Course Specification
(Bachelor)

Course Title:	SOLUTION CHEMISTRY
Course Code:	445CHEM3
Program:	Bachelor of Science in Chemistry
Department:	Physical Sciences
College:	College of Science
Institution:	Jazan University (JU)
Version:	TP 153- 2024
Last Revision Date:	5/5/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3H)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (Level 7//Year 4)

4. Course general Description:

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre- requisite*
		Lec.	*Prac.*				
Solution Chemistry	*445CHEM3*	*2*	*1*	*3*	*4*	*7*	*344CHEM3*

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

Course objectives: They are to identify the following.

- ***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.

5. Pre-requirements for this course (if any)**:**

344CHEM

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

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

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

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

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**; (Upon completion of the 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 chemistry topics including electrolyte solution, Debye Huckel (DHLL) Theory, Application of DHLL in determinations of solubility measurements, activity coefficient,	K(1.1)	***lecture / discussion Seminars /presentation***	***Objective question***

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	electrolytic conductance, ion association theories ……etc. (P)			
1.2	Describe correctly the different phenomena associated with solution chemistry i.e.; Kohlrausch's laws for weak and strong electrolyte, Arrhenius theory, application of conductance measurements (P)	K(1.2)	***lecture / discussion / Seminars /Individual presentation***	Essay question
2.0	**Skills**; (Upon completion of the 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, electrolytic conductance, different laws, and theories based on electrolytic conductance. (P)	S(2.1)	***lecture / discussion / Seminars /Individual presentation***	Solving Problems & chart analysis
2.2	Perform experiments in Solution chemistry, record, analyze, interpret the scientific data, and write reports. (P)	S(2.2)	***Lab work, group work***	***Objective question, Essay question,*** ***lab report rubric***
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)	S(2.3)	***lab demonstrations / hands-on student learning activities***	***Safety exam***
3.0	**Values, autonomy, and responsibility**; (Upon completion of the course, student will be able to)			
3.1	Working as a group leader in cooperation with other colleagues. (P)	V(3.1)	***lab demonstrations / whole group and small group discussion***	***Practical group work Rubric***

C. Course Content

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

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	*Homework assignment*	*3-12*	*2 %*
2.	*Lecture Quizzes*	*4-12*	*3 %*
3.	*Mid-term exam*	*9-12*	*15 %*
4.	*LAB Sheet*	*15*	*5 %*
5.	*Quiz in Safety*	*15*	*4%*
6.	*Final practical exam*	*15*	*7 %*
7.	*Lab report*	*2-13*	*10 %*
8.	*Group work evaluation*	*2-13*	*4%*
9.	*Final Exam*	*16-17*	*50 %*
...	*Total*		*100 %*

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	An Introduction to Aqueous Electrolyte Solutions, by Margaret Robson Wright Formerly of St Andrews University, UK. Willy 2007.

Supportive References	Essentials Of Physical Chemistry. Bahl A., et al. S.Chand. 2010, English. 4ed. 1166\1166. 1122910
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. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1 Lecture room(s) for groups of 50 students
Technology equipment (projector, smart board, software)	Smart board, Data show, Black board, internet
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect
Effectiveness of Students assessment	Instructor & Course coordinator	Classroom evaluation (direct & indirect
Quality of learning resources	Program coordinator	Indirect
The extent to which CLOs have been achieved	Assessment committee	Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council
REFERENCE NO.	Psci2415
DATE	28/03/1446 Corresponding to 1 / 10 /2024

H. Attachments

1- Practical Work

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 Hückel 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	Experimental Validation of Ostwald's dilution law for weak base	Amm Hydroxide, conductivity cell and conductivity meter	None
10	Experimental Validation of Ostwald's dilution law	Acetic acid, conductivity cell and conductivity meter	None
11	Determination of ionization constant of some selected electrolytes	HCl, NH_4Cl, HCOOH, CH_3COOH, H_2SO_4, conductivity cell and conductivity meter	None
12	Determination of square root law for ammonium oxalate	Amm. Oxalate, conductivity cell and conductivity meter	None
13	Determination of square root law for ammonium hydroxide	Amm. hydroxide, conductivity cell and conductivity meter	None
14	Effect of Temperature of Conductivity	HCl, NH_4Cl, HCOOH, CH_3COOH, H_2SO_4, conductivity cell and conductivity meter	None
15	Revision		None

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

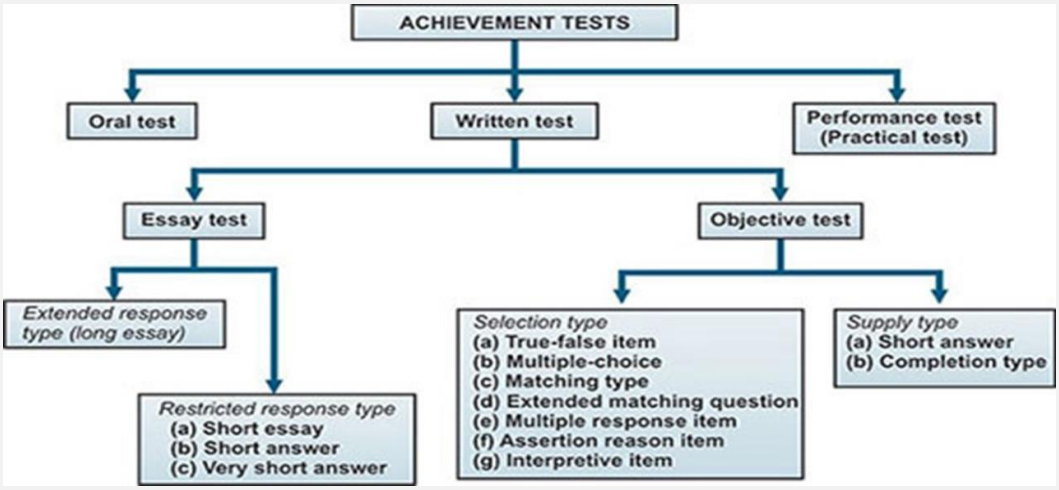
2- Blue Print

2- Blue Print

Course Name	Solution Chemistry
Course Code	445CHEM-3

PLOs	K1	K2	S1	S2	S3	S4	V1	V2
CLOs	1.1	1.2	2.1	2.2	2.3	2.4	3.1	3.2
Marks	12	20	38	21	4	--	5	---

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	1.1 (12M)	Quiz	Objective question	1	1	1
			Mid term	Objective question	2	2	2
			Final Exam	Objective question	9	9	9
	K2	1.2 (20M)	Quiz	***Essay question***	2	2	2
			Mid term	***Essay question***	4	4	4
			Final Exam	***Essay question***	2	14	14
Skills	S1	2.1 (38M)	H.W	Solving Problems & chart analysis	4	2	2
			Quiz	Solving Problems & chart analysis	2	2	2
			Mid term	Solving Problems & chart analysis	2	5	7
			Final Exam	Solving Problems & chart analysis	6	24	27
	S2	2.2 (21M)	Practical Sheet	Objective question	6	3	3
				Essay question	2	2	2
			Lab Report	10 EXP.	10	10	10
			Final Lab Exam	Task	1	7	7
	S3	2.3 (4M)	Safety Quiz	Objective question	8	4	4
Value	V1	3.1 (5M)	Continuous assessment	Group evaluation rubric	-	5	5
TOTAL		100					100


ACHIEVEMENT TESTS
Oral test
Written test
Performance test (Practical test)
Essay test
Objective test
Extended response type (long essay)
Restricted response type
(a) Short essay
(b) Short answer
(c) Very short answer
Selection type
(a) True-false item
(b) Multiple-choice
(c) Matching type
(d) Extended matching question
(e) Multiple response item
(f) Assertion reason item
(g) Interpretive item
Supply type
(a) Short answer
(b) Completion type