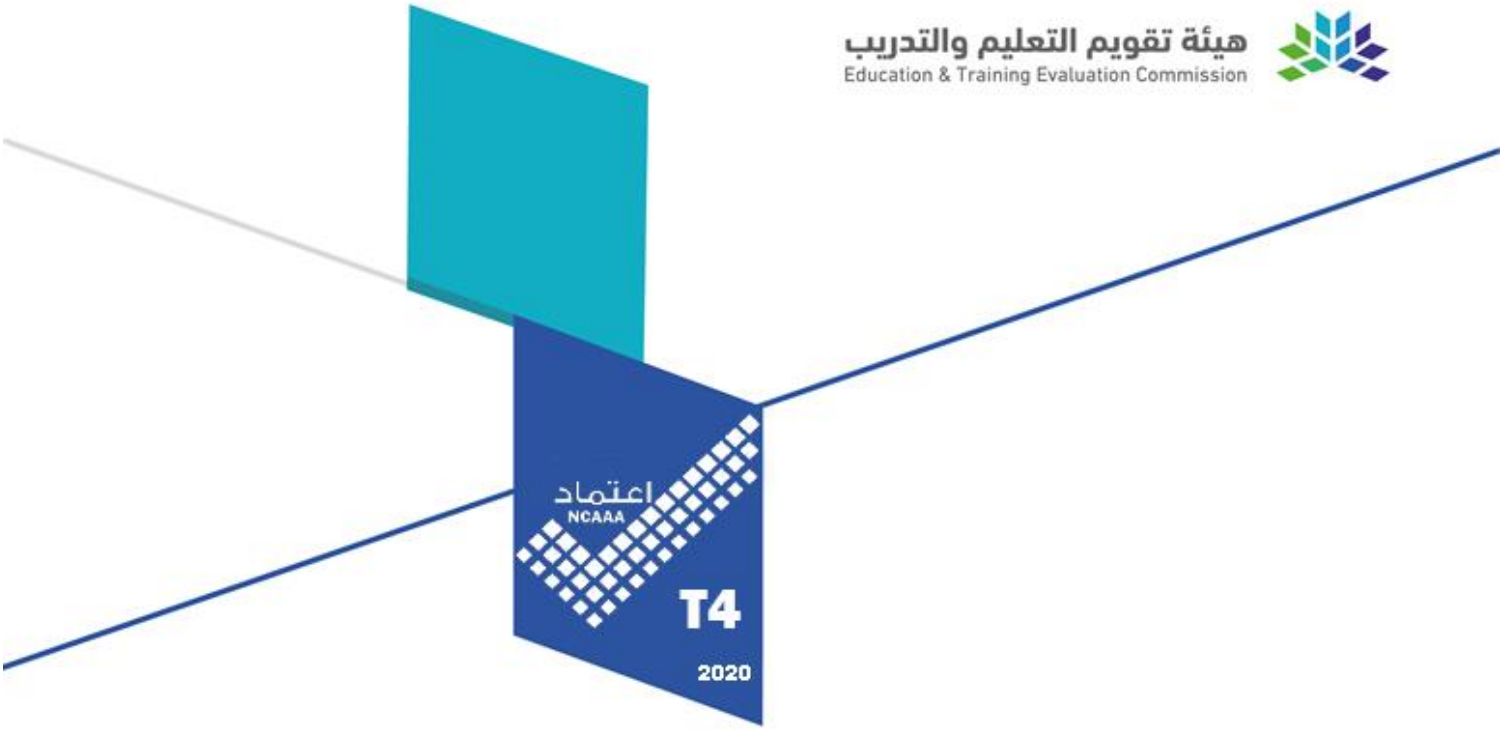
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission



Course Specifications

Course Title:	**Solution chemistry**
Course Code:	**CHEM 445**
Program:	**Bachelor in Chemistry**
Department:	**Chemistry**
College:	**College of Science**
Institution:	**Jazan University (J U)**

Table of Contents

A. Course Identification

1. Credit hours: 3hs **Workload:** 167 **ECTS:** 6.0	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 7 Year 4	
4. Pre-requisites for this course (if any)**:**	
none	
5. Co-requisites for this course (if any)**:**	
none	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	100 %
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

Course Title	Course Number	Contact Hours (CH)		Credit unit (CU)	Year	Level	Pre-requisite
		Lec.	Prac.				
Electrochemistry	CHEM 445	2	1	3	4	7	none

Course Objectives

- ***Become acquainted with the theory and assumptions of Debye - Hückel.***
- ***Become acquainted with the electrolytic conductivities and their applications***
- ***Become acquainted with the theory of diffusion and transport numbers and implications***
- ***Identify Ion Association and the various theories that have addressed ion association.***

Syllabus: A-Theoretical contents

a) The scientific content of the theoretical part:

- ***Debye – Hückel theory, Concentration and activity, Electrolytic conductance, Ionic association, Properties of electrolytic conductance, diffusion theory, Transport numbers, Theories of ion association, Bjerrum theory, Brönsted theory, Fuoss theory, Different methods for measurements of ion association.***

b) The scientific content of the practical part:

- ***Some selected experiments in the field of chemical kinetics, thermo chemistry and solution chemistry.***

Syllabus: A-Practical contents

Experimental work illustrating selected parts of the theoretical content.

2. Course Main Objective

The course is designed to give the students basic information about the Solution chemistry, Debye Huckel theory, conductivity measurements and its application, Transport numbers and Ion association

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:** ***Upon completion of this course, student will be able to***	
1.1	***Demonstrate a broad understanding and critical view on principal of solution chemistry, Concepts and terminology of solution topics including; Types of electrolytic solution, conductivity and different theories that treat the conductivity of both strong and weak electrolytes and their applications (M)***	***K1***
1.2	***Describe correctly the different phenomena associated with electrolytes conductivity, factors affecting conductivity, application of conductance measurements, Transport number and ion association theories (M)***	***K2***
2	**Skills :** ***Upon completion of this course, student will be able to understand***	
2.1	***Demonstrate an ability in critical thinking, numeracy, statistical, analytical reasoning, use graphs, charts and to solving problems related to Debye***	***S1***

CLOs		Aligned PLOs
	Huckel Theory and conductivities calculations (P)	
2.2	***Perform experiments in solution chemistry, record, analyze, interpret the scientific data, and write reports. (M)***	***S2***
2.3	***Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals. (P)***	***S3***
2.4	***Write a report/ poster on electrochemistry using communication and online technology in a good verbal and clear scientific language. (M)***	***S4***
3	**Values:**	
3.1	*Possess a good interpersonal skill with high ability to work collaboratively as part of a team undertaking a range of different team roles* ***(P)***	***V1***
3.2	*Act with integrity and good ethics in chemistry profession and their obligation to society* ***(P)***	***V2***

C. Course Content

No	List of Topics	Contact Hours
1	Basic concepts of solution chemistry	1
2	Postulates of Debye – Huckel theory	2
3	Derivation of Debye Huckel theory	5
4	Experimental support for the limiting law Solubility of sparingly soluble salt	5
5	Treatment of conductance data of weak electrolyte	4
6	Transport properties in electrolyte	4
7	Ionic velocity and mobility	4
8	Electrolytic conductance	2
9	Application of conductance measurements	2
10	Ionic association	1
11	Selected topics related to course content	30
Total		***60***

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding** ***Upon completion of this course, student will be able to***		
1.1	***Demonstrate a broad understanding and critical view on principal of solution chemistry, Concepts and terminology of solution topics including; Types of electrolytic solution, conductivity and different theories that treat the conductivity of both strong and weak electrolytes and their applications (M)***	***lecture / discussion Seminars /presentation***	***oral and written examinations laboratory reports***

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.2	*Describe correctly the different phenomena associated with electrolytes conductivity, factors affecting conductivity, application of conductance measurements, Transport number and ion association theories (M)*	*lecture / discussion / Seminars /Individual presentation*	*oral and written examinations laboratory reports*
2.0	**Skills** *Upon completion of this course, student will be able to*		
2.1	*Demonstrate an ability in critical thinking, numeracy, statistical, analytical reasoning, use graphs, charts and to solving problems related to Debye Huckel Theory and conductivities calculations (P)*	*lecture / discussion / Seminars /Individual presentation*	*oral and written examinations laboratory reports*
2.2	*Perform experiments in solution chemistry, record, analyze, interpret the scientific data, and write reports. (M)*	*Lab work, group work*	*lab report/ Lab notebook.*
2.3	*Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals. (P)*	*lab demonstrations / hands-on student learning activities*	*Observation of practical skills / Safety exam / Practical assignments and laboratory reports*
2.4	*Write a report/ poster on electrochemistry using communication and online technology in a good verbal and clear scientific language. (M)*	*research activities / project-based learning / Technology-enabled learning*	*assignments and reports / project / seminar / report*
3.0	*Values* *Upon completion of this course, student will be able to*		
3.1	*Possess a good interpersonal skill with high ability to work collaboratively as part of a team undertaking a range of different team roles*	*lab demonstrations /hands-on student learning activities / whole group and small group discussion / project-based learning / Internship in industry*	*group project reports / Practical assignments and laboratory reports*
3.2	*Act with integrity and good ethics in chemistry profession and their obligation to society*	*research activities / project-based learning / Technology-enabled learning / group work discussion*	*Viva voce interviews assessment methods*

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score

1	*Homework assignment*		*2*	*1 %*
2	*Mid-term exam*		*6*	*15 %*
3	*Presentation (S4)*		*12*	*2*
4	*Group work report (V1)*		*10*	*2*
5	*Ethics rules examination in research (V2)*		*10*	*3*
6	*Quiz in Safety (S3)*		*9*	*2*
7		*LAB final Sheet*	*15*	*5 %*
8		*Lab reports*	*During semester*	*10 %*
9		*Final practical exam*	*15*	*10 %*
10	*Final Exam*		*16*	*50 %*
			Total	*100 %*

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- ***Instructor will be available for academic counseling on daily basis for at 4h/day during office hours.***
- ***The office hours are listed in the instructor time table and delivered to students in the first lecturer in each semester.***
- ***Instructor is available in a WhatsApp group with student.***
- ***E-mail and Telephone number are delivered to student for any help during semesters.***

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	An Introduction to Aqueous Electrolyte Solutions, by Margaret Robson Wright Formerly of St Andrews University, UK. Willy 2007.
Essential References Materials	An Introduction to Aqueous Electrolyte Solutions, by Margaret Robson Wright Formerly of St Andrews University, UK. Willy 2007.
Electronic Materials	***Some course contents and materials are posted on Black board sites***
Other Learning Materials	• https://chem.libretexts.org/Special:Search?qid=&fpid=230&fpth=&query=electrolyte+solution&type=wiki. • ***www.wikipedia.org/*** ***http://www.wpi.edu/Academics/Depts/Chemistry/Courses/General/***

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	***1 Lecture room(s) for groups of 50 students*** ***1 Lab room for group of 25student***
Technology Resources (AV, data show, Smart Board, software, etc.)	***Smart board, Data show, Black board, Internet***

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	***Conductivity meter, pH meter, Power source, Balance, viscometers and density bottles.***

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	***Student***	***Likert-type Survey (CES) Indirect***
Extent of achievement of course learning outcomes	***Instructor & Course coordinator***	***Class room evaluation (direct & indirect)***
Quality of learning resources	***Program coordinator***	***Indirect***
Exam Quality assessment	***Assessment committee***	***Indirect***
Effectiveness of Teaching and Assessment	***Student***	***Likert-type Survey (CES) Indirect***

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Chemistry Department Council
Reference No.	42 / 35 /102 112
Date	17 /09 /1442 Corresponding to 28 / 04 /2021

Attachment:
LAB EXPERMENTS

Week	EXPERMENTAL TITLE	Chemicals and Apparatus used	Remarks
1	Safety and regulations		
2	Revision on Determination of cell constant	Acids ,bases ,conductivity cell and conductivity meter	None
3	Revision on Determination of equivalent conductance of strong electrolyte	HCl , conductivity cell and conductivity meter	None
4	Revision on Determination of equivalent conductance of weak electrolyte	Acetic acid , conductivity cell and conductivity meter	None
5	Validation of Debye Huckel theory using Ionic strength Calculations	HCl, NaOH, conductivity cell and conductivity meter	None
6	Experimental validation of Kohlrausch's Law for weak electrolytes	HCOOH, Acetic acid, NH_4OH, conductivity cell and conductivity meter	None
7	Experimental validation of Kohlrausch's Law for strong electrolytes	KCl, NaCl, NaOH, conductivity cell and conductivity meter	None
8	Experimental Validation of Ostwald's dilution law	Acetic acid, conductivity cell and conductivity meter	None
9	Determination of ionization constant of some selected electrolytes	HCl, NH_4Cl, HCOOH, CH_3COOH, H_2SO_4, conductivity cell and conductivity meter	None

For unavailable equipments, we use some stimulated experiments through links as:
https://pages.uoregon.edu/tgreenbo/voltaicCellEMF.html
http://introchem.chem.okstate.edu/DCICLA/voltaicCell20.html