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**COURSE: COMPLEMENTS OF APPLIED ELECTROCHEMISTRY**

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**ACADEMIC YEAR: 2016-2017**

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**TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characterizing, Affine, Free choice, Other) F**

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**TEACHER: Casella Innocenzo**

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**Language: Italian**

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**ECTS: (lessons e  
tutorials/practice): 6****n. of hours: (lessons e  
tutorials/practice): 48****Campus: Potenza/Matera  
Dept./School:  
Program:****Semester: II**

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**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

The objectives of this course are based on the acquisition and general knowledge about the basic aspects of the applied electrochemistry.

A first part of the course aims to the understanding some important concepts of thermodynamic and kinetics in electrochemistry.

The definition of galvanic and electrolysis cells; electrodes and their characteristics.

Electrochemistry in the analysis context: potentiometric measurements and titrations, pulsed amperometric detection techniques, etc.

The discussion and graphical approach of E-pH should provide useful means of evaluation and prediction about the evolution of the common corrosive processes.

The second part of the course aims primarily to the understanding of the basic principles of electrochemistry and it is direct to description of some important industrial applications for the production of substances of general interest.

The main objectives that the course aims are primarily:

- Acquisition of basic knowledge of the electrode kinetics and some relevant thermodynamic aspects;
- Management and prediction of some important redox species to the equilibrium conditions;
- Knowledge of the main practical applications of electrochemistry for the production of species of interest.

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**PRE-REQUIREMENTS**

The optimal approach of the Course in Applied Electrochemistry implies the minimal knowledge of:

Mathematics and Physics.

In addition, is necessary the acquisition of the basic knowledge of General Chemistry, Analytical Chemistry I and Physics-Chemistry I.

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SYLLABUS

- 1) Measurements in electrochemistry, electrode potentials, cells. Cells with and without transportation. Electrochemical and galvanic cells. production / energy conservation. Galvanic cells for the measurement of the equilibrium species. Calculation and measurement of pH limits. pH measurement error associated with the uncertainty of the junction potential.
- 2) Methods of electrochemical investigation: voltammetric / polarographic: on macro-micro solid and liquid electrodes, etc. Equations Heyrovsky, Ilkovich, etc. Technical differential pulsed. Techniques of stripping voltammetry. chemically modified electrodes.
- 3) Kinetics of electrode: Potential electrode and kinetics conditions: overvoltage. Kinetic control of electrochemical reactions. Butler and Volmer equation. Tafel equation. The charge transfer resistance. diffusion limiting current. discharge curves. Electrochemical reversibility/irreversibility.
- 4) Corrosion Processes: Construction and use of potential-pH diagrams (Pourbaix). Evans diagrams. Types of corrosion.
- 5) Energy storage systems: Primary batteries (or batteries): conventional cells (Pile Leclanché, Alkaline batteries, secondary batteries, fuel cells, batteries with intercalation, etc.
- 6) Electrochemical processes for environmental remediation and removal of molecules of interest.  
Environmental: General Definitions; types of working electrodes and application examples. Chlorination processes.
- 7) The Electrochemistry in industrial production processes: chloralkali process; use of electrolysis cells with and without transport; production of aluminum, copper, etc.

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TEACHING METHODS

At the beginning of the course es is presented the program of the lessons and successively:

- Presentation of the program and approach at the study; modality of interaction, etc.
- Brief description of each topic to be treated and its relevant bibliography;

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EVALUATION METHODS

The evaluation procedures provide a direct comparison phase with students during the cycle of lessons through numerical exercises and questions of topics of interest.

The final and definitive evaluation concerning the verification of the learning state, is based on oral examination with numerical approach to the subject of study.

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TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Electrochemical Methods. A.J. Bard, L.R. Faulkner. John Wiley & Sons, New York.

Trattato di Elettrochimica, G. Kortum, Piccin Editore

Electroanalytical Methods, F. Scholz (Ed) Springer.

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INTERACTION WITH STUDENTS

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EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

24/03/2017; 12/05/2017; 23/06/2017; 27/07/2017; 20/10/2017; 15/12/2017; 26/01/2018

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.