MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Refrigeration & Air Conditioning Principles**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOMU0201041**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	**2**	**Semester of Deliver**	**4**		
Administering Department	**PM**	**College**	**TE**		
Module Leader	Essam Mohi	**e-mail**	Essam.Mohi@uomus.edu.iq		
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D		
Module Tutor	Hassan Ghanim Hassan	**e-mail**			
Peer Reviewer Name		**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 Objectives أهداف المادة الدراسية	1. Understand the basic principles of refrigeration and air conditioning systems. 2. To understand the fundamental properties of Air and Water vapor mixture.

	3. This course deals with the basic concept of air-conditioning processes. 4. Identify and describe the components of a typical refrigeration and air conditioning system. 5. To explain the thermodynamic principles involved in refrigeration and air conditioning processes. 6. Demonstrate knowledge of refrigerants and their properties, including safety considerations and environmental impacts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define Refrigeration and Air conditioning and identify their applications. 2. Define and calculate moist air properties using related equations. 3. Recognize how to use a Psychrometric chart in solving various Air conditioning processes. 4. Analyze the simple vapor compression cycle. 5. Describe the factors affecting vapor compression cycle performance. 6. Identify the multi pressure Refrigeration systems. 7. Recognize the refrigerant types and their effect on Ozone and How to Number it.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Part A - Air conditioning** Air conditioning definition , Air conditioning systems and applications, SI units, Fundamental properties of Air and Water vapor mixture; definition of (moist air properties), Calculation of moist air properties using related equations. [14 hrs] Psychrometric chart and its construction, Air-conditioning processes, Air-conditioning processes (sensible cooling, and sensible heating). [14 hrs] Air-conditioning processes (Dehumidification, Humidification, Mixing of air streams, Cooling and dehumidification with reheat, and Pre heating with humidification and reheat). [14 hrs] Summer and winter cycle. [4 hrs] **Part B - Refrigeration** Refrigeration definition, Refrigeration systems and applications, heat pump, reversed Carnot cycle, [7 hrs] Simple vapor compression cycle components and analysis, Ideal and actual vapor compression cycle, factors affecting vapor compression cycle performance, Multi Pressure systems. [30 hrs] Refrigerants. [14 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The Refrigeration and Air Conditioning module employs a range of effective learning and teaching strategies. Students engage in theoretical lectures, practical demonstrations, and hands-on laboratory sessions to grasp the underlying principles

	and gain practical skills. Case studies and real-world scenarios enhance problem-solving abilities, while group projects foster teamwork and communication skills. Continuous assessment methods, including assignments and practical assessments, ensure students' progress and understanding of the subject matter. The module promotes equipping students with the knowledge and skills necessary for success in the field of refrigeration and air conditioning.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	123	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	0
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	0
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**200**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	5	10% (10)	2, 6, 10, 12, and 14	LO #1, #3 and #6
	Assignments	4	10% (10)	1, 3, 5 and 15	LO #2, #4 and #5, #7
	Projects / Lab.	10	20% (10)	continuous	ALL
	Report				
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1, #2 and #3
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Air conditioning, Air conditioning systems, SI units, Fundamental properties of Air and Water vapour mixture; definition of (moist air properties) , Dry bulb, wet bulb and Dew point temperatures, partial pressure, Relative humidity, moisture content, Specific volume and Enthalpy.
Week 2	The General Gas Law, Dalton's law of partial pressure, Calculation of moist air properties

	using related equations.
Week 3	Psychrometric chart, Construction of psychrometric chart, Sensible Heat and Latent Heat.
Week 4	Air-conditioning processes, Adiabatic saturation process, sensible cooling, and sensible heating.
Week 5	Dehumidification; by pass factor, contact factor, Humidification – Humidification by water injection, steam injection.
Week 6	Mixing of air streams, Cooling and dehumidification with reheat.
Week 7	Preheating with humidification and reheat. Summer and winter cycle.
Week 8	Refrigeration application, refrigeration theory, heat pump, reversed Carnot cycle.
Week 9	Simple vapour compression cycle, vapour compression cycle components, Simple vapour compression cycle analysis.
Week 10	Ideal and actual vapour compression cycle, factors affecting vapour compression cycle performance (effect of suction temperature, effect of condensing temperature, effect of subcooling, effect of superheating, effect of pressure loss).
Week 11	Multi Pressure systems: Removing of flash gas, inter-cooler.
Week 12	Single evaporator and single compressor, single compressor and two evaporators.
Week 13	Two compressors and two evaporators, multi-stage compression cycle using, water intercooler, flash intercooler, liquid refrigerants intercooler.
Week 14	Refrigerants, types of old and new refrigerant. Effect of refrigerant on Ozone, secondary refrigerants.
Week 15	Numbering of Refrigerants.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Measuring of air velocity using Pitot tube and Manometer.
Week 2	Lab 2: Air Properties.
Week 3	Lab 3: Application on air Psychrometric chart.
Week 4	Lab 4: Sensible heating.
Week 5	Lab 5: Sensible cooling.
Week 6	Lab 6: Dehumidification of air.
Week 7	Lab 7: Heating with humidification of air.
Week 8	Lab 8: Mixing of air.
Week 9	Lab 9: Refrigerator and Heat pump.
Week 10	Lab 10:Calculation of the capacity and coefficient of performance of vapor compression unit.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Refrigeration & Air Conditioning, W.F. Stoecker & J.W Jones, Second Edition, McGraw-Hill, Inc.	Yes
Recommended Texts	Air Conditioning Engineering , W.P. Jones, Fifth Edition Elsevier Butterworth-Heinemann	No
Websites	https://www.ashrae.org/technical-resources/ashrae-handbook	

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.

Module 1

Code	**Course/Module Title**	**ECTS**	**Semester**
PM 200	Refrigeration & Air Conditioning Principles	8	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	4	123	77
Description			
The Refrigeration and Air Conditioning Principles module provides students with a comprehensive understanding of the principles, components, and applications of refrigeration and air conditioning systems. This module combines theoretical knowledge with practical skills. Throughout the module, students delve into the fundamental principles of thermodynamics, heat transfer, and psychrometrics, which form the basis of refrigeration and air conditioning processes. They learn about the various components involved in these systems, including compressors, condensers, evaporators, expansion devices, and controls, and understand their functions and interactions. Hands-on activities and laboratory sessions enable students to calculate and analyze different air conditioning processes and refrigeration systems. The module encourages the students to communicate effectively and work collaboratively in teams, simulating real-world scenarios they may encounter in the field.			