MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Mass and Energy Balances			**Module Delivery**	
Module Type	C			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	UOMU0206031				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		**UGII**	**Semester of Delivery**		**Three**
Administering Department		**Fuel and energy Engineering Techniques**	**College**	**Engineering Technical College**	
Module Leader	**Mahdi Shanshal Jafar**		**e-mail**	**mahdy.jaafar@uomus.edu.iq**	
Module Leader's Acad. Title		**Lecturer**	**Module Leader's Qualification**		**Msc. Chemical Engineering**
Module Tutor	**Msc. Elaf jasem mohammed**		**e-mail**	elaf.jasem.mohammed@uomus.edu.iq	
Peer Reviewer Name			**e-mail**	E-mail	
Scientific Committee Approval Date			**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	
Module Aims أهداف المادة الدراسية	1- Understanding the fundamentals of conservation of both Mass and Energy are fundamentals on which all Chemical Processing is based. Being able to properly formulate and solve material and energy balances and in so doing integrate and interpret physical property data from different sources and in a variety of different units is an essential skills for an engineer. 2- To know the fundamental concept used when analysing the mass and energy flows in chemical processing 3- To knowledge the solve material and energy balances on chemical process systems(batch, semibatch, continuous, transient and steady state processes) and lays the foundation for subsequent in thermodynamics, unit operations and transport phenomena, sketch a flowchart and labels it. 4- To know solving process-related problems: breaking a process down into its components, establishing the relations between known and unknown process variables, assembling the information needed to solve for the unknowns using a combination of experimentation, empiricism, and the application of natural laws, and, finally, putting the pieces together to obtain the desired problem solution.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students are expected to be able to demonstrate understanding of: Principles of mass and energy balances; • apply material balances on nonreactive single-unit processes and apply material balances on reactive multiple unit processes • explain the meaning of batch, semibatch, continuous, transient and steady state processes. • sketch a flowchart and labels it. • identify a convenient basis of calculation. • calculate the degrees of freedom. • explain the meaning of purge, recycle and bypass. • identify the sub systems for which balances might be written. • calculate the unknown variables by solving material balances. • list and define the three components of the total energy of a process system and the two forms of energy transfer between a system and its surroundings by stating the conditions under which heat and work are

	positive. • define the terms closed system, open system, isothermal process and adiabatic process. • solve the energy balance for a given closed system. • define the terms flow work, shaft work, specific internal energy, specific volume and specific enthalpy. • derive the steady state mechanical energy balance equation for an open system. • use Hess law. • solve combustion problems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Topics covered include material balances around single process units and groups of units, involving simple systems and recycle streams, and non-reacting and reacting systems.(12 hr) Total, component, and elemental balances are covered. Other topics include systems of units and unit conversion, and compositions of mixtures.(10hr) Energy balances: The concepts of energy, work and heat, the units of energy, internal energy, enthalpy, heat capacity, latent heat, evaluation of enthalpy changes. The general energy balance equation, enthalpy balances, system boundaries. Enthalpies of pure components and selection of enthalpy data conditions.(12 hr) Energy balances and chemical reactions: Heat of reaction, definitions of standard heat of reaction, standard heat of formation, standard heat of combustion. Hess' Law of adding stoichiometric equations. Adiabatic reaction temperature. Heats of solutions and dilution, and use of enthalpy-concentration charts. Simultaneous material and energy balances.(13 hr)
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Assessment is based on hand-in assignments, written exam, Quizzes, reports, seminars, and Online testing.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	70	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	9
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	3,6, 9,12	
	Assignments	2	10% (10)	6, 12	
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	14	
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	15	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Revision to Material Balances.
Week 2	Material and energy balances on steady state processes. identify a convenient basis of calculation. calculate the degrees of freedom.
Week 3	

	Multiple unit system involving reaction
Week 4	recycle, and purge
Week 5	Differential balance, integral balance, unsteady state material balances on non-reactive systems,
Week 6	Flow sheets,
Week 7	Balances for batch and continuous plants.
Week 8	Elements of energy balances.
Week 9	-Change in pressure at constant temperature, sensible heat, heat capacities.
Week 10	Energy balance on single-phase systems, energy balance on phase change systems.
Week 11	Energy balance on phase change systems.
Week 12	Heats of solution and mixing, latent heat of vaporization,
Week 13	Enthalpy calculation. Concentration charts, Partial saturation and humidity, Psychometric charts
Week 14	Heats of reaction, Heats of formation, heat of combustion, adiabatic systems.
Week 15	unsteady state energy balances on reactive systems

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- **Richard M. Felder and Ronald W. Rousseau,"ELEMENTARY PRINCIPLESOF CHEMICALPROCESSES", Third Edition John Wiley & Sons, Inc., 2005 Edition,with Integrated Media and Study Tools.**	no

	2--Mass and Energy Balancing Calculations for Plant Design, David Pritchard and Shaik Feroz, © 2021 Taylor & Francis Group, LLC	
Recommended Texts	1-**SUPPLEMENTARY PROBLEMS FOR BASIC PRINCIPLES AND CALCULATIONS INCHEMICAL ENGINEERING 6TH EDITION, David M. Himmeblau,The University of Texas,©1996 by David M. Himmelblau.** **2.- ,David M. Himmelblau James B. Riggs, SOLUTIONS MANUAL,Basic Principles and Calculations in Chemical Engineering,Eighth Edition, Copyright © 2012 Pearson Education, Inc.**	no
Websites		

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.