

## MODULE DESCRIPTION FORM

### نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Refrigeration & Air Conditioning Principles		Module Delivery
Module Type	C		<input checked="" type="checkbox"/> Theory
Module Code	RETE 204		<input type="checkbox"/> Lecture
ECTS Credits	6		<input checked="" type="checkbox"/> Lab
SWL (hr/sem)	150		<input checked="" type="checkbox"/> Tutorial
			<input type="checkbox"/> Practical
			<input type="checkbox"/> Seminar
Module Level	2	Semester of Delivery	4
Administration Department	RETE	College	College of Oil and Gas Techniques Engineering - Kirkuk, Northern Technical University, Iraq
Module Leader	Marwa Khaleel Rashid	e-mail	<a href="mailto:marwa.khaleel23@ntu.edu.iq">marwa.khaleel23@ntu.edu.iq</a>
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.Sc.
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

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

<p><b>Module Aims</b> أهداف المادة الدراسية</p>	<ol style="list-style-type: none"> <li>1. Understand the basic principles of refrigeration and air conditioning systems.</li> <li>2. To understand the fundamental properties of Air and Water vapor mixture.</li> <li>3. This course deals with the basic concept of air-conditioning processes.</li> <li>4. Identify and describe the components of a typical refrigeration and air conditioning system.</li> <li>5. To explain the thermodynamic principles involved in refrigeration and air conditioning processes.</li> <li>6. Demonstrate knowledge of refrigerants and their properties, including safety considerations and environmental impacts.</li> </ol>
<p><b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none"> <li>1. Define Refrigeration and Air conditioning and identify their applications.</li> <li>2. Define and calculate moist air properties using related equations.</li> <li>3. Recognize how to use a Psychrometric chart in solving various Air conditioning processes.</li> <li>4. Analyze the simple vapor compression cycle.</li> <li>5. Describe the factors affecting vapor compression cycle performance.</li> <li>6. Identify the multi pressure Refrigeration systems.</li> <li>7. Recognize the refrigerant types and their effect on Ozone and How to Number it</li> </ol>
<p><b>Indicative Contents</b> المحتويات الإرشادية</p>	<p>Indicative content includes the following.</p> <p>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]</p> <p>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]</p> <p>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]</p>

## Learning and Teaching Strategies

## استراتيجيات التعلم والتعليم

<b>Strategies</b>	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.
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## Student Workload (SWL)

### الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	4.8
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	5	10% (10)	3,6, 8 and 12,14	LO #1, #3 #6, #8, and 10
	Assignments	4	10% (10)	2,4,9,and 14	LO #2, #4, #5 and #7
	Lab Report	10	20% (20)	Continuous	All
Summative assessment	Mid Term exam	2 hr	10% (10)	7	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
100% (100 Marks)					

## Delivery Plan (Weekly Syllabus)

### المنهاج الأسبوعي النظري

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
Weeks 7	Mid-Term Exam
Weeks 8	Preheating with humidification and reheat. Summer and winter cycle.
Week 9	Refrigeration application, refrigeration theory, heat pump, reversed Carnot cycle.
Week 10	Simple vapour compression cycle, vapour compression cycle components, Simple vapour compression cycle analysis
Week 11	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 12	Multi Pressure systems: Removing of flash gas, inter-cooler
Week 13	Single evaporator and single compressor, single compressor and two evaporators.
Week 14	Two compressors and two evaporators, multi-stage compression cycle using, water intercooler, flash intercooler, liquid refrigerants intercooler
Week 15	Preparing for the final Exam

### Delivery Plan (Weekly Lab. Syllabus)

#### المنهاج الاسبوعي للمختبر

	Material Covered
<b>Week 1</b>	Lab 1: Measuring of air velocity using Pitot tube and Manometer.
<b>Week 2</b>	Lab 2: Air Properties.
<b>Week 3</b>	Lab 3: Application on air Psychrometric chart.
<b>Week 4</b>	Lab 4: Sensible heating.

<b>Week 5</b>	Lab 5: Sensible cooling.
<b>Week 6</b>	Lab 6: Dehumidification of air
<b>Week 7</b>	Lab 7: Heating with humidification of air.
<b>Week 8</b>	Lab 8: Mixing of air.
<b>Week 9</b>	Lab 9: Refrigerator and Heat pump.
<b>Week 10</b>	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	NO
Recommended Texts	Air Conditioning Engineering , W.P. Jones, Fifth Edition Elsevier Butterworth-Heinemann <a href="https://www.ashrae.org/technical-resources/ashrae-handbook">https://www.ashrae.org/technical-resources/ashrae-handbook</a>	No

## 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.