



وزارة التعليم العالي والبحث العلمي - العراق

جامعة وارث الأنبياء
كلية الهندسة
قسم تقنيات التبريد والتكييف



نموذج وصف المادة الدراسية

Module Information

معلومات المادة الدراسية

Module Title	Air Conditioning and Refrigeration systems		
Module Type	C		
Module Code	MPAC304		
ECTS Credits	10		
SWL (hr/sem)	250		
Module Level		Semester of Delivery	
Administering Department	Mechanical Power Eng. Dep.	College	TCB
Module Leader	Ihab Omar	e-mail	ihab.om@uowa.edu.iq
Module Leader's Acad. Title	Lecture	Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date	31 / 08/2025	Version Number	1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	MPAC205	Semester	4
Co-requisites module		Semester	2

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	This topic aims to enable and qualify the student to know the heating, ventilation, and air conditioning systems, estimate the cooling and heating load, identify the pipe and duct design, select fans and pumps, etc., and estimate the refrigeration load of the food storage stores and diseases that affect food products during the storage period.
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Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Course Outcomes: <ol style="list-style-type: none"> 1. To apply the knowledge of mathematics, science, and engineering fundamentals 2. To model refrigeration and air conditioning engineering. 3. To study the design procedures of cooling load, heating load, duct design, piping design, food preservation and food microbiology diseases. 4. To study the design of cold store refrigeration load. 5. To know the software that related to the subject.
	<p>Indicative content includes the following.</p> <p>Part A Cooling and heating load estimation Site survey of air conditioned space, relation between heat gain and cooling load. Inside and outside design conditions, for winter & summer, heating load calculation (heat loss from windows, doors, walls, roof, floor, base of building, ventilation (air change method, air required for each person, air volume per unit area,) infiltration (crack method) total heating load, Cooling load (radiation glasses, conduction heat transfer through walls, roof, glasses,..etc using equivalent temperature deference,) Heat transfer through part ions, peoples heat generated, people metabolic rate, lighting heat, motors & equipment, ventilation and infiltration load. Room total load, zone load, building load, bypass factor, cooling coil temperature. Heating load estimation, outdoor load, indoor load, ventilation and infiltration load. [30 hrs]</p>
Indicative Contents المحتويات الإرشادية	<p>Part B Duct design and fans selection Air ducting (pressure loses in straight duct, duct fittings (sudden enlargement & contraction, branches, bends,etc) Duct design, methods of design, equal friction method, balancing of duct system. Fans (type, selection, performance of centrifugal, laws) room air distribution, selection of supply & return air opening, diffusers, grilles, return grilles.) [18 hrs]</p> <p>Part C Piping and pumps selection Water piping design, pressure losses in straight, and other links, valves, and accessories, cooling water pipes, water pipe network design. Pumps (performance, types, pump selections, design of water distribution system , design of expansion tank) [12 hrs]</p> <p>Part D Food Preservation Food thermal properties, water contain, primary freezing point, ice fraction, density, specific heat. Freezing and nonfreezing foods, thermal conductivity, parallel method, respiration heat, heat transfer coefficient of surface. Time of Food cooling and freezing. Estimation of Food cooling Time depending on dimensionless heat transfer coefficient, method of freezing estimation. Blank Equation for freezing</p>

time estimation. Refrigeration and the food deceases, biological deceases sources, microbes growth, critical growth requirement of microbes, control of microbes growth, HACCP method [18 hrs]

Part E

Refrigeration Load

Thermal load of transportation, air filtration, equipment, safety factor, total ref. load, principle of freezing storage design, volume calculation, design of the storage construction, storage requirement. Methods of construction, space requirement, treatment of air and vapor infiltration from cracks, floor structure, preparing of the roof, water derange, Freezing systems, fan coil unit, valve selection, vale position, system design, Refrigerators [12 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 type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	144	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	10
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	106	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	11
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	250		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,7,10	LO #1, 2, 3,4,5
	Assignments	2	10% (10)	2, 8	LO # 3, 4
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	10	LO # 3,4,5
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 12,3,4
	Final Exam	2hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Cooling and heating load estimation	
Week 1	Site survey of air conditioned space, relation between heat gain and cooling load. Inside and outside design conditions, for winter & summer, heating load calculation (heat loss from windows, doors, walls, roof, floor, base of building, ventilation (air change method, air required for each person, air volume per unit area,) infiltration (crack method) total heating load.
Week 2	Cooling load (radiation glasses, conduction heat transfer through walls, roof, glasses,..etc using equivalent temperature deference,)
Week 3	Heat transfer through part ions, peoples heat generated, people metabolic rate, lighting heat, motors & equipment, ventilation and infiltration load.
Week 4	Room total load, zone load, building load, bypass factor, cooling coil temperature.
Week 5	Heating load estimation, outdoor load, indoor load, ventilation and infiltration load.
Duct design and fans selection	
Week 6	Air ducting (pressure loses in straight duct, duct fittings (sudden enlargement & contraction, branches, bends,etc)
Week 7	Duct design, methods of design, equal friction method, balancing of duct system.
Week 8	Fans (type, selection, performance of centrifugal, laws) room air distribution, selection of supply & return air opening, diffusers, grilles, return grilles.)
Piping and pumps selection	
Week 9	Water piping design, pressure losses in straight, and other links, valves, and accessories, cooling water pipes, water pipe network design.
Week 10	Pumps (performance, types, pump selections, design of water distribution system , design of expansion tank)
Food Preservation	
Week 11	Food thermal properties, water contain, primary freezing point, ice fraction, density, specific heat. Freezing and nonfreezing foods, thermal conductivity, parallel method, respiration heat, heat transfer coefficient of surface.
Week 12	Time of Food cooling and freezing. Estimation of Food cooling Time depending on dimensionless heat transfer coefficient, method of freezing estimation.
Week 13	Blank Equation for freezing time estimation. Refrigeration and the food deceases, biological deceases sources, microbes growth, critical growth requirement of microbes, control of microbes growth, HACCP method.
Refrigeration Load	

Week 14	Thermal load of transportation, air filtration, equipment, safety factor, total ref. load, principle of freezing storage design, volume calculation, design of the storage construction, storage requirement,
Week 15	Methods of construction, space requirement, treatment of air and vapor infiltration from cracks, floor structure, preparing of the roof, water derange, Freezing systems, fan coil unit, valve selection, vale position, system design, Refrigerators.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1-3	Case study for cooling load estimation, each student will select a house map and achieving the cooling load for the given house
Week 4-5	Case study for heating load estimation, each student will select a house map and achieving the cooling load for the given house
Week 6-7	Depending on the cooling and heating load, the student design the duct system to the house
Week 8	Design the duct system for the building and select the fan for the duct system. Finding the operating point, power consumption and pressure loss of the fan.
Week 9	Design the piping system for the heating load of the house
Week 10	Select the pumping system, system and finding the operating point, power consumption and pressure loss of the pumps.
Week 11	Perform a calculation for the freezing time of the food
Week 12-13	Perform the refrigeration load for a given cold store
Week 14-15	Estimation the freezing load of the cold store

Learning and Teaching Resources

مصادر التعلم والتدریس

	Text	Available in the Library?
Required Texts	<ol style="list-style-type: none"> 1. Carrier Handbook 2. ASHRAE – Fundamental 3. Stanford III, Herbert W., and Adam F. Spach. Analysis and Design of Heating, Ventilating, and Air-Conditioning Systems. CRC Press, 2019. 4. Wijeyesundara, Nihal E. Principles of Heating, Ventilation and Air Conditioning with Worked Examples. World Scientific, 2015. 5. Berk, Zeki. Food process engineering and technology. Academic press, 2018. 	Yes

Recommended Texts	1. Stanford III, Herbert W., and Adam F. Spach. Analysis and Design of Heating, Ventilating, and Air-Conditioning Systems. CRC Press, 2019. 2. Wijeysundara, Nihal E. Principles of Heating, Ventilation and Air Conditioning with Worked Examples. World Scientific, 2015. 3. Berk, Zeki. Food process engineering and technology. Academic press, 2018.	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.

رئيس القسم

أ.م.د محمد حسن عبود
التاريخ: ٢٠٢٥-٠٨-٣١

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التاريخ: ٢٠٢٥-٠٨-٣١

