



Ministry of Higher Education and  
Scientific Research - Iraq  
University of Tikrit  
College of Petroleum Process Engineering  
Department of Petroleum and Gas Refining  
Engineering



## MODULE DESCRIPTOR FORM

### نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
<b>Module Title</b>	Principles of process engineering I		<b>Module Delivery</b>
<b>Module Type</b>	Core		<input checked="" type="checkbox"/> Theory
<b>Module Code</b>	PGR111		<input type="checkbox"/> Lecture
<b>ECTS Credits</b>	7		<input type="checkbox"/> Lab
<b>SWL (hr/sem)</b>	175		<input checked="" type="checkbox"/> Tutorial
			<input type="checkbox"/> Practical
			<input type="checkbox"/> Seminar
<b>Module Level</b>	UGI	<b>Semester of Delivery</b>	1
<b>Administering Department</b>	PGR	<b>College</b>	PPE
<b>Module Leader</b>	Muayad A. Shihab	<b>e-mail</b>	<a href="mailto:muayad.abed@tu.edu.iq">muayad.abed@tu.edu.iq</a>
<b>Module Leader's Acad. Title</b>	Asst. Prof.	<b>Module Leader's Qualification</b>	PhD
<b>Module Tutor</b>	Hamad K. Mohammed	<b>e-mail</b>	<a href="mailto:hamadalkhalid@tu.edu.iq">hamadalkhalid@tu.edu.iq</a>
<b>Peer Reviewer Name</b>	-	<b>e-mail</b>	-
<b>Review Committee Approval</b>		<b>Version Number</b>	1.0

Relation With Other Modules			
العلاقة مع المواد الدراسية الأخرى			
<b>Prerequisite module</b>	None	<b>Semester</b>	-
<b>Co-requisites module</b>	None	<b>Semester</b>	-

## Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

<p><b>Module Aims</b> أهداف المادة الدراسية</p>	<p>This course is intended to serve as an introduction to the fundamentals and techniques utilized in the fields of chemical and petroleum engineering. It provides the foundational skills, knowledge, and professional practice necessary for the successful completion of undergraduate and postgraduate petroleum refining engineering studies. The course will cover concepts ranging from basics such as units, dimensions, and stoichiometry to the simultaneous application of material balances with and without occurrence of chemical reaction. Its primary objective is to teach you how to systematically formulate and solve material balance problems. In addition, this course serves to introduce you to the scope of processes that petroleum refining engineers deal with in the petroleum industry.</p>
<p><b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none"><li>1. Deal with systems of units (primary and derivative), conversion of units and dimensional consistency for validation of an equation.</li><li>2. Identify and understand the unit operations involved in a process, draw flowcharts, and develop relationships between process variables.</li><li>3. Ability to choose an appropriate basis and effectively employ the various units associated with density, concentration, temperature, and pressure and calculate the average molecular weight of a mixture.</li><li>4. Develop a conceptual understanding of material balances and understand the features of open, closed, steady-state, and unsteady-state systems.</li><li>5. Apply the ten-step strategy to solve problems that do not involve chemical reactions.</li><li>6. Determine the stoichiometric quantities of reactants and products in moles or mass given the chemical reaction.</li><li>7. Identify the limiting and excess reactants in a reaction, and calculate the fraction or percent excess reactant(s); the percent conversion, or completion; the yield; and the extent of reaction apply it in material balance calculations.</li><li>8. Formulate and solve material balances using species and element balances.</li><li>9. Understand the meaning of stack gas, flue gas, orsat analysis, dry</li></ol>

	<p>basis, wet basis, theoretical air (oxygen), and excess air (oxygen), and employ these concepts in combustion problems.</p> <p>10. Understand the purpose of recycle, bypass, and purge streams.</p> <p>11. Apply the ten-step strategy to solve multi-unit steady-state problems (with and without chemical reactions) involving sequential, recycle, and/or bypass, and/or purge streams.</p> <p>12. Understand in a general sense how material balances are used in industry.</p>
<p><b>Indicative Contents</b> المحتويات الإرشادية</p>	<p>Indicative content includes the following:</p> <ol style="list-style-type: none"> <li>1. Definition of chemical engineering, Petroleum and gas refining engineering, Flow sheet and representation of a chemical process (PFD), The difference between a chemist and a chemical engineer. [2 hrs].</li> <li>2. Dimensions, units, symbols and conversion factors, Dimensional consistency, Precision and significant figures, Density and specific gravity, Temperature, Pressure, The mole unit, Composition and concentration, Basis of calculation, Principles and expressions of stoichiometry [8 hrs].</li> <li>3. Concepts of material balance and general strategy for solving material balance problems [4 hrs].</li> <li>4. Material balances without chemical reactions [8 hrs].</li> <li>5. Material balances with chemical reactions, stoichiometry, extent of reaction, limiting and excess reactants, conversion and degree of completion, selectivity, and yield [12 hrs].</li> <li>6. Material balances with multiple chemical reactions and element material balances [4 hrs].</li> <li>7. Material balances for combustion processes [8 hrs].</li> <li>8. Material balances involving multi-unit systems, recycle, bypass and purge streams [12 hrs].</li> </ol>
<p><b>Learning and Teaching Strategies</b> استراتيجيات التعلم والتعليم</p>	
<p><b>Strategies</b></p>	<p>The students will be actively engaged in the tasks, which will help them develop and hone their critical thinking abilities. This will be accomplished via lectures, interactive tutorials, and assignments incorporating fascinating tasks. The course includes:</p> <ol style="list-style-type: none"> <li>1- Numerous examples worked out in detail to illustrate the basic principles.</li> </ol>

	<p>2- A consistent strategy for problem solving that can be applied to any problem.</p> <p>3- Figures, sketches, and diagrams to provide a detailed description and reinforcement of what you read.</p> <p>4- Self-Assessment Tests at the end of each section, with answers so that you can evaluate your progress in learning.</p> <p>5- Many problems will be discussed and solved in the tutorial classes, which offer working with one or more classmates to exchange ideas and discuss the material.</p>
--	--

<b>Student Workload (SWL)</b> الحمل الدراسي للطالب			
<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	87	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعياً	6
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	88	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعياً	6.3
<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	20% (20)	4, 11	LO #1, 2, 3, 7, 8 and 9
	<b>Assignments</b>	4	10% (10)	Continuous	
	<b>Case study</b>	2	10% (10)	6, 13	LO #1-5, and 10, 11
	<b>Report</b>	-	-	-	-
<b>Summative assessment</b>	<b>Midterm Exam</b>	2 hr	10% (10)	7	LO #1-7
	<b>Final Exam</b>	3 hr	50% (50)	16	All
<b>Total assessment</b>			100% (100 Marks)		

<b>Delivery Plan (Weekly Syllabus)</b> المنهاج الأسبوعي النظري	
	Material Covered
<b>Week 1</b>	<ul style="list-style-type: none"> <li>- Introduction</li> <li>- Dimensions, units, symbols and conversion factors, dimensional consistency, precision and significant figures</li> </ul>

<b>Week 2</b>	Density and specific gravity, temperature, and pressure
<b>Week 3</b>	The mole unit, composition and concentration, basis of calculation, principles and expressions of stoichiometry
<b>Week 4</b>	Concepts of material balance
<b>Week 5</b>	Material balances without chemical reactions
<b>Week 6</b>	Material balances without chemical reactions
<b>Week 7</b>	Material balances with chemical reactions.
<b>Week 8</b>	Material balances with chemical reactions.
<b>Week 9</b>	Material balances with chemical reactions.
<b>Week 10</b>	Material balances with multiple chemical reactions
<b>Week 11</b>	Material balances for combustion processes
<b>Week 12</b>	Material balances involving multi-unit systems, recycle, bypass and purge streams
<b>Week 13</b>	Material balances involving multi-unit systems, recycle, bypass and purge streams
<b>Week 14</b>	Material balances involving multi-unit systems, recycle, bypass and purge streams
<b>Week 15</b>	<b>Preparatory Week</b>
<b>Week 16</b>	<b>Final Exam</b>

<b>Learning and Teaching Resources</b>		
مصادر التعلم والتدريس		
	Text	Available in the Library?
<b>Required Texts</b>	David M. Himmelblau, James B. Riggs, Basic principles and calculations in chemical engineering, 8 <sup>th</sup> edition, 2012.	Yes
<b>Recommended Texts</b>	Richard M. Felder, Ronald W. Rousseau, Lisa G. Bullard, Elementary principles of chemical processes, 4 <sup>th</sup> edition, 2016.	No
<b>Websites</b>	-	

**APPENDIX:**

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