Sana'a University
Faculty of Engineering
Mechatronics Engineering Department
Mechatronics Engineering Program

Course Specification of Engineering Chemistry

I. Course Identification and General Information:

1.	Course Title:	Engineering Chemistry.				
2.	Course Code & Number:	BR003.				
3.	Credit hours: 3	C.H				TOTAL Credit Hours
		Th.	Seminar	Pr.	Tu.	
		2	-	-	2	3
4.	Study level/ semester at which this course is offered:	First Yeat- Second Semester.				
5.	Pre –requisite (if any):	Nil.				
6.	Co –requisite (if any):	Nil.				
7.	Program (s) in which the course is offered:	Mechatronics Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechatronics Engineering Department.				
10.	Prepared By:	Ass. Prof. Dr. Riyad A. Muharram.				
11.	Date of Approval:					

II. Course Description:

This course will focus on the concepts of theoretical and its application in the field of engineering chemistry and highlighted the theories which are based in this field. They are: gases laws and gases liquefactions, engineering materials & applications, thermodynamic's laws and energetics, conductors, semiconductors and insulators. It also aims to define the student in electrochemistry, electrochemical cells , chemical and electrochemical power sources and as well as corrosion &corrosion control, fuels and combustion, treatment of industrial wastes and pollution and it's control.

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
Ass. Prof. Dr. Riyad Muharram	Ass. Prof. Dr. Abdul-Malik Momin	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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III.	Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a.1	Characterize the principles of Chemistry science in the area of the Mechatronics.	A1
a.2	Classify methodologies for data collection and interpretation in solving engineering problems via engineering chemistry knowledge.	A3
a.3	Depict impacts of effective Mechatronics solutions on society and environment issues related to chemical engineering.	A7
b.1	Integrate fundamental chemical parameters and standards to construct useful Mechatronics products.	B1
c.1	Employ standard chemical specifications while integrating Mechatronics systems.	C5
d.1	Cooperate efficiently in the evaluation and integration of information and share learned knowledge.	D1
d.2	Defend acquisition of new knowledge as a part of life- long learning strategy.	D5
d.3	Review a search of literature and use databases and other sources of information.	D7

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Characterize the principles of Chemistry science in the area of the Mechatronics.	• Lecture. • Tutorial.	• Written examination for assessment of knowledge and understanding.

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a2. Classify methodologies for data collection and interpretation in solving engineering problems via engineering chemistry knowledge.	• Lecture. • Tutorial / demonstration • Discussions.	• Assignment assessment. • Partial and total work assessment**.**
a3. Depict impacts of effective Mechatronics solutions on society and environment issues related to chemical engineering.	• Lecture. • Tutorial / demonstration. • Discussions.	• Written examination**.**

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Integrate fundamental chemical parameters and standards to construct useful Mechatronics products**.**	• Lecture. • Demonstration.	• Problem set – assignment. • Partial and total work assessment**.**

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c.1 . Employ standard chemical specifications while integrating Mechatronics systems.	• Lecture. • Demonstration.	• Problem set – assignment. • Partial and total work assessment**.**

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(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Cooperate efficiently in the evaluation and integration of information and share learned knowledge.	• Group learning • Tutorial classes.	• Written reports and essay. • Presentations.
d 2. Defend acquisition of new knowledge as a part of life- long learning strategy.	• Discussion sessions. • Tutorial classes.	• Tests and presentations. • Scientific research work.
d 3. Review a search of literature and use databases and other sources of information.	• Discussion sessions • Tutorial classes.	• Tests and presentations. • Scientific research work.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Measurements and Units.	a1,a2,b1,d2.	- Unit Conversions - Estimating - Stoichiometry	1	2
2.	Gases, Gas Liquefaction.	a1,a2,b1 ,d1.	- Pressure - The Gases Laws - Dalton's Law of Partial Pressure - The Kinetic Molecular Theory of Gases - Effusion and Diffusion - Gas liquefaction -Andrews isotherms of carbon dioxide- CO_2	2	4

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3.	Engineering Materials & Applications.	a2,a3,b1,c1,d1,d2.	- Atomic structure of materials - Nanostructure - Classification of Engineering Materials - Metallurgy and Alloys - Ceramics - Polymers - Composites	2	4
4.	Conductors, Semiconductors and Insulators.	a2,a3,b1,c1,d1,d2.	- Conductors, - Semiconductors, - Insulators	2	4
5.	Mid-Term Exam.		The first 4 Chapters.	1	2
6.	Thermodynamics' Laws and Energetics.	a 1,a3,b1,c1,d1,d2.	- First Law of Thermodynamics - Entropy- Second Law of Thermodynamics - Hess's Law - Gibbs Free Energy ΔG - Third Law of Thermodynamics	2	4
7.	Electrochemistry.	a1,a2,b1 ,d1.	- Galvanic cell - Electrolyze cells - Fuel cell - Potential cell ,EMF	1	2
8.	Chemical and Electrochemical Power Sources.	a2,a3,d2,d3.	- Solid, Liquid, Gaseous Sources - Batteries - New Energy Sources - Biomass and Biomass Energy	1	2
9.	Fuels and Combustions.	a2,a3,d2,d3.	- Modern Concept of Fuel - Classification of Fuels -Solar Energy -Nonconventional Energy Sources -Combustions of oil	1	2
10.	Corrosion & Corrosion Control.	a 2,a3,d2, d3.	-Sources and Characteristics of Water - Hardness of Water - Water Treatment - Sewage and Sewage Treatment	1	2

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11.	Pollution and it's Control.	a2,a3,b1,c1, d1,d2,d3.	- Introduction - Pollutants - Classification of Pollutants - Air Pollution - Acid Rain - Ozone Chemistry	1	2
12.	Final Exam.		All the Chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Measurements and units-Tutorial 1.	1	2	a1,a2,b1,d2.
2.	Gases Problems –Tutorial 2.	2	4	a1,a2,b1 ,d1.
3.	Thermodynamics problems-Tutorial 3.	4	8	a 1,a3,b1,c1,d1,d2.
4.	Electrochemistry's problems-Tutorial 4.	3	6	a1,a2,b1 ,d1.
5.	Gibbs free energy problems-Tutorial 5	2	4	a2,a3,d2,d3.
6.	Fuels problems-Tutorial 6.	2	4	a2,a3,d2,d3.
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Class Room Lectures.
- Power Point Lectures.
- Solved Problems.
- Tutorials.
- Independent Study.

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VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignments-6 chapters.	a1,a2,a3,b1,c1, d1, d2, d3.	2-9	5
Total				5

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assignments	Every Chapter	7.5	5	a1, a2, a3, b1,c1, ,d1,d2, d3.
2.	Quizzes.	Two times randomly	7.5	5	a1,a2,a3,b1, c1
3.	Mid-Term Exam.	8th	22.5	15	a1,a2,a3,b1, c1.
4.	Research.	12th	7.5	5	a1, a2, a3, b1,c1, ,d1,d2, d3.
5.	Final-Exam.	16 th	105	70	a1,a2,a3, b1, c1.
Sum			**150**	**100%**	

VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- Dr. B.S.Chauhan – 2008-Engineering Chemistry-Third Edition-New Delhi –Laxmi Publications (P) LTD – India.
2- Clausen C.A, 1992, Text Book of Engineering chemistry , ,oxford.

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	3- Clausen C.A., 1987, Willy Chemistry for Engineers.
2- Essential References.	
	1- Teh Fu Yen , Chemistry for Engineers, USA-2008 2- Zumdahl S. , Chemistry , Seventh Edition USA -2007
3- Electronic Materials and Web Sites *etc*.	
	1- Periodicals and web sites of Chemical Engineering 2- http://www.chem.eng-online.org

IX. Course Policies:

1.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3.	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4.	**Assignments & Projects:** The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
5.	**Cheating**: If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquires.
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7.	**Other policies:**

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	-All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

Reviewed By	Vice Dean for Academic Affairs and Post Graduate Studies: Dr. Tarek A. Barakat President of Quality Assurance Unit: Ass. Prof. Dr. Mohammed Algorafi Head of Mechatronics Engineering Department: Ass. Prof. Dr. Abdul-Malik Momin
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa Ass. Prof. Dr. Ahmed Mujahed Dr. Munaser Alsubri

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Template for Course Plan of Engineering Chemistry

I- Information about Faculty Member Responsible for the Course:								
Name	Ass. Prof. Dr. Riyad A.M. Muharam	**Office Hours**						
Location& Telephone No.	Faculty of Engineering -Sana'a. 770-521-271	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	DrRiyad@yahoo.com		2		2		

II.Course Identification and General Information:						
1-	Course Title:	Engineering Chemistry**.**				
2-	Course Number & Code:	BR003**.**				
3-	Credit hours:	C.H				TOTAL Credit Hours
		Th.	Seminar	Pr.	Tu.	
		2	-	-	2	3
4-	Study level/year at which this course is offered:	First Year –Second Semester.				
5-	Pre –requisite (if any):	Nil				
6-	Co –requisite (if any):	Nil				
7-	Program (s) in which the course is offered	Mechatronic Engineering Program.				
8-	Language of teaching the course:	English Language.				
9-	System of Study:	Semesters.				
10-	Mode of delivery:	Lectures and Tutorials.				
11-	Location of teaching the course:	Mechatronics Engineering Department.				

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III.Course Description:

This course will focus on the concepts of theoretical and its application in the field of engineering chemistry and highlighted the theories which are based in this field. They are: gases laws and gases liquefactions, engineering materials & applications, thermodynamic's laws and energetics, conductors, semiconductors and insulators. It also aims to define the student in electrochemistry, electrochemical cells , chemical and electrochemical power sources and as well as corrosion &corrosion control, fuels and combustion, treatment of industrial wastes and pollution and it's control.

	IV.Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a.1	Characterize the principles of Chemistry science in the area of the Mechatronics.	A1
a.2	Classify methodologies for data collection and interpretation in solving engineering problems via engineering chemistry knowledge.	A3
a.3	Depict impacts of effective Mechatronics solutions on society and environment issues related to chemical engineering.	A7
b.1	Integrate fundamental chemical parameters and standards to construct useful Mechatronics products.	B1
c.1	Employ standard chemical specifications while integrating Mechatronics systems.	C5
d.1	Cooperate efficiently in the evaluation and integration of information and share learned knowledge.	D1
d.2	Defend acquisition of new knowledge as a part of life- long learning strategy.	D5
d.3	Review a search of literature and use databases and other sources of information.	D7

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V.Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	Measurements and Units.	- Unit Conversions - Estimating - Stoichiometry	1	2
2.	Gases, Gas Liquefaction.	- Pressure - The Gases Laws - Dalton's Law of Partial Pressure - The Kinetic Molecular Theory of Gases - Effusion and Diffusion - Gas liquefaction -Andrews isotherms of carbon dioxide- CO_2	2,3	4
3.	Engineering Materials & Applications.	- Atomic structure of materials - Nanostructure - Classification of Engineering Materials - Metallurgy and Alloys - Ceramics - Polymers - Composites	4,5	4
4.	Conductors, Semiconductors and Insulators.	- Conductors, - Semiconductors, - Insulators	6,7	4
5.	Mid-Term Exam.	All the 4 chapters.	8	2
6.	Thermodynamics' Laws and Energetics.	- First Law of Thermodynamics - Entropy- Second Law of Thermodynamics - Hess's Law - Gibbs Free Energy ΔG - Third Law of Thermodynamics	9,10	4
7.	Electrochemistry.	- Galvanic cell - Electrolyze cells	11	2

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		- Fuel cell - Potential cell ,EMF		
8.	Chemical and Electrochemical Power Sources.	- Solid, Liquid, Gaseous Sources - Batteries - New Energy Sources - Biomass and Biomass Energy	12	2
9.	Fuels and Combustions.	- Modern Concept of Fuel - Classification of Fuels -Solar Energy -Nonconventional Energy Sources -Combustions of oil	13	2
10.	Corrosion & Corrosion Control.	-Sources and Characteristics of Water - Hardness of Water - Water Treatment - Sewage and Sewage Treatment	14	2
11.	Pollution and it's Control.	- Introduction - Pollutants - Classification of Pollutants - Air Pollution - Acid Rain - Ozone Chemistry	15	2
12.	Final Exam.	All the chapters.	16	2
Number of Weeks /and Units Per Semester			**16**	**32**

B - Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Measurements and units-Tutorial 1.	1	2	a1,a2,b1,d2.
2.	Gases Problems –Tutorial 2.	2,3	4	a1,a2,b1 ,d1.
3.	Thermodynamics problems-Tutorial 3.	4,5,6,7	8	a 1,a3,b1,c1,d1,d2.

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4.	Electrochemistry's problems-Tutorial 4.	8,9,10	6	a1,a2,b1 ,d1.
5.	Gibbs free energy problems-Tutorial 5	11,12	4	a2,a3,d2,d3.
6.	Fuels problems-Tutorial 6.	13,14	4	a2,a3,d2,d3.
Number of Weeks /and Units Per Semester		**14**	**28**	

VI. Teaching strategies of the course:

- Class Room Lectures.
- Power Point Lectures.
- Solved Problems.
- Tutorials.
- Independent Study.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignments-6 chapters.	a1,a2,a3,b1	2-9	5
Total				**5**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assignments	Every Chapter	7.5	5	a1, a2, a3, b1,c1, ,d1,d2, d3.
2.	Quizzes.	Two times randomly	7.5	5	a1,a2,a3,b1, c1
3.	Mid-Term Exam.	8^{th}	22.5	15	a1,a2,a3,b1, c1.
4.	Research.	12^{th}	7.5	5	a1, a2, a3, b1,c1, ,d1,d2, d3.

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5.	Final-Exam.	16 th	105	70	a1,a2,a3, b1, c1.
	Sum		**150**	**100%**	

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2- Essential References.

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