LMAPR2011

2014-2015

Methods of Physical and Chemical Analysis

5.0 credits	30.0 h + 30.0 h	1q

Teacher(s) :	Devaux Jacques ; Delcorte Arnaud ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=MAPR2011
Main themes :	The purpose of this course is to familiarize the student with the analytical methods used for the structural, elemental, chemical and molecular characterization of matter. An important part of the course concerns the analysis of materials in the solid state but some basic methods for the analysis of compounds in the liquid and the gas phase are also described. The course introduces the fundamental science needed for a good understanding of the characterization methods, such as the physics of radiation-matter interactions or the principles of compound separation in the liquid or the gas phase. The practical examples are chosen within the different application fields in which the engineer is expected to work, for instance, the technology of polymers and composites, the catalysis, the bio- and nanotechnologies, etc. Via interactive demonstrations of the analytical technique in the laboratory, the emphasis is put on the practical aspects of materials characterization in a spirit of solving problems such as those encountered in the industrial context.
Aims :	Contribution of the course to the program objectives See: http://www.uclouvain.be/prog-2014-kima2m-competences_et_acquis See: http://www.uclouvain.be/prog-2014-fyap2m-competences_et_acquis Axis Nº1 : 1.1 Axis N°2 : 2.2,2.3 Axis Nº5 : 5.1 à 5.5 Axis Nº6 : 6.1, 6.3 Specific learning outcomes of the course -- Explain the basic phenomena underlying the techniques used for materials characterization; -- Master the concepts related to wave- and particle-matter interactions and be able to explain the common points, differences and effects of the various types of interactions; -- In practice, indicate an appropriate method for the analysis of an unknown solid, liquid or gaseous sample and to justify the choice of method(s) to answer a problem in materials characterization (such as those encountered in the industrial context); -- Critically discuss the analysis results with experts in the considered domains; -- Write a concise lab experiment report, structured and adequately illustrated, describing the technical aspects of the analysis, from the sample preparation protocol to the obtained results, in a precise scientificlanguage. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Written test during the exam period, laboratory reports.
Teaching methods :	The course is taught in the form of presentations in the classroom, with various examples of applications of the analysis methods to the different fields of activities in which the chemical/physical engineer is likely to evolve. The practical training to the characterization techniques is performed in the laboratory, using the numerous instruments available in the IMCN institute.
Content :	-- INTRODUCTION: Characterization of matter: structure, composition; Physical and chemical methods; Classification, scales, application fields. -- SPECTROSCOPIC METHODS - BASICS: Interacting medium; Types of radiations; Electromagnetic waves; Wave-corpuscle duality; Common bases of the spectroscopic techniques (signal to noise ratio, resolution, etc.) -- ABSORPTION/EMISSION SPECTRO(PHOTO)METRY: Principles of atomic absorption / emission; Lambert-Beer law; absorption / emission methods (Ex: Fluorescence, UV vis, infrared, Raman, nuclear magnetic resonance etc.) -- X-RAY DIFFRACTION AND CRISTALLOGRAPHIC STRUCTURE: Elastic interaction of XR with matter; LAUE kinematic theory; Experimental methods of XR diffraction; Structure determination by RX. --

	ELECTRON-MATTER INTERACTION AND ELECTRONIC MICROSCOPIES: Types of electron-matter interactions and electronic emission; Scanning (SEM+EDX) and transmission microscopy (TEM); Electronic diffraction and electron microprobe (Auger). -- MASS SPECTROMETRIES AND HYBRID METHODS: Principles and ion sources; Mass spectrometers; Structural analysis; Analysis of gas and solutions (Ex: GC-MS, LC-MS); Analysis and imaging of solid samples; Ambient mass spectrometry. -- INTRODUCTION TO SPECIALIZED COURSES OF SURFACE ANALYSIS: Characterization of inorganic materials; Physical and chemical surface analysis.
Bibliography :	-- Slides of the presentations; -- Reference textbooks on materials characterization.
Other infos :	The course presentations and the slides are in English.
Cycle and year of study :	> Master [120] in Biomedical Engineering > Master [120] in Physical Engineering > Master [120] in Chemical and Materials Engineering
Faculty or entity in charge:	FYKI