**COURSE SYLLABUS**

|  |  |
| --- | --- |
| **Subject: Electrochemistry** | **Academic field: Materials Science and Nanotechnology** |
| **Lecturer: NGUYEN Van - Quynh** |  |
| **Phone : 0973327073** | **E-mail: mr.quynh311 @gmail.com** |
| **Academic year: 2015-2016** |  |

**COURSE DESCRIPTION**

|  |  |
| --- | --- |
| **Credit points** | 4 |
| **Level** | Bachelor |
| **Teaching time** **Location** | DD/MM/YYYYUniversity of Science and Technology of Hanoi |
| **Time Commitment** | Lecture | 24 hrs |
| Exercise  | 6 hrs |
| Practice | 10 hrs |
| Lab-work | 0 hrs |
| Total | 40 hrs |
| **Prerequisites** | Students should have knowledge on fundamental physical chemistry |
| **Recommended background knowledge** | Fundamental knowledge on electrochemistry is needed. |
| **Subject description:** |  The course provides basic knowledge on electrochemical batteries, including fuel cells and their potential applications. |
| **Objectives & Out-come** | Understanding the chemistry of some electrochemical objects, including batteries and fuel cells. |
| **Assessment/ Evaluation** | Attendance/Attitude | 10 % |
| Class exercise(s) | 10 % |
| Practical | 20% |
| Final exam | 60 % |
| **Prescribed Textbook(s)** | [1] Allen J. Bard Larry R. Faulkner, Electrochemical Methods: Fundamentals and Applications, John Wiley & Sons, Inc., 2001 |

**COURSE CONTENTS & SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Class**  | **Contents** | **Hours** | **Ref./Resources** | **Assignment(s)**  |
| **Lect.** | **Exr.** | **Prc.** |
| 1 | 1. **Potentials and Thermodynamics of cells**
	1. Basic electrochemical thermodynamics
	2. A more detailed view of interfacial potential differences
	3. Liquid junction potentials
 | 3 | 0 | 0 |  |  |
| 2 | 1. **Kinetics of electrode reactions**
	1. Butler – Volmermodel of electrode kinetics
	2. Implications of the Butler – Volmer model for the one-step, one-electron process
 | 3 | 3 | 0 |  |  |
| 3 | 1. **Mass transfer by migration and diffusion**

3.1.Derivation of general mass transfer equation* 1. Migration
	2. Mixed migration and diffusion near an active electrode
	3. Diffusion
 | 3 | 3 | 0 |  |  |
| 4 | 1. **Essential electrochemical technique**
	1. Potentiometry
	2. Voltammetry
	3. Electrochemical Methods of Analysis
	4. Digital Simulation, Equivalent Circuit, Impedance
 | 3 | 0 | 5 |  |  |
| 5 | 1. **General introduction of applications**
* Industrial Electrolytic Processes
* Electrochemical Reactors
* Corrosion of Metals
* Electroplating
* Fuel Cells
* Batteries (Electrochemical Power Sources)
 | 3 | 0 | 2 |  |  |
| 6 | 1. **Electrochemical Energy Conversion**
* Electrical characteristics
* Chemical current - producing reactions in batteries
* Performance of batteries
* OCV and Discharge Voltage
* Electrical Characteristics of Storage Batteries
* Comparative Characteristics
 | 3 | 0 | 0 |  |  |
| 7 | 1. **Fuel cells**
* Design principle
* Relationships between parameters in fuel cells
* Types of Fuel cells (Direct Methanol; Methanol Permeation Through the Membrane; Development Prospects)
 | 3 | 0 | 0 |  |  |
| 8 | 1. **Photoelectrochemistry and photogalvanic cells**
* Semiconductor Electrodes
* Current-Potential Curves at Semiconductor Electrodes
* Photo effects at Semiconductor Electrodes
* Surface Photocatalytic Processes at Semiconductor Particles
* Electrochemistry of Photolytic Products
* Photogalvanic Cells
 | 3 | 0 | 3 |  |  |

*Notes:*

* *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*
* *Assignments may include assignments, practical work, reports, exercises ...for each class sessions*

**Reference Literature:**

[1]. Christopher M.A. Brett and Ana Maria Olivia Brett, Electrochemistry: Principles, Methods and Applications, Oxford University Press, 1993.

[2]. V. S. Bagotsky, Fundamentals of Electrochemistry, Second Edition, John Wiley & Sons, Inc., Publication, 2005

[3]. R.G.Compton, C.E. Banks, Understanding Voltammetry, Second Edition, Imperial College Press, 201