MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	**Principles of Air Conditioning Systems Design**	**Module Delivery**
Module Type	**Core**	☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	**RAC 403**	
ECTS Credits	**6**	
SWL (hr/sem)	150	

Module Level	Four	Semester of Deliver	Seven
Administering Department	PM	**College**	TEMO
Module Leader	Omar Sadoon Khaleel	**e-mail**	omarsadoon@ntu.edu.iq
Module Leader's Acad. Title	Assist. Lecturer	**Module Leader's Qualification**	M.Sc.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	1/6/2023	**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. To understand types of air conditioning systems. 2. To understand how to select the best A/C system for each application. 3. To understand the basic processes for refrigeration and air conditioning systems. 4. To understand the air properties and how to use a psychrometric chart to draw each process. 5. To understand types of air distribution within each zone. 6. To understand advanced air duct design. 7. To understand how to select the best air diffuser with all accessories.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Demonstrate the ability to do technical work in a variety of heating, cooling, and refrigeration fields. 2. Identify and describe various components in a typical air-conditioning system. 3. Identify and demonstrate correct use of tools, materials, and equipment used in the trade. 4. Evaluate a motor in a hermetic compressor to determine if it is electrically sound and safe to start. 5. Follow the circuit of a typical electric air-conditioning system. 6. Take wet-bulb and dry-bulb temperature readings and determine relative humidity from the psychometrics chart. 7. Use information to determine the level of comfort from the ASHRAE generalized comfort chart.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Types of Air Condition System** [20 hrs] **Advanced Air Duct Design** [15 hrs] **Air Distribution** [10 hrs] **Fan Types and Characteristics** [15 hrs] **Air Filtration** [10 hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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**	3	10% (10)	3,5 and 10	LO #1, #2 #3,#4and #5, #6
	Assignments	2	10% (10)	2 and 14	LO #4 and, #7
	Projects / Lab.	15	20% (20)	Continuous	All
	Report		0		0
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

	Delivery Plan (Weekly Syllabus)
	المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction - Air conditioning systems, Types of air conditioning systems for building.
Week 2	All - air systems, single duct, types, advantages and disadvantages. Single zone system, variable volume, advantages and disadvantages.
Week 3	Air handling unit advantages and disadvantages, Fan coil units advantages and disadvantages.
Week 4	Dual duct systems, multiple zone, advantages and disadvantages.
Week 5	Air - water systems, characteristics and advantages and disadvantages for each type and comparison with other systems, approaches of components selections. Induction systems, advantages and disadvantages
Week 6	All - water systems, performance, designs and applications. Useful pictures for each A/C system.
Week 7	Method of design air duct, Air duct system resistance.
Week 8	Static and dynamic pressure losses calculations, Fan total pressure estimate.
Week 9	Air distributed inside the room, Air distributes requirements inside the rooms.
Week 10	Ventilation apertures, How to select the air diffuser, Types of air diffuser with picture.
Week 11	Fans design and its selection, Fans types and its calculations.
Week 12	Selection of fans for design, Fan's laws.
Week 13	Filter types and its employment.
Week 14	Air impurities, How to select the air filter.
Week 15	HEPA filter with application, Modern air filter.
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 with specification
Week 3	Lab 3: Estimation static pressure losses in the flexible duct
Week 4	Lab 4: Estimation total pressure losses in the flexible duct
Week 5	Lab 5: Estimation static pressure losses in the smooth duct
Week 6	Lab 6: Estimation total pressure losses in the smooth duct
Week 7	Lab 7: Comparison of static pressure losses within different duct metal
Week 8	Lab 8: Comparison of dynamic pressure losses within different duct metal
Week 9	Lab 9: Comparison of total pressure losses within different duct metal
Week 10	Lab 10: Estimation the static pressure losses within sharp and smooth elbow fitting
Week 11	Lab 11: Estimation the dynamic pressure losses within sharp and smooth elbow fitting
Week 12	Lab 12: Estimation the total pressure losses within sharp and smooth elbow fitting
Week 13	Lab 13: Effect of air velocity on the static pressure losses
Week 14	Lab 14: Effect of air velocity on the dynamic pressure losses
Week 15	Lab 15: Effect of air velocity on the total pressure losses

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	ASHRAE Fundamentals Handbook for air conditioning and Refrigeration, SI,1997.	Yes
Recommended Texts	Handbook of Air Conditioning System Design /Carrier Air Conditioning Co. by Carrier Air Conditioning Pty. Ltd	Yes
Websites	http://www.learnhvac.org/	

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.

Code	Course/Module Title	ECTS	Semester
RAC 403	Principles of Air Conditioning Systems Design	6	7

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/sem)
3	2	78	72

Description

The Principles of Air Conditioning Systems Design course provides a comprehensive understanding of the design principles and methodologies involved in creating efficient and effective air conditioning systems. Students will learn about the fundamentals of thermodynamics, heat transfer, psychometrics, and fluid mechanics as they relate to air conditioning. The course covers topics such as load calculations, equipment selection, duct design, refrigeration cycles, system components, and control strategies. Students will gain practical experience through hands-on design projects, simulations, and analysis of real-world case studies. The course also emphasizes energy efficiency, sustainability, indoor air quality, and environmental considerations in air conditioning design. By the end of the course, students will have the knowledge and skills to design air conditioning systems that meet the comfort requirements of various applications while minimizing energy consumption and environmental impact. This course prepares students for careers in HVAC engineering, building design, and sustainable construction.