Course specification

University/Academy: Damanhour University

Faculty/Institute: Faculty of Science

Department: Chemistry

1. Course Data:

Course code: Chem. 421	Course title: **Physical Chemistry 5**	Academic year/level: 2010-2011 Fourth year – first term
Specialization: **Chemistry/Physics** - **Chemistry/Botany** - **Chemistry/Zoology** - **Chemistry/Microbiology** - **Chemistry/Biochemistry**	No. of instructional units: lecture 2 tutorial 1 practical 5	

Course Aim	**This course is aimed to give a solid foundation of phase equilibria and electrochemistry of electrolytic solutions that may be required by the students in the course of their careers.**

2. Intended learning outcome

Knowledge and understanding	**At the end of this course the students will be able to know and understand the following:** **a1. Recognize the homo- and heterogeneous phase equilibria, recognize the thermodynamic treatment of the phase rule, discuss the different application of phase rule for one, two and three components systems, memorize the fractional distillation techniques and curves as well as fractionating column..** **a2. Describe Advanced Electrochemistry (Electrolytic)**
Intellectual skills	**At the end of the course, students should be able to:** **b1. Deduce the phase rule and Tafel equations** **b2. Analyze e the number of degrees of freedom for different systems** **b3.compaire between different types of overpotential.**

Professional skills	**At the end of this course students will have the ability to:** **c1. Examine practical skills in electrochemistry and phase rule.** **c2. Manage skills that enable a harmonic working group.**
a) General skills	**At the end of this course students will have the ability to:** **d1. Communication skills, covering both written and oral communication.** **d2. Problem-solving skills, relating to qualitative and quantitative information.**
3. course content	**Introduction, homo- and heterogeneous equilibrium, definitions of P, C and F.** **-Deduction of the phase rule equation, examples and problems.** **-Thermodynamic treatment of the phase rule (Clausius-Clapeyron Equation).** **-One component systems: (water system and CO2 system).** **One component systems: (carbon system, sulfur system), Definition of polymorphism, allotropy and enantiotropy.** **-One component systems: (phosphorous system).** **Two component systems: classification, liquid-liquid equilibria, properties of ideal solutions, fractional distillation technique and curve, Fractionating Column.** **Two component systems: fractional distillation curve for real solution, the Lever rule for partially miscible liquids. Immiscible liquids system.** **Two component systems: solid-liquid equilibria , eutectic systems with completely miscible liquids, and with partially miscible liquids.** **Two component systems: solid-liquid equilibria , eutectic systems with congruent melting point, and with incongruent melting point.** **Two component systems: Solid solution, completely miscible, Ideal and real solid solution with partial miscibility.** **Three component systems: Construction of the phase diagram, System of three liquids,** **Plait point, effect of temperature.** **Three component systems: retrograde solubility, three components system with two and three pairs of partially miscible liquids.** **-Nature of electrolyte solution.** **-Derivation of ionic atmosphere theory** **-Debye-Huckel and activity relationship –DHLL- DHEL** **-Bjerium theory – ion pairs and association constant** **-Born model (ion –solvent interaction)** **-Electrocapillary phenomena- definition of electrical double layer – measurements of interfacial tension**

	Structure models of EDL **-Stern model and its postulates, Types of overpotential** **-Tafel equation – slow discharge theory – slow combination theory** **-Theories of corrosion** **-Electrochemical mechanism of corrosion** **-factors affecting corrosion – passivity – Flade potential** **- Pourbaix diagrams** **-Inhibitors, protection of metals by coating**
Teaching and learning methods	**4.1. Lecture** **4.2. Contact hours** **4.3. Problem-Based Learning** **4.4. Encourage students to use online and library resources**
Teaching and learning methods for students with special needs	• **Computer hall to be used in visual labs and simulation experiments.** • **Data show, overhead projector, Molecular models and chemistry computer programs.** **Changing to credit hours system, it is more effective.**
4. Student Assessment	**Class activities (reports, discussions, practical…etc) to assess the student intellectual, professional, and general skills** **Final-Term Examination to assess the student skill in presenting facts, applications, theories and calculations.**
Procedures used:	**Assessment Schedule** Week: 16
Schedule:	**Assessment 1: Practical Examination Week12** **Assessment 2: Final-Term Examination Week16**
a) Weighing of Assessment:	Mid-Term Examination: **10** Final-Term Examination: **100** Practical Examination: **80** Semester Work: **10**

	Total: 200
List of Textbooks and References:	**Modern Electrochemistry 1: Ionics, John O'M. Bockris and Amulya K.N. Reddy, Springer; 2nd edition (March 1998).** **The phase rule and heterogeneous equilibrium, John E. Ricci, Dover Publications, New York, 1966.** **General Chemistry, Peter William Atkins and J. A. Beran, W.H. Freeman &Sons Company; 2nd edition (March 1992).**
Course Notes	**Lecture notes of physical chemistry for 4th year students - faculty of science – Damanhour University.**
Required Books (Textbooks)	**Modern Electrochemistry 1: Ionics, John O'M. Bockris and Amulya K.N. Reddy, Springer; 2nd edition (March 1998).** **The phase rule and heterogeneous equilibrium, John E. Ricci, Dover Publications, New York, 1966.** **General Chemistry, Peter William Atkins and J. A. Beran, W.H. Freeman &Sons Company; 2nd edition (March 1992).**
Recommended Books	**The Physical Chemistry Of The Metals, Friedrich Rudolf Schenck, Read Books (January 31, 2008)**
Periodicals, web sites,…,etc	**http://www.tulane.edu/~sanelson/geol212/2compphasdiag.html** **http://www.ac.wwu.edu/~debari/406/Lec6to9.htm**

Course Instructor

Dr. Medhat A. Shaker

Date: **20 / 9 / 2009**

Head of Department

Dr. Medhat A. Shaker