	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

Module Title	Principles of process engineering II	**Module Delivery**	
Module Type	Core	☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	PGR121		
ECTS Credits	7		
SWL (hr/sem)	175		
Module Level	UGI	**Semester of Delivery**	2
Administering Department	PGR	**College**	PPE
Module Leader	Muayad A. Shihab	**e-mail**	muayad.abed@tu.edu.iq
Module Leader's Acad. Title	Asst. Prof.	**Module Leader's Qualification**	PhD
Module Tutor	Hamad K. Mohammed Farah Qahtan Khalaf	**e-mail**	hamadalkhalid@tu.edu.iq
Peer Reviewer Name	-	**e-mail**	-
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	PGR111	**Semester**	1
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This course is a complement to the fundamentals and techniques used in the chemical and petroleum engineering fields, as it provides the essential skills, knowledge, and professional practice needed to successfully complete undergraduate and postgraduate studies in petroleum refining engineering. The course will cover concepts ranging from the ideal gas laws, real gas, and their relationships, multiphase equilibrium to energy balances with and without a chemical reaction, enthalpy calculations, and humidity. Its primary goal is to teach you how to deal with ideal and real gases and to formulate and solve energy balance problems systematically. In addition, this course introduces you to the scope of operations that petroleum refining engineers deal with in the petroleum industry.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand the conditions under which the ideal gas law applies, and the conditions for which real gas relations must be used. 2. Solve material balances involving ideal or real gases. 3. Recognize the connection between multiphase equilibrium and separation technology. 4. Understand phase diagrams and the associated terminology as well as the phase rule. 5. Understand vapor-liquid equilibrium for a binary system. 6. Understand terminology associated with energy balances. 7. Understand types of energy included in energy balances. 8. Formulate and solve energy balances without reaction. 9. Understand the meaning of standard heat (enthalpy) of formation, heat (enthalpy) of reaction, higher and lower heating values. 10. Calculate the standard heat of reaction from tabulated standard heats of formation (or combustion) for different reactions. 11. Combine the heat of formation with sensible heat changes to solve problems involving chemical reactions. 12. Solve simple material and energy balance problems involving reactions. 13. Understand humidity, dry-bulb temperature, wet-bulb temperature,

	humidity chart, moist volume, and adiabatic cooling line. 14. Use the humidity chart to determine the properties of moist air. 15. Calculate enthalpy changes and solve heating and cooling problems involving moist air.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Ideal gases, ideal gas mixture, material balances involving ideal gases. [6 hrs]. 2. Real gases, equation of state, critical state and compressibility, compressibility charts [6 hrs]. 3. Multiphase equilibrium, phase diagrams and the phase rule, single-component two phase systems (vapor pressure), two component gas/single component liquid systems (saturation, condensation, and vaporization), two component gas/two component liquid systems, ideal solution relations, vapor-liquid equilibria phase diagrams, K-value, bubble point and dew point calculations, multicomponent vapor-liquid equilibrium [20 hrs]. 4. Energy balances: Terminology, types (heat, work, kinetic, potential, and internal energies, Enthalpy), heat capacity [6 hrs]. 5. Energy balances without chemical reactions, steady-state close and open systems [8 hrs]. 6. Energy balances with chemical reactions, the standard heat (enthalpy) of formation, the heat (enthalpy) of reaction, integration of heat of formation and sensible heat, the heat (enthalpy) of combustion [16 hrs]. 7. Humidity: Terminology, the humidity (psychrometric) chart and its application [8 hrs].
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	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: 1- Numerous examples worked out in detail to illustrate the basic principles. 2- A consistent strategy for problem solving that can be applied to any problem. 3- Figures, sketches, and diagrams to provide a detailed description and reinforcement of what you read.

	4- Self-Assessment Tests at the end of each section, with answers so that you can evaluate your progress in learning. 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.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	87	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	88	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	5, 11	LO #1-4, and 8-11
	Assignments	4	10% (10)	Continuous	
	Case study	2	10% (10)	6, 13	LO #1-6, and 8-12
	Report	-	-	-	-
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO #1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Ideal gases
Week 2	Real gases (equation of state and compressibility)
Week 3	Multiphase equilibrium (phase diagrams and the phase rule and vapor pressure)
Week 4	Multiphase equilibrium (saturation, condensation, and vaporization)
Week 5	Multiphase equilibrium (two component gas/two component liquid systems)

Week 6	Multiphase equilibrium (vapor-liquid equilibria phase diagrams)
Week 7	Energy balances (terminology, types, and units)
Week 8	Energy balances without chemical reactions
Week 9	Energy balances without chemical reactions
Week 10	Energy balances with chemical reactions (enthalpy of formation)
Week 11	Energy balances with chemical reactions (enthalpy of reaction)
Week 12	Energy balances with chemical reactions (enthalpy of combustion)
Week 13	Humidity (terminology and the humidity chart)
Week 14	Humidity (applications of the humidity chart)
Week 15	**Preparatory Week**
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

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

APPENDIX:

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	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

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.