COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	POLITEHNICA University of Bucharest
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics and Information Engineering
1.4 Domain of studies	Electronics, Telecommunications and Informational Technologies
1.5 Cycle of studies	License
1.6 Program of studies/Qualification	Applied Electronics

2. Course identification information

2.1 Name of the course				Chemistry			
2.2 Lecturer				Prof. Habil. Dr. Ing. Ileana Rău			
2.3 Instructor for practical activities				Prof. Habil. Dr. Ing. Ileana Rău, As. Dr. Ing. Cristina Dumitriu As. Dr. Ing. Daniela Romonţi			
2.4 Year of studies	I	2.5 Semester	I	2.6 Evaluation type	V	2.7 Course choice type	Compulsory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	3	3.2 course	2	3.3 practical activities	1
3.4 Total hours in the curricula, out of which	42	3.5 course	28	3.6 practical activities	14

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	24
Supplemental documentation (library, electronic access resources, in the field, etc)	3
Preparation for practical activities, homeworks, essays, portfolios, etc.	6
Tutoring	0
Examinations	3
Other activities	0

3.7 Total hours of individual study	36
3.9 Total hours per semester	78
3. 10 Number of ECTS credit points	3

4. Prerequisites (if applicable)

4.1 curricular	Chemistry, physics (molecular, thermodynamics, atomic physics, radiations, electricity), algebra, mathematic analysis learnt in high school.
4.2 competence-based	Make calculations, abilities in handling specific tools and equipment for chemistry laboratory

5. Requisites (if applicable)

5.1 for running the course	The existence of a properly equipped amphitheater (with a chalkboard and videoprojector) to ensure at least 1 m^2/student
5.2 for running of the applications	The existence of a properly equipped laboratory to ensure minimum 4 m^2/student. Compulsory attendance at laboratories (according to university regulations in UPB).

6. Specific competences

Professional competences	C1 Using fundamental elements relating to the circuits and electronic instrumentation;
Transversal competences	Honorable behavior, responsible, ethical, within the law to ensure the reputation of the profession;

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	The student acquires general knowledge on chemistry, fundamental science, involved in electronic devices (component) production. The information provided by the courses offers a better understanding of some chemical phenomena, such as those needed in the electronics industry. Moreover, the courses offer the tools for a better communication between the electronic engineers and specialists in chemistry.
4.2 Specific objectives	The purpose of this subject is to develop the student abilities to apply the general knowledge of chemistry in specific projects related to construction and applications of electronic devices. The received skills may be used in developing high technologies, where controlled chemical structures are essential (i.e. nanomaterials), and also for the ecological approach in the electronic industry field.

8. Content

8.1 Lectures	Teaching techniques	Remarks
Correlation between chemical bonds, structure and properties of materials. 1.1. Ionic, covalent and metallic bonds formation. Examples of chemical substances used in electronics (in crystalline, amorphous, liquid, liquid crystal state). 1.2. Surface phenomena. Adsorption. Colloids. Sol-gel processes. Micro and nano-dispersions. Membrane processes. 1.3. The influence of chemical structure on electrical, magnetic and optical properties of the substances. Applications on chemical and biochemical sensors. 1.4. Organic macromolecular compounds with applications in electronic industry. 1.5. Organic/inorganic Semiconductors.	Teaching is based on using the video projector (covering communication function and demonstration); the used oral communication methods are expository method and problem-method. Course materials are lecture notes and presentations..	6 ore
Thermodynamics of chemical processes. 2.1. Intensive and extensive state parameters. 2.2. Thermal effects of chemical processes at constant pressure and volume. Hess Law. Kirchhoff Law. 2.3. Thermodynamic functions: entropy, free energy, free enthalpy, correlated with chemical affinity. Chemical potential. 2.4. Phase Equilibriums, Phases Rule. Phase diagram for a pure compound. Vapor pressure. Using of Phase Diagrams in substances separation and purification 2.5. Chemical equilibrium. Principle of chemical equilibrium evolution. Relationship between thermodynamic functions and equilibrium constant.		6 ore
Kinetics of chemical reactions. 3.1. Kinetic parameters: chemical reaction rate, rate constant, reaction order, molecularity, activation energy. Simple and complex reactions. 3.2. Homogeneous chemical reactions. Reactions of 1st and 2nd order. 3.3. Heterogeneous reactions. Corrosion of metals and semiconductors in dry gases. Catalytic reactions.		4 ore

3.4. Chain reactions. Photochemical reactions. 3.5. Molecular theories in chemical kinetics. Molecular collisions. Theory of activated complex.		
Electrochemistry 4.1. Subject matter. Electrochemical cells. Electrochemical double layer. 4.2. Electrolytes. Ionic equilibrium. Electrical conductivity of electrolytes. 4.3. Electrochemical reactions. Electromotive force and thermodynamic functions of the reactions. Electrode potential. Electrodes types. Activity series of the elements. Polarization and over-potential. 4.4. Basic principles in bioelectrochemistry. 4.5. Electrochemical power sources. Primary, storage and fuel cells. 4.6. Electrolytic processes in electronic devices technologies. 4.6. Electrochemical corrosion. Thermodynamics and kinetics of corrosion process. Anticorrosive protection methods.		12 ore

Bibliography

- C. Pirvu, Chimie generala; Notiuni fundamentale, Ed. Printech, 2009.
- I. Rău, S.A. Popescu, General Chemistry, Ed Printech, 2009
- G. Hubca, M. Tomescu, C. Pirvu, Polimeri utilizati in electronica, electrotehnica si tehnica de calcul, Ed. Semne, 2006.
- Atkins, P. W. si Paula, J. de – Tratat de Chimie Fizica, Editura Tehnica, 2005.
- C.D. Nenitescu, Chimie generală, Ed. Didactică şi Pedagogică, Bucureşti, 1973.

Situl cursului: http://electronica07.curs.ncit.pub.ro

8.2 Practical applications	Teaching techniques	Remarks
Chemical kinetics. Determination of partial reaction order, of the rate constant and of the activation energy.	The laboratory is partially computerized and has the appropriate level of course material resources generally. By rotation, each group of two students performed a new practical work every laboratory session. The teaching materials are included in the tutorial lab platforms laboratory.	2 ore
Thermochemistry. Determination of neutralization enthalpy and dissolution enthalpy.		2 ore
Chemical equilibrium. Factors that influence the evolution of chemical equilibrium, Le Chatelier principle.		2 ore
Electrochemistry. Determination of the		2 ore

electrode potential. Daniell Jacobi cell electromotive force variation, as a function of the electrolytes concentration.		
Electrochemistry. Determination of the corrosion potential. Corrosion protection methods.		2 ore
Electrochemistry. Determination of the electrical conductivity of electrolytic solutions and of the dissociation constant.		2 ore
Laboratory final assessment.		2 ore

Bibliography

- M. Tomescu, C. Pirvu – Teste grila si aplicatii de chimie generala, Ed. Printech, Bucureşti, 2004.
- M. Mindroiu, C. Pirvu, R. Popescu, Chimie generală experimentală, Ed. Politehnica Press, 2008

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

Chemistry is one of the fundamental sciences that studies the structure of substances and their properties, looking at the same time on the effect of chemical reactions on substances.

The electronic devices industry has progressed rapidly in recent decades. Since the appearance of the first transistor and up to the complex integrated circuits, in which the size of the elements down to tens of nanometers, it past only few decades.

This progress is due to the development of technology in order to obtain materials with reliability, longevity, accuracy, light weight and special properties.

In order to achieve these performances the knowledge about the structure and properties of materials, the possibility of spontaneous evolution of chemical or physico-chemical processes, the thermal effects that accompany these processes and their progress rate, as well as the possibility of obtaining renewable energy are essential.

The Chemistry Course ensures introduction into the main concepts needed for the training of an engineer able to adapt to demands of market economy and new technologies.

It assures to graduates students appropriate skills for the actual training needs and a modern, quality and competitive scientific and technical training, enabling them a rapid employment after graduation, being perfectly framed in Politehnica University of Bucharest policy, both in terms of content and structure and in terms of skills and international openness for students.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	- Understanding and acquiring fundamental theoretical concepts of all chapters related to this subject; - Knowledge of the application of theory to specific problems;	Written test verification during the semester, held at a date fixed at the beginning of the course;	40%
		Individual report on fields of interest	10%
		Final verification	20%
10.5 Practical applications	- Participation in all laboratory works, understanding and knowledge acquisition for each practical work done in laboratory	Final colloquy Laboratory (oral evaluation)	30%
10.6 Minimal performance standard			
Proper use of basic knowledge in the field, acquired from the course material Attendance at all laboratory works and acquiring minimal knowledge related to each laboratory work done, proper use of knowledge acquired through participating in the laboratory;			

Date
18.10.2014

Lecturer

Prof. Habil. Dr. Ing. Ileana Rău

Instructor for practical activities

As. Dr. Ing. Crisina Dumitriu
As. Dr. Ing. Daniela Romonţi

Date of department approval
21.10.2014

Director of Department,
Prof. Dr. Ing. Cristian Pirvu