards establishing the main macroscopic parameters (reagents concentration, pH, potential) that allow setting-up identification, separation, and quantification methods for simple and complex samples. It provides models for setting-up volumetric analysis methods based on proton, electron and ion or molecule exchange reactions, ensuring practical means for adding titration reagent to the titrated species, determining the equivalence point and evaluating the quality of the final result.

INTRODUCTION TO INFORMATION TECHNOLOGY

In order to prepare the students for real life event in IT&C world, this course provides an overview of the computer and networks security and it will raise student’s awareness about computer network and

computers itself operating systems issues. Also, some basic concepts concerning network management and computers network security will be presented.

The course has as main objective to provide an overview of the computer operating systems. This course aims to introduce basic concepts and mechanisms of modern operating systems and virtualization.

The emphasis is on principles and organization of operating systems, but also on practice, so as to illustrate key concepts in a practical context. At the end of the course, the students will understand some of the basic concepts concerning computers operating systems and will be able to configure basic computer operating systems, interconnect two or more computers, and to apply basic security and protection to operating systems.

During the practical laboratory/project part of the course, the students will develop practical skills about enabling computers security, setting up firewalls and Network Address Translation tables and policies using "iptables" software, configuring of firewalls in order to solve specific issues. During project assignments, the students will improve self-learning and team work capabilities. The teaching is in English and that helps the students to improve their English language command. In the same time, the students will consolidate their English language usage because the teaching, bibliography and support materials are in English.

ENGINEERING GRAPHICS I

The Engineering Graphics, on which designing, project making and manufacturing are based, is one of the most important study disciplines in superior technical education. Engineering Graphics is a science and a language too; it's a tool of knowledge, communication and social interaction. The components of this science are: Descriptive geometry, Technical drawing, and Computer graphics. Descriptive Geometry establishes laws which are to enable the representation of spatial objects and of spatial situations. These laws (rules) are coming directly from the elementary geometry. Technical drawing relies on orthogonal (orthographic) projection, which supplies the best conditions for describing shape of an object, and it is best fitted to make dimensioning, which is the second function of a technical drawing.

PROFESSIONNAL COMMUNICATION

The practical course (seminar) English language – Professional Communication 1 is addressed to Romanian and foreign students in year I, of the FILS and it has as its general objective the development of the communicative competence of the students in English which is used as a medium of instruction in FILS. Stress is placed on the four fundamental components: listening, writing, reading and oral communication, developed on the basis of the adequate grammatical and lexical support corresponding to the required level. The teaching of this subject has the following secondary objectives: the capacity to use in real contexts communication situations adequate to simple/phraseological units incorporating cultural and civilization

connotations, adequately using the necessary lexical and grammatical structures, with a focus on those structures encountered in the academic technical study in English.

EUROPEAN CULTURE AND CIVILISATION I

The course is designed as an introduction to some major issues of European culture and philosophy, which may give an account of what does it mean to be European. The focus will be on the theoretical and historical roots of individualism, liberalism and rights versus collectivism, traditionalism and beliefs. This would increase students capacity for judging, assessing and understanding not only theoretical problems but also practical questions generated by their complex social engagements. Topics covered: I. Greek cosmos; II. Medieval divine cosmos; III. Modern secular thought; IV. Contract, rights,individualism; V. Enlighment; VI. Social utopia, collectivism, and totalitarianism; VII.Post-comunism and post-modernism; VIII. EU and Globalization; IX. One Europe or several?

PHYSICAL EDUCATION I

The aim of this course is to Enhance physical and intellectual effort capacity; Harmonious development of the body; Optimize health; Prevent the appearance of global and segmental physical deficiencies; Form and maintain correct body attitudes

ENGLISH FOR ENGINEERING ACADEMIC STUDY 1

The discipline ENGLISH FOR ENGINEERING ACADEMIC STUDY – EEAS is addressed to all students of bachelor level year i of FILS – English stream; it has as its main objective the development of academic study skills in the context in which English is the medium of instruction in a technical university. The course and seminar aim to: develop the skills and level of proficiency in English for academic study of the engineering type, particularly reading with reflection on the structures and senses of different kinds of texts and other study materials, efficient note taking at courses and preparation for written/oral examinations. A range of specific objectives cover: successful effective communication in the university and in the working environment, the optimal efficient model of accessing different types of texts of the technical academic kind, text, paragraph and sentence structure with a view to developing writing skills in the academic environment, the development of specific academic lexis in the engineering context, as well as the appropriate grammatical support.

LIMBA SI CULTURA ROMANA (PENTRU STRAINI)

The aim of this course is the development of students' communication competence with a focus on the four fundamental skills: listening, writing, reading and speaking. The capacity to use in real communication contexts simple and complex vocabulary structures with reference to cultural and civilization conotations The capacity to adequately use grammar structures

I Year, 2nd Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.F.2.O.001.EC	F	O	1	2	Calculus II	E	3	1			6
UPB.12.F.2.O.011.EC	F	O	1	2	Physics I	E	2		1		5
UPB.12.F.2.O.032.EC	D	O	1	2	Inorganic Chemistry II	E	2	2	2		4
UPB.12.F.2.O.034.EC	D	O	1	2	Analytical Chemistry II	E	2		2		3
UPB.12.F.2.O.042.EC	F	O	1	2	Programming languages	V	1		1		3
UPB.12.T.2.O.001.EC	D	O	1	2	Transition Metals Chemistry	E	2	1			3
UPB.12.T.2.O.012.EC	F	O	1	2	Theoretical Mechanics	V	1	1			2
UPB.12.S.2.O.001.EC	D	O	1	2	Collaborative Work	V		2			2
UPB.12.U.2.O.002.EC	C	O	1	2	European Culture and Civilisation II	V	1	1			2
UPB.12.C.2.L.005.EC	C	L	1	2	English for Engineering Academic Study 2	V	1	1			2
UPB.12.U.2.L.003.EC	C	L	1	2	Limba si cultura romana (pentru straini)	V		2			2

CALCULUS II

The course Calculus 2 is a presentation of the theory of the integral of functions of several variables. The main topics are: the Riemann integral, improper Riemann integral, functions defined by integrals, double and triple integrals, line and surface integrals. The integral formulae (Green-Riemann, Gauss-Ostrogradski and Stokes) and an introduction to the field theory are presented too. The course contains also a brief introduction to the metric spaces theory and applications of the fixed point principle.

PHYSICS I

The ultimate goal of Physics I Course is to provide the students with an opportunity to develop their knowledge of the physical world through study in wave optics. Students will learn the concepts, principles and technical vocabulary associated with optics areas of very wide-ranging application. The course will

describe the nature and properties of light, its propagation, light – matter interactions, the main optical phenomena and their applications. The students will acquire theoretical and practical knowledge about some modern equipments and techniques using optical phenomena.

INORGANIC CHEMISTRY II

The Inorganic chemistry course covers basic concepts in inorganic chemistry which are illustrated through the main group elements and compounds. Descriptive chemistry of the main group elements utilizes the concepts of periodicity, uniqueness principle, inert pair-effect, metal-nonmetal line, diagonal effect, le Chatelier's principle etc. These concepts are expanded further to include subjects from diverse areas as solid state chemistry, environmental chemistry etc. The relevance of this chemistry is highlighted with real examples of inorganic chemistry.

ANALYTICAL CHEMISTRY II

Analytical Chemistry II is dedicated to introduction in instrumental analysis. Instrumental analysis involves the use of various equipment within the field of analytical chemistry. Instrumental methods of chemical analysis became principal tools for obtaining information in diverse areas of science and technology. With this knowledge, a well-educated scientist can develop appropriate analytical methods to solve problems and obtain precise, accurate and valid information according to the scope. Instrumental analysis methods in this course will address electrochemistry. Electrochemistry is the science of electrified surfaces, being a vast domain, as consequence during a term course there will be introduced general aspects, fundamentals of domain and potentiometric method principles.

PROGRAMMING LANGUAGES

This course is an introductory programming course that uses Matlab/Octave to illustrate general concepts in computer science and programming. Matlab /Octave is a programming system and language that is easy to learn, versatile and very useful for mechanical engineers. Students will become familiar with general topics in computer science, will gain a general understanding of the programming concepts and will obtain a solid foundation in the use of the Matlab/ Octave programming language.

TRANSITION METALS CHEMISTRY

The Transition metals chemistry course provides a solid background in coordination chemistry, solid state chemistry, including the structure types of simple solids, Band Theory (with the aim of understanding electrical properties of transition metals and their compounds). Also, for the students to get an insight into

the principles of obtaining metals (especially transition metals), several lectures are devoted to an introduction in metallurgy. The concepts studied during this compulsory core course are essential for the development of analytical skills toward advanced materials specialization.

THEORETICAL MECHANICS

The course of Theoretical Mechanics is structured into four parts. The first part familiarizes students with the notions, principles and fundamental methods of the statics. The mechanical interactions and the constraints between bodies are defined. The theoretical concepts are applied in the study of the equilibrium of bodies and systems of bodies.

The second part is dedicated to the kinematics of the absolute motion of a material point and of a rigid body, as well as of the relative motion of a material point. Characteristic quantities of the motion are introduced, such as velocity and acceleration.

In the third part, the course presents the principles and the fundamental methods of the dynamics. The way interactions determine the motions of bodies is shown and the conditions, the physical significances, as well as the practical consequences of the conservation of some mechanical quantities are studied.

The fourth part presents briefly the fundamentals of the analytical mechanics.

COLLABORATIVE WORK

The aim of this course ist o develop the Capacity to understand, respect and adapt to cultural differences in various intercultural working environments; the capacity of talking on the phone in a style adapted to the level of formality of professional work; the capacity to discuss about professional life, schedule, working styles, aspirations, career plan, using the lexis specific to English for professional communication; the capacity to communicate in writing by short documents, acc to academic rules, by using specific formulas and structures and by observing an appropriate register of formality.

EUROPEAN CULTURE AND CIVILISATION II

The course is designed as an introduction to some major issues of European culture and philosophy, which may give an account of what does it mean to be European. The focus will be on the theoretical and historical roots of individualism, liberalism and rights versus collectivism, traditionalism and beliefs. This would increase students capacity for judging, assessing and understanding not only theoretical problems but also practical questions generated by their complex social engagements. Topics covered: I. Greek cosmos; II. Medieval divine cosmos; III. Modern secular thought; IV. Contract, rights,individualism;

V. Enlighment; VI. Social utopia, collectivism, and totalitarianism; VII.Post-comunism and post-modernism; VIII. EU and Globalization; IX. One Europe or several?

ENGLISH FOR ENGINEERING ACADEMIC STUDY 2

The discipline ENGLISH FOR ENGINEERING ACADEMIC STUDY – EEAS is addressed to all students of bachelor level year I of FILS – English stream; it has as its main objective the development of academic study skills in the context in which English is the medium of instruction in a technical university. The course and seminar aim to: develop the skills and level of proficiency in English for academic study of the engineering type, particularly reading with reflection on the structures and senses of different kinds of texts and other study materials, efficient note taking at courses and preparation for written/oral examinations. A range of specific objectives cover: successful effective communication in the university and in the working environment, the optimal efficient model of accessing different types of texts of the technical academic kind, text, paragraph and sentence structure with a view to developing writing skills in the academic environment, the development of specific academic lexis in the engineering context, as well as the appropriate grammatical support.

LIMBA SI CULTURA ROMANA (PENTRU STRAINI)

The aim of this course is the development of students' communication competence with a focus on the four fundamental skills: listening, writing, reading and speaking; The capacity to use in real communication contexts simple and complex vocabulary structures with reference to cultural and civilization conotations; The capacity to adequately use grammar structures.

II Year , 1st Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.F.3.O.002.EC	F	O	2	3	Probabilities & Statistics	V	1	1			2
UPB.12.F.3.O.011.EC	F	O	2	3	Physics II	E	2		1		4
UPB.12.F.3.O.031.EC	D	O	2	3	Physical Chemistry I	E	3	2			5
UPB.12.F.3.O.032.EC	D	O	2	3	Physical Chemistry I Lab	V	0		2		2
UPB.12.F.3.O.033.EC	D	O	2	3	Organic Chemistry	E	3	1	2		6
UPB.12.T.3.O.001.EC	D	O	2	3	Strength of Materials I	E	2	1			4
UPB.12.T.3.O.002.EC	D	O	2	3	Electrical Engineering I	C	2		1		3
UPB.12.S.3.O.001.EC	D	O	2	3	Collaborative Work	C		2			2
UPB.12.E.3.O.001.EC	C	O	2	3	Microeconomics	C	1	1			2
UPB.12.U.3.L.002.EC	C	L	2	3	Limba si cultura romana (pentru straini)	V		2			2

PROBABILITIES & STATISTICS

By the use of methods specific to the probability theory and statistics, there can be modeled real world phenomena, such as in engineering, game theory, information theory. A good comprehension of these phenomena imposes necessarily a solid background knowledge of the basic notions of the probability theory and statistics. The course refers to notions connected with the conditional probability, applications to reliability, the total probability formula, discrete and continuous random variables, numerical characteristics of random variables, random vectors, marginal densities, functions of random variables, sequences of random variables, graphical methods of presenting data, data analysis, the estimation of parameters, approximation methods in statistics. The problems approached during the seminar are carefully selected, according to the material presented at the course.

PHYSICS II

With the growing interest in nanotechnology, quantum physics has recently become increasingly important for an ever-widening range of engineering disciplines. The Physics II course is intended to provide the student with a clear and logical presentation of the basic concepts and principles of quantum physics and

to strengthen an understanding of the concepts and principles through practical applications. During the first part of the course students learn phenomena that have lead to the quantum ideas. Then, the formalism of quantum physics is presented in two steps. Probability plays a central role in making sense of quantum physics. Applications are emphasized whenever possible, including those related to the mathematical formalism, i.e., the quantum computer and quantum cryptography. Quantum mechanics formalism is used in the explanation of the periodic table of elements and the understanding of electrical properties of solids.

PHYSICAL CHEMISTRY I

Physical Chemistry I introduce students to fundamental laws of physical and chemical processes in the field of Chemical Thermodynamics, Chemical Kinetics and Statistical Thermodynamics. Students learn to evaluate and calculate different properties such as heat capacities, thermodynamic functions of phase transitions and chemical reactions in order to evaluate mass and energy balances, establishing optimal conditions for equilibrium, concepts useful in designing reactors and industrial plants for chemical industry.

PHYSICAL CHEMISTRY I LABORATORY

The objective of this laboratory is to introduce students to fundamentals of physico-chemical laws of physical and chemical processes in the field of Chemical Thermodynamics, computation of some properties mainly, heat capacities, thermodynamic functions of phase transitions and chemical reactions in order to evaluate mass and energy balances, establishing optimal conditions for equilibrium, concepts useful in designing reactors and industrial plants for chemical industry

ORGANIC CHEMISTRY

The Organic Chemistry I course is conceived to teach the student the basic notions of organic chemistry and of organic reactions by both theory and applications. The presentation of the fundamental concepts starts with the chemical bond, chemical structure, elements of the chemical reaction and its energetic profile, and continues with the presentation of hydrocarbons.

In this category, the subjects are organized in ascending complexity, from saturated, to unsaturated and to aromatic ones. Synthetic and reactivity aspects of the representatives in each category are outlined. The main topics presented above are completed by the stereochemistry lecture, that adds to the first approaches from the conformational structure of alkanes and cycloalkanes and to the geometric isomerism at alkenes.

STRENGTH OF MATERIALS I

The aim of this cours is to correctly understanding of phenomena related to the state of stress and deformation of mechanical structures; Understanding the principal methodologies specific to the mechanics of deformable bodies concerning the calculus of stresses and deformations in the loading of bidimensional structures made of bars; Application of strength, stiffness, and stability criteria in analyzing elastic structures.

ELECTRICAL ENGINEERING I

This course develops the student's abilities in applying the basic knowledge of electromagnetic field theory and circuit theory to understand, model and analyze the field and circuit problems, to understand the limits of the used models.

The goals of this course are: Understanding the main phenomena of electromagnetism. Correct identification and formulation of macroscopic laws of electromagnetism. Identify important consequences resulting from the system laws of electromagnetism macroscopic theory. Correct identification of the electric circuit state associated to a certain type of application; Correct writing of Kirchhoff equations and powers for a given circuit.

COLLABORATIVE WORK

The practical course (seminar) of English Language - Collaborative work has a general objective the development of the four fundamental components of communication: written and oral comprehension, written and oral communication (listening, speaking, reading, writing), within the context of professional communication. The teaching of this subject has the following seconday objectives: the development of the ability to edit a CV and a letter of intent in acc. with the academic requirements and current rules; the development of the capacity to successfully prove and promote one's professional skills in an interview; the development of the lexis specific to professional activity: schedule, career plan, strong points and working abilities, company life; the development of the capacity to correctly clearly and concisely structure and make in a fluent manner an oral presentation.

MICROECONOMICS

The subject teaches microeconomics notions laws and principles for engineers. The goal of such a subject is to support with basic economic knowledge the foundation of a future engineer in approaching correctly decisions in companies. Microeconomics is about individuals' choices of where to live and work how much to save, what to buy, and firms' decisions about allocation, hiring, firing, and investment - involves issues

that concern us on a daily basis. This course develops students' abilities to construct and sustain an argument, develop the literacy and verbal communication, skills necessary for presenting reasons of economic nature. Upon completion, students should be able to identify and evaluate consumer and business alternatives in order to achieve economic objectives efficiently.

LIMBA SI CULTURA ROMANA (PENTRU STRAINI)

The Romanian language seminar for foreign students of the second year aims to develop the ability to understand the current Romanian language, the development of communication and writing skills, proposing a series of activities and topics to consolidate grammar and vocabulary knowledge. Written and oral comprehension, written and oral expression in a correct and fluent manner in the Romanian language is the general objective of the discipline. Encouraging interactive activities to stimulate the use of notions of grammar and vocabulary learned in their own communication contexts, such as conversations, negotiations, descriptions, presentations, the Romanian language seminar aims to motivate students to use Romanian verbally and in writing in a correct manner. , fluent and polite. Another objective is to introduce foreign students in the context of Romanian culture and civilization, presenting them with details about the ways of communication and behavior in different communication contexts in Romania and also presenting details about Romanian traditions and customs.

II Year , 2nd Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.F.4.O.031.EC	D	O	2	4	Physical Chemistry II	E	3	2			6
UPB.12.F.4.O.032.EC	D	O	2	4	Physical Chemistry II Laboratory	V			2		4
UPB.12.F.4.O.033.EC	D	O	2	4	Organic Chemistry II	E	3	1	2		7
UPB.12.T.4.O.001.EC	S	O	2	4	Instrumental analysis in organic chemistry	E	2		2		6
UPB.12.T.4.O.023.EC	F	O	2	4	Numerical methods	C	2		2		3
UPB.12.S.4.O.001.EC	D	O	2	4	Technical writing	C		2			2
UPB.12.E.4.O.001.EC	C	O	2	4	Macroeconomics	C	1	1			2
UPB.12.U.4.L.002.EC	C	L	2	4	Limba si cultura romana (pentru straini)	V		2			2

PHYSICAL CHEMISTRY II

Physical Chemistry II introduce students to fundamental laws of physical and chemical processes in the field of Chemical Thermodynamics, Chemical Kinetics and Statistical Thermodynamics. Students learn to evaluate and calculate different properties such as heat capacities, thermodynamic functions of phase transitions and chemical reactions in order to evaluate mass and energy balances, establishing optimal conditions for equilibrium, concepts useful in designing reactors and industrial plants for chemical industry.

PHYSICAL CHEMISTRY II LABORATORY

The objective of this laboratory is to introduce students to fundamentals of physico-chemical laws of physical and chemical processes in the field of Chemical Thermodynamics, computation of some properties mainly, heat capacities, thermodynamic functions of phase transitions and chemical reactions in order to evaluate mass and energy balances, establishing optimal conditions for equilibrium, concepts useful in designing reactors and industrial plants for chemical industry

ORGANIC CHEMISTRY II

The Organic Chemistry II course is dedicated to the more complex notions of organic chemistry, regarding preparation and reactivity of compounds with simple (single) functional groups. The theory is completed by the chosen applications. The presentation of the functionalized compounds starts with the haloderivatives, continues with compounds bearing the OH and the –O– group, sulfonic acids, compounds substituted with groups bearing one or several nitrogen atoms, carbonyl derivatives, and, finally, carboxylic acids. Synthetic and reactivity aspects of the representatives in each category are outlined. The main topics presented above are preesented in their interconversion capabilities, with their stereochemistry features, etc.

INSTRUMENTAL ANALYSIS IN ORGANIC CHEMISTRY

The Instrumental analysis in organic chemistry Course is adding to the descriptive organic chemistry some basic information over the analytical methods for unknown compounds' structure determination, for identification of known compounds and for reactions' survey by means of instrumental analysis.

The course is providing notions on the result of the interraction between the electromagnetic radiation with the organic molecules, namely the base of spectroscopy. In its first part, the course presents modern possibilities of separation and purification of organic compounds, by means of chromatographic methods.The principle of the equipment, its construction fundamentals and the importance of parameters upon the quality of the record are also stressed. The course contains different issues, such as: Chromatography, Mass spectrometry, IR and FTIR Spectroscopy, UV Spectroscopy, NMR spectroscopy

and combined techniques for inducing the students to coroborate data in order to solve complex problems of structure determination.

NUMERICAL METHODS

This course provides an introduction to numerical methods and computer programming for the solution of various types of scientific problems. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, their applicability and limits of their appropriate use. The course is interdisciplinary in nature, incorporating a number of case studies in information technology, electronic engineering, mechanics and chemistry.

TECHNICAL WRITING

The practical course (seminar) of English Language - Technical Writing has as its general objective the development of the four fundamental components of communication: oral and written comprehension, oral and written skills (listening, speaking, reading, writing), in the context of professional communication. The teaching of this subject has the following seconday objectives: getting the students familiar with the specific of written communicatin in science and technology (general and particular features of various types of written scientific text types); the development of the capacity to create, structure and evaluate texts with scientific/technical character; the development of the capacity to understand and translate texts with scientific and technical character.

MACROECONOMICS

Macroeconomics studies the aggregate behavior of the economy. This course provides an introduction to the economic analysis of key macroeconomic variables such as output, employment, inflation, interest rates and exchange rates. The important elements of the course include measurement of macroeconomic variables, the development of models and theories to explain the behavior of macroeconomic variables, the use of empirical evidence in evaluating different models, and the role of government policy in seeking to influence macroeconomic outcomes. The course will provide students with a framework for understanding the workings of the whole economy and the various interactions among households, business and governments.

LIMBA SI CULTURA ROMANA (PENTRU STRAINI)

The Romanian language seminar for foreign students of the second year aims to develop the ability to understand the current Romanian language, the development of communication and writing skills,

proposing a series of activities and topics to consolidate grammar and vocabulary knowledge. Written and oral comprehension, written and oral expression in a correct and fluent manner in the Romanian language is the general objective of the discipline. Encouraging interactive activities to stimulate the use of notions of grammar and vocabulary learned in their own communication contexts, such as conversations, negotiations, descriptions, presentations, the Romanian language seminar aims to motivate students to use Romanian verbally and in writing in a correct manner. , fluent and polite. Another objective is to introduce foreign students in the context of Romanian culture and civilization, presenting them with details about the ways of communication and behavior in different communication contexts in Romania and also presenting details about Romanian traditions and customs.

III Year , 1st Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.F.5.O.033.EC	D	O	3	5	Organic Chemistry III	E	2		2		4
UPB.12.T.5.O.001.EC	D	O	3	5	Transport Processes	E	3	1	2		6
UPB.12.T.5.O.002.EC	D	O	3	5	Organic and Composite Materials	E	3		2		5
UPB.12.T.5.O.003.EC	D	O	3	5	Electrochemistry	E	2		2		4
UPB.12.T.5.O.004.EC	S	O	3	5	Reaction Mechanisms	E	2	1			4
UPB.12.T.5.O.005.EC	S	O	3	5	Organic Technologies I	E	2		2		5
UPB.12.M.5.O.041.EC	C	O	3	5	Money and Banking	V	1	1			2

ORGANIC CHEMISTRY III

The Organic chemistry III Course is completing the organic chemistry basic knowledge and overview, initiated in the second year, providing the capability to understand the mutual transformations between functional classes of compounds and their relationship with the biochemical transformations. The course offers a medium level of knowledge of the chemistry main topics concerning functional derivatives of carboxylic acids, the acyl nucleophilic substitution as the linking principle between these classes of derivatives, beta-ketoesters, sugars, aminoacids, heterocycles.

TRANSPORT PROCESSES

The lecture presents fundamental knowledge for chemical engineering disciplines and it is a base for following lectures, unit operations and chemical reactors. The lecture has three main chapters: fluid flow,

heat transfer and mass transfer. The first chapter presents the main laws governing the fluid flow: conservation of impulse, energy balance for a liquid that flows, the study of pressure drop for a fluid flowing in a tube or over hydrodynamic obstacles. In the second chapter the main mechanisms for heat transfer are studied: conduction, convection and radiation. The calculation of heat transfer coefficients for cooling/heating or in heat transfer with phase change (boiling and condensation) is presented. The third chapter, mass transfer, focusses on the understanding of mass transfer mechanisms, the calculation of mass flux for the diffusion through a stagnant layer of inert or by equimolar counter-diffusion, the interphase mass transfer, the calculation of mass transfer coefficients and overall mass transfer coefficients for absorption and distillation.

ORGANIC AND COMPOSITE MATERIALS

Organic materials are quite spread in our everyday life starting with natural organic materials like wood, natural leather, natural rubber and continuing with synthetic materials like polymer-based materials and composites with various applications like aerospace engineering, medicine, transportation, electronics, etc. Each composite consists from at least two components: one matrix and one reinforcing agent or filler. This course is devoted to polymer matrices and the full range of polymers used in composites are described: thermoplastics, thermosets and elastomers. For each class of these categories a detailed presentation concerning the synthesis methods, the physico-chemical and mechanical properties and processing methods and applications are described extensively to point out the main benefits of these materials type. The main categories of reinforcing agents are presented as fibers, both inorganic and organic types, together with the synthesis methods describing mainly the main advantages for using in diverse applications like skis, electronic storing devices, etc. A special chapter is dedicated to the use of polymer-based composites in controlled-drug delivery systems and other medical and biomedical applications.

ELECTROCHEMISTRY

The purpose of this course is to introduce the students to electrochemistry processes and phenomena of practically important systems such as batteries, fuel cells, electrolysis, corrosion and corrosion protection, systems that will provide them with additional useful skills that might be used to obtain an advantage when prospecting the labour market.

The laboratory sessions are directly linked to the course content, starts from simple systems towards more complex equipment and targets the formation of practical skills for operating, analysing and connecting various electrochemical systems to classical chemical experimental layouts helping the students with the necessary professional practise.

The course is fully compatible and complies with the recommendations of the The Working Party on Electrochemistry of the Federation of European Chemical Societies and the International Society of Electrochemistry as established in the "Eurocurriculum for Electrochemistry" guidelines for teaching of electrochemistry and corrosion at European universities.

REACTION MECHANISMS

The course presents the possibilities of understanding the reaction mechanisms during the chemical transformations, explained step by step, including the formation of the intermediates and their possible structures. This course is not a classical presentation of Organic Chemistry discipline – structured on classes of derivatives – but presents the reaction mechanisms regarding the appearance of the different types of intermediates during the chemical transformations. The course explains the formations of these intermediates and their different structures (free radicals, cations and carbocations, anions and carbanions). Also, are explained some different transformations which take place during some special reactions such as the pericyclic reactions with concertated mechanisms.

The applications for the "Reaction Mechanisms" course are the seminaries - here are presented specific exercises necessary to explain the basic reactions mechanisms (radical addition and substitution, nucleophyle and electrophyle substitution, nucleophyle and electrophyle addition, rearrangements and eliminations, concertated mechanisms, etc.)

ORGANIC TECHNOLOGIES I

The course offers the students information about the sources of raw material (renewable and non-renewable) in organic chemistry, about the main processes of separation, conversion and purification which are used to obtain all types of hydrocarbons used in the organic chemical industry.

Each chapter presents the theoretical bases of every process (chemistry, thermodynamics, reaction mechanism, kinetics and catalysis), and these elements serve to determine the optimal conditions for synthesis, the reactor type and the appropriate technological outline which ensure a high productivity and selectivity. Each chapter takes into consideration the most important aspects related to the impact of organic chemical industry on environmental protection.

During the course the students gain knowledge about the global reserves of raw materials and about the way to choose the raw material necessary for obtaining certain compounds, developing some technological processes of separation, conversion or upgrading in order to obtain various types of hydrocarbons.

By applications the students are getting familiar with the main types of processes (laboratory plant) used for separation, conversion and upgrading of hydrocarbons and raw materials used in organic chemical

industry. Besides they perform in laboratory technological calculations: the mass balance and thermal balance, specific consumption, and calculation of costs.

MONEY AND BANKING

The subject focuses on interest rates, the concept of money, exchange rates and monetary policy. Topics covered include banking structures and function, the European Central Bank, determinants of the money supply, fiscal policy and monetary policy, and international economies. The course will present an opportunity to discuss the financial institutions and monetary policies of different nations and evaluate their relative success in recovering from the financial crisis. Within this, the interaction between the financial system (in terms of its institutions and instruments) and the macro-economy will be examined and there will be a strong practical and policy related element to the course.

III Year , 2nd Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.T.6.O.001.EC	S	O	3	6	Inorganic Industrial Chemistry	V	2	1			2
UPB.12.T.6.O.002.EC	D	O	3	6	Biochemistry	E	2		2		3
UPB.12.T.6.O.003.EC	S	O	3	6	Organic Technologies II	E	2		2	1	4
UPB.12.T.6.O.004.EC	S	O	3	6	Oxide and Metallic Materials	E	3		2		4
UPB.12.T.6.O.005.EC	S	O	3	6	Macromolecular Compounds I	E	3		2		5
UPB.12.T.6.O.006.EC	D	O	3	6	Unit Operations I	E	2	1	1		4
UPB.12.S.6.O.007.EC	D+S	O	3	6	Practical Workshop	V					6
UPB.12.M.6.O.041.EC	D	O	3	6	Business Administration	V	1	1			2

INORGANIC INDUSTRIAL CHEMISTRY

The inorganic chemical industry adds value to raw materials and plays an essential role in the global chemical industry by providing inorganic compounds that are used as intermediates in the production of other compounds or chemical products. The manufacture of inorganic compounds is carried out both on a large scale or small scale. The largest production capacities are developed for the manufacture of basic chemicals for use as reactants in various industrial processes and for the manufacture of finished products. The course chapters will cover the description, analysis and use of the fundamental concepts and theories

of chemistry and chemical engineering in the manufacture of high volume inorganic chemicals. The course will present the major inorganic industries on a large scale: ammonia, nitric acid, sulfuric acid, urea and fertilizers. Each technological process describes the main chemical processes, thermodynamics and reaction kinetics, the main technological flows, the current technologies, and the best available techniques. For each industry, a brief description of the specific treatment of emissions (gas, wastewater and waste) in accordance with European legislation.

BIOCHEMISTRY

General biochemistry course is intended to provide the student with a general view of the basic principles of biochemistry, the molecular logic of life, the main metabolic pathways common to prokaryotes, plants and animals. During the course the main classes of biomolecules (proteins, nucleic acids, vitamins and hormons) are described with respect to their chemical structures and properties in close connection with their physiological role within the body. Along with the emphasis of the biological role of different biomolecules and their implication in different metabolic pathways, the integration and regulation of biochemical processes is presented as well. The aim is to develop the capability of the students to correlate and integrate knowledge and information to get a general view of how living cells work, grow, maintain, and replicate themselves. The basic mechanisms of communication within and between cells (the information flow in the cell), the basic mechanisms by which cell homeostasis is maintained, the basic mechanisms of energy generation and consumption (the energy flow in the cell), the basic mechanisms of long-term storage, transcription and translation of the genetic information are presented.

ORGANIC TECHNOLOGIES II

The course offers the students information about the about the main processes of separation, conversion and purification which are used to obtain all types of primary industrial intermediates used in the organic chemical industry.

Each chapter presents the theoretical bases of every process (chemistry, thermodynamics, reaction mechanism, kinetics and catalysis), and these elements serve to determine the optimal conditions for synthesis, the reactor type and the appropriate technological outline which ensure a high productivity and selectivity. Each chapter takes into consideration the most important aspects related to the impact of organic chemical industry on environmental protection.

During the course the students gain knowledge about the way to choose the raw material necessary for obtaining certain compounds, developing some technological processes of separation, conversion or upgrading in order to obtain various types of organic intermediates, understanding and managing the

technological process used for the synthesis of chemical products in large quantities and the possibility of providing specialized technical consultancy services.

By applications the students are getting familiar with the main types of processes (laboratory plant) used for separation, conversion and upgrading used in organic chemical industry. Besides they perform in laboratory technological calculations: the mass balance and thermal balance, specific consumption, and calculation of costs.

OXIDE AND METALLIC MATERIALS

Modern science and technology are highly dependent on materials whose properties can be controlled to accommodate a wide range of applications. The multidisciplinary field of materials science and engineering outlines approaches to enhance the manipulation of existing materials and synthesis of new materials. Further, the study of materials science and engineering provides the basis for understanding material properties with respect to chemistry and atomic structure and specifically the ability to tailor chemistry and structure to bring about specific properties. The purpose of this course is to present to students the basic principles necessary to understand structure-property relations in engineering materials. The course assumes a basic knowledge of general physics, general chemistry, and mathematics. With these tools and the subject matter outlined in this course, students will obtain a wide knowledge of modern challenges to the application of modern materials. When appropriate, state-of-the-art problems will be discussed to illustrate the structure-property relationship in materials. The student will grasp concepts of structure from bonding to microstructure, and then learn to consider the interrelationships between structure and property. Properties ranging from mechanical, thermal, electrical, optical, magnetic, and chemical in nature will all be considered. Further, examples will be given to discuss the manipulation of these structure-property relationships in terms of the engineering of materials such as ceramics, glasses, composite materials and nanomaterials.

MACROMOLECULAR COMPOUNDS I

Polymer materials are one of the most important classes of material that nowadays occupy a leader position on the world market of materials. The subject addresses the most important methods of synthesizing macromolecular compounds (via step-growth and chain polymerization as well as copolymerization) together with the reactions on polymers and polymer degradation, thus offering a complete view on the polymer chemistry. The theoretical notions are completed with the basis of the technology of polymer synthesis: polymerization techniques and examples of some technological flows for the best known polymers synthesized industrially.

UNIT OPERATIONS I

The notion of a processing plant containing several operations, such as mixing, evaporation, filtration, distillation, etc., and of these operations being similar, whatever the product, led to the concept of unit operations. They are the building blocks of a chemical process. The number of unit operations is not large. The complexity arises from the variety of conditions under which the unit operations are conducted. Unit operations are based mainly on the laws of physical chemistry and physics. The study and understanding of unit operations gives the future chemist engineer the knowledge necessary to compute, design and optimize a technological process

PRACTICAL WORKSHOP

Identifying and applying concepts, methods and theories to solve problems specific to chemical engineering, under qualified assistance. Monitorization of processes form chemical industry, identification of anomalous situations and propose solutions, under qualified assistance. Critical analysis and using the specific principles, methods and techniques to quantitatively/qualitatively evaluate the processes in chemical industry. Critical evaluation of processes, equipment, procedures and products in chemical industry, using specific evaluation instruments and methods. Applying basic principles and methods for solving problems/scenarios typical for the area of Chemical Engineering, under qualified assistance. Adequate use of standard methods and criteria of evaluation in order to appreciate the quality, advantages and limits of processes, programs, projects, concepts, methods and theories.

BUSINESS ADMINISTRATION

The purpose of the course is to completely integrate the area of economic subjects thought to engineering students with an applied project in the area of business administration and entrepreneurship. Three major components comprise the course: initial analysis (marketing environment, promotion, price, distribution, product) for an organization/product, the development of future strategies with ethical, competitive and environment considerations and the implementation plan. Students are asked to complete a business plan on a new product or a new business in the market and all the mandatory steps are followed in order to actually lunch the idea in the market. Another objective of the course is to encourage team-work, most of the projects are completed in a team and if it’s possible in a multicultural team.

IV Year, 1st Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.T.7.O.001.EC	D	O	4	7	Unit Operations II	E	3	1	1	1	6
UPB.12.T.7.O.002.EC	S	O	4	7	Macromolecular Compounds II	E	3		1		5
UPB.12.M.7.O.041.EC	C	O	4	7	Fundamentals of Management	V	1	1			2
	S	A	4	7	Polymer Physics	E	3		3		6
	S	A	4	7	Technologies of Polymer Synthesis	E	3		3		6
	S	A	4	7	Biopolymers and Biocomposites	E	2		2		5

UNIT OPERATIONS II

Unit Operations (part II) course is intended to provide the student with the ability to apply the general principles of sciences and mathematics, and also to use the specific concepts and tools of chemical engineering in analysis of physical transformations that occur in process equipments. The course gives the ability to perform material and energy balances at the level of process units in the aim to evaluate their efficiency. The main topics are: distillation (differential, equilibrium, batch, continuous, extractive, and azeotropic), absorption, liquid-liquid extraction, and drying. The topic of the project consists in the design of two distillation columns (for separation of a ternary and a binary mixture) and of a heat exchanger, and the verification of the solutions with HYSYS computer simulator. The calculation of a multistage extraction process is the theme of the homework. Several laboratory works from the field of distillation and drying are included in the curricula.

MACROMOLECULAR COMPOUNDS II

(SIPOL): Continuing the presentation of the main areas of polymer chemistry started with Macromolecular Compounds I, the subject points towards other important reactions involving polymers: synthesis of macromolecular compounds via ionic polymerization, copolymerization, reactions on polymers (polymer analogous reactions, cross-linking reactions, grafting and block-copolymerization) and polymer degradation via various mechanisms. Bases of polymer chemistry (mechanisms, kinetics, copolymer composition, etc) are presented together with implications for laboratory and industrial practice.

(CISOPC): Adhesives and surface coatings are a class of products based on the adhesive properties of polymers. Since they represent a class with a large area of application the subject addresses the most

important aspects of the adhesive and film-forming materials: theory of adhesion, classes of adhesives (synthesis, application and testing), classes of film-forming materials (composition, manufacture, application and testing), including sealants, paints, varnishes and primers. The accent is on the engineering aspects such as designing an adhesive joint, choosing the best adhesive for a given situation, understanding the practical aspects of obtaining adhesive joints, classes of surface coatings and their main properties, types of polymers used as binders and additives for surface coatings (pigments, solvents, corrosion inhibitors). To understand the notions included, some basic notions of polymer physics are studied in the introduction part of the subject.

FUNDAMENTALS OF MANAGEMENT

The object of the discipline "Fundamentals of Management" is to complete the students' education through there familiarization with the fundamental technical, economic and managerial notions.

Some of the course objectives are To understand the role and importance of management in the future activity of graduates; to understand the basic technical and economic notions; to be familiarized with the basic tools used in management; to acquire skills in approaching the decision process through information and calculus; to understand the role and importance of management in the future activity of graduates and to understand the basic technical and economic notions. The topics covered by the course are: Management – art or science? Managers. Foreseeing in management. Activity organization. Directing employees. Coordination and control.

POLYMER PHYSICS

Due to their macromolecular structure, polymers have a series of physical and mechanical properties that are not encountered in the area of low molecular compounds. In order to understand those, the shape of the macromolecular coil is investigated. The substates of amorphous polymers (glassy polymers, rubber elasticiy, viscoelastic fluids) are described together with the biphasic polymers. For these, mechanical, thermal and electrical properties are presented in separate chapters. The subject continues with the theory of polymer solutions and the applications in polymer fractionation and measuring average molecular weights of polymers

TECHNOLOGY OF POLYMER SYNTHESIS

The scientific area dealing with polymer science is an interdisciplinary domain comprised of knowledge from chemical, physical, engineering, processing and theoretical aspects. It also has enormous impact on the development of materials science. Aiming to provide the basis for the synthesis of polymeric materials

and comprehension of structure-property relationships, this discipline is giving the full particulars of all these aspects. Many modern functional materials, gears, and devices have polymers as integral parts, thus a future engineer must know the basic principles, methods and technologies on which relies the production of thermoplastic polymers. Technology of Polymer Synthesis assume studies regarding synthesis of polymeric materials, emphasizing interrelationships of chemical pathways, process conditions, and microarchitecture of produced molecules. Other techniques are discussed, including free radical polymerizations and catalytic approaches to obtain well-defined architectures. Process technological conditions include bulk, solution, emulsion, suspension, gas phase, and batch vs. continuous fluidized bed.

BIOPOLYMERS AND BIOCOMPOSITES

A wide range of polymers (natural and synthetic) and biocomposites are available for material applications. Naturally occurring polymers, derived from renewable resources, perform a diverse set of functions in their native setting. Proteins function as structural materials, catalysts, controllers of cell functions and recognition elements. Polysaccharides function in membranes and intracellular communication, in recognition events at the cell surface, as cell wall structures. The beneficial aspects of utilizing polymers from renewable resources, when considering synthesis, processing, disposal, biodegradability, and overall material life-cycle issues, suggests that this will continue to be an important and growing area of interest. Among synthetic biodegradable polymers an increased interest is dedicated to aliphatic polyesters such as polylactic acid, poly(glycolic acid), polyhydroxyalkanoates and their copolymers.

IV Year, 2nd Semester

Codul disciplinei	F/D/S/C	Obl=O / Opt=A / Fac=L	An	Sem	Denumire	E/V	C	S	L	P	Credite
UPB.12.S.8.O.002.EC	S	O	4	8	Chemical Reactors	V	3	2		1	6
UPB.12.S.8.O.007.EC	S	O	4	8	Diploma Project Chemistry	V				4	10
UPB.12.M.8.O.041.EC	C	O	4	8	Industrial Management	V	1	1			2
	S	A	4	8	Polymer Processing	V	3		2		4
	S	A	4	8	Industrial Polymer Materials	V	3		2		3
	S	A	4	8	Adhesives, Paints and Putties	V	2		1		3

	S	A	4	8	Polymer Recycling	V	2		1		2

CHEMICAL REACTORS

Chemical Reactors addresses the problems related to the understanding, modeling, simulation and optimization of the core unit of any chemical plant, the chemical reactor, where the chemical transformations take place. The main areas covered are the homogeneous reactors (ideal and nonideal, their thermal behavior with stability analysis) and the heterogeneous ones (gas-liquid, catalytic, gas-solid non-catalytic, polymerization and liquid-liquid). The main goals of this course are to give the student both a complete and thorough understanding of the chemical processes and the way they are scaled-up into a plant. Knowing the behavior of the very core of a chemical plant, the chemical reactor, is the prerequisite for the engineer to operate the process on a knowledge-based basis, to cope with the various uncertainties or to maintain the parameters as near as possible to the optimal values.

DIPLOMA PROJECT CHEMISTRY

Realization of professional projects regarding the design of the technologies in the area of chemical engineering. Critical evaluation of processes, equipment, procedures and products in the industry of synthesis of organic intermediaries/organic products/fine organic synthesis/thermoplastics/thermo-settings/synthetic fibres/rubbers/polymer processing. Realization of a technological project for the manufacture of an intermediate in organic synthesis/a final product/ a thermoplastic, rubber or synthetic fibre. Realization of a professional project in the area of a discipline included in the curriculum.

INDUSTRIAL MANAGEMENT

The purpose of this course is to offer students a broad understanding and knowledge of management applied in industrial organizations and also to bring information on the manner in which industrial units interact in national, European and international context. The objectives of this course are related to offering information that will lead to understanding and knowledge of several industrial management concepts, principles and methods. They include research & development, operations management, forecasting, scheduling, quality assurance, human resources management, finance & accounting management, and commercial management. Emphasis will be placed on the application of these concepts to actual business situations.

POLYMER PROCESSING

Within the industry of macromolecular compounds, polymer processing is the last step resulting in goods for various activity domains. The objective of this course is to review the design and manufacture of polymer products, with particular emphasis on material selection and processing technology. The course offers competencies, skills and the necessary knowledge for the student to obtain processing mixtures and to transform them in finite products. The engineering properties of elastomers, thermoplastics, blends, composites and specialty polymers are discussed in terms of processing characteristics and end-use performance. Industrial processing operations such as milling, calendaring, extrusion, fibre spinning, moulding and mixing are presented in detail. The design component of the course requires students to select appropriate materials and processing methods for an engineering application.

INDUSTRIAL POLYMER MATERIALS

This course emphasizes the main polymeric materials classes such as thermoplastics, thermosets, elastomers, reinforced materials, fibres, but also the main types of additives within the composition of polymeric materials: plasticizers, stabilizers, filling agents, reinforcing agents etc. The course Industrial Polymeric Materials develops competences and skills and offer the necessary knowledge for the bachelor students to correctly choose the specific additives for a certain polymer, to correctly establish the polymer properties (mechanical, electrical, optical and thermal) and to correlate them with the polymer structure. The laboratory activity is very important for this discipline and it refers to: practical knowledge about main types of additives from the polymeric mixtures, main classes of industrial polymer materials (thermoplastics, elastomers, fibres etc), mechanical properties for different types of industrial-grade polymeric materials, physico-chemical analyses for the determination of additive content out of polymeric products.

ADHESIVES, PAINTS AND PUTTIES

Adhesives and surface coatings are a class of products based on the adhesive properties of polymers. Since they represent a class with a large area of application the subject addresses the most important aspects of the adhesive and film-forming materials: theory of adhesion, classes of adhesives (synthesis, application and testing), classes of film-forming materials (composition, manufacture, application and testing), including sealants, paints, varnishes and primers. The accent is on the engineering aspects such as designing an adhesive joint, choosing the best adhesive for a given situation, understanding the practical aspects of obtaining adhesive joints, classes of surface coatings and their main properties, types of polymers used as binders and additives for surface coatings (pigments, solvents, corrosion inhibitors).

POLYMER RECYCLING

Polymers are increasingly indispensable to humans because of their advantages, such as easy processability into various shapes, low cost, lightweight, and durability, over conventional materials. Following an introduction to various polymer structures and their resulting properties, the course initially deals with different methods of sorting. Then, industrial methods of recycling for common polymers as polyethylene, polypropylene and PET, as well as rubbers from the tire industry are presented. Detailed discussion of recycling of synthetic polymers, and some indications on the biodegradable polymers alternative are given. The whole discipline is rounded off with a look at future technologies and the impact of recycling on the polymers structure and properties.