



Ministry of Higher Education and  
Scientific Research - Iraq  
Northern Technical University  
College of Oil and Gas Techniques  
Engineering-Kirkuk  
Department of Fuel and Energy  
Techniques Engineering



## MODULE DESCRIPTION FORM

### نموذج وصف المادة الدراسية

Module Information				
معلومات المادة الدراسية				
Module Title	Physical Chemistry		Module Delivery	
Module Type	Core		<input checked="" type="checkbox"/> Theory <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar	
Module Code	FEK203			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	2	Semester of Delivery		2
Administering Department	FEK	College	COGTEK	
Module Leader	Qays Adnan Ali		e-mail	alnajarqays@ntu.edu.iq
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph. D.
Module Tutor			e-mail	E-mail
Peer Reviewer Name			e-mail	E-mail
Scientific Committee Approval Date	01/06/2023	Version Number	1.0	

## Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

## Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<b>Module Aims</b> أهداف المادة الدراسية	<p>1-Providing students with the basics of scientific knowledge in the field of fuel and energy engineering and improving their professional abilities in the direction of analytical, creative and environmental thinking.</p> <p>2. Preparing qualified engineers to improve the activities of fuel and energy engineering and the ability to manage dealing with them in all life facilities.</p> <p>3.To develop an understanding of the broad role of the chemist in measurement and problem solving for analytical tasks.</p> <p>4.To develop some understanding of the professional and safety responsibilities residing in working on chemical analysis.</p>
<b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية	<p>1-Recognizing the role of chemistry in physics in engineering fields</p> <p>2- Choosing the appropriate methods and mechanisms to obtain the required results</p> <p>3- The ability to design systems to meet the required needs in the field of fuel and energy engineering.</p> <p>4- The ability to use contemporary techniques, skills and devices in the engineering field.</p> <p>5-Written and oral communication skills, initiative and sensitivity to the interests</p> <p>6-Ability to cope with ambiguity, positive interaction with others, common sense and good judgement</p> <p>7-Using the analytical lab to develop meaningful problem-solving skills and to demonstrate and have students participate in the entire analytical process.</p>
<b>Indicative Contents</b> المحتويات الإرشادية	<p>Indicative content includes the following.</p> <p>1- It is very important to understand and follow the general safety concept in the lab.</p> <p>2- Using gloves mask and safety goggles in the lab.</p>

	3- Cautions while using different chemical compounds during the chemical reactions.
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<b>Learning and Teaching Strategies</b> استراتيجيات التعلم والتعليم	
<b>Strategies</b>	Explanation of the concept of Analytical Chemistry can be done using various relevant methods and strategies to make it easier for students to understand, for example through laboratory or practicum activities, using problem-based learning, or problems solving. In this case, the learning can be a combination of conceptual understanding, exercises, and problem teaching. Problems are an important feature of analytical chemistry as it helps in developing analytical thinking and serves to expand the field of interest, so the selection of problem sequences is an important aspect of increasing deductive and inductive reasoning.

<b>Student Workload (SWL)</b> الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	112	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعيا	7
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	63	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطالب خلال الفصل	175		

<b>Module Evaluation</b> تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
<b>Formative assessment</b>	<b>Quizzes</b>	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	<b>Assignments</b>	2	10% (10)	2, 12	LO # 3, 4, 6 and 7

	<b>Projects / Lab.</b>	1	10% (10)	Continuous	All
	<b>Report</b>	1	10% (10)	13	LO # 5, 8 and 10
<b>Summative assessment</b>	<b>Midterm Exam</b>	2 hr	10% (10)	7	LO # 1-7
	<b>Final Exam</b>	2hr	50% (50)	16	All
<b>Total assessment</b>			100% (100 Marks)		

### Delivery Plan (Weekly Syllabus)

#### المنهاج الاسبوعي النظري

	Material Covered
<b>Week 1</b>	Properties of gases. Maxwell's distribution of molecular velocities. Collision properties
<b>Week 2</b>	Deviation from ideal behavior, van-der Waals equation of state.
<b>Week 3</b>	Equation of liquids state, structure of liquids – vacancy model
<b>Week 4</b>	vapor pressure, heat of vaporization, Trouton's rule.
<b>Week 5</b>	Change of State: One component systems: Vapor pressure and external pressure
<b>Week 6</b>	Liquid-vapor composition diagram, Liquid-Liquid binary mixture, Raoult's law for ideal
<b>Week 7</b>	Non-ideal Liquid mixtures, The principle of distillation
<b>Week 8</b>	Henry's law, solubility of gases in Liquids
<b>Week 9</b>	First law of Thermodynamics, Enthalpy, reversible changes, maximum work
<b>Week 10</b>	Heat capacities at constant pressure and volume, adiabatic changes
<b>Week 11</b>	Reaction, heat of Formation, Heat of Combustion,
<b>Week 12</b>	Second and Third Laws of Thermodynamics, spontaneous processes, Entropy change for an ideal gas and accompanying phase change,
<b>Week 13</b>	Heats of Formation, Temperature dependence of the heat of reaction,
<b>Week 14</b>	. Reversible reactions, Thermodynamic equilibrium constant, Extent of Reaction
<b>Week 15</b>	Laws of Electrolysis and their applications. Difference between Galvanic and Electrolytic cells, electrode reactions
<b>Week 16</b>	Determination of size and shape, Colloids (Classification and preparation, Structure and stability

### Delivery Plan (Weekly Lab. Syllabus)

#### المنهاج الاسبوعي للمختبر

	Material Covered
<b>Week 1</b>	Learn about the physical chemistry laboratory, the use of laws, acidity and basicity calculations, and how to prepare solutions

<b>Week 2</b>	Preparation of solution
<b>Week 3</b>	Preparation of solid
<b>Week 4</b>	Preparation of a Weak acid ( $\text{CH}_3\text{COOH}$ ) and a strong base ( $\text{Na}_2\text{CO}_3$ ), and a graph showing the pH and volume of acid and base
<b>Week 5</b>	Preparation of a strong acid ( $\text{HCl}$ ) and a strong base ( $\text{NaOH}$ ), and a graph showing the pH and volume of acid and base
<b>Week 6</b>	Preparation of a strong acid ( $\text{H}_2\text{SO}_4$ ) and a Weak base ( $\text{NaCl}$ ), and a graph showing the pH and volume of acid and base
<b>Week 7</b>	Preparation of a strong acid ( $\text{H}_2\text{SO}_4$ ) and a Weakbase ( $\text{NaCl}$ ), and a graph showing the $(\Delta)$ and volume of acid and base
<b>Week 8</b>	Preparation of a Weak acid ( $\text{CH}_3\text{COOH}$ ) and a strong base ( $\text{NaOH}$ ), and a graph showing the $(\Delta)$ and volume of acid and base
<b>Week 9</b>	Preparation of Solution ( $\text{NaCl}$ ) and a graph showing the $(\Delta)$ and $(\frac{\sqrt{c}}{c})$
<b>Week 10</b>	Preparation of Solution ( $\text{NaOH}$ ) and a graph showing the $(\Delta)$ and $(\frac{\sqrt{c}}{c})$
<b>Week 11</b>	Determination of the surface tension of pure liquids
<b>Week 12</b>	Measurement of kinematic and kinematic viscosity of liquids
<b>Week 13</b>	Measure the partial weight of a volatile substance using the Vector method
<b>Week 14</b>	Analysis of Nickel Oxide by gravimetric Method
<b>Week 15</b>	Final Exam

### Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
<b>Required Texts</b>	Elements of Physical Chemistry by Samuel Glasstone and David Lewis Macmillan & Co.Ltd., London.	
<b>Recommended Texts</b>	Physical Chemistry (3rd Edition) by P.W.Atkins, Oxford University Press	
<b>Websites</b>	Smith J. M. & Van Ness H.V., Introduction to Chemical Engineering Thermodynamics, McGraw Hill.	

## Grading Scheme

### مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.