MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Heat Transfer**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**RE 300**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	3		**Semester of Deliver**	5	
Administering Department	PM		**College**	TEMO	
Module Leader	Ayad Suleiman Abdullah		**e-mail**	Ayad.selman@ntu.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	01/6/2023		**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. Introduce the student to the groups used in heat transfer and to know their composition and how they work. 2. Introduce the student Basic Concepts of Heat Transfer, Heat Transfer Mechanisms 3. Introducing the student the main scientific principle in the field of heat transfer and its application in the Refrigeration, Cooling, and air conditioning fields. 4. Introducing students how calculation Over all Heat Transfer Coefficient 5. Introducing students study the heat conduction through a large plane wall and cylinder as one dimension steady state case. 6. Introducing students to how he calculation therate of heat transfer through a multilayer plane walls, cylinders, and spheres medium under steady conditions and surface temperatures difference. 7. Introducing the student to Investigate the steady state one dimensional heat conduction in a cylinder and sphere, and estimate the critical radius of insulation for them 8. Providing the student with practical and technical experience in calculating the heat transfer from finned surfaces.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Show the student's ability to use knowledge to prepare scientific and applied research. 2. The ability to use electronic programs to solve the problems of heat transfer.

مخرجات التعلم للمادة الدراسية	3. The ability to think to extract engineering solutions to problems related to heat transfer. 4. The ability to keep pace with scientific and technical modernity. 5. Teaching leadership skills, the value of commitment, love of work and devotion to it. 6. The ability to calculate the rate of heat transfer. 7. The ability to calculate the heat transfer from finned surfaces.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Basic Concepts of Heat Transfer, and Heat Transfer Mechanisms [10 hrs] Steady State One Dimensional Heat Conduction in a Large Plane Wall, and in a Cylinder [15 hrs] Conduction through Multilayer Plane Wall Over-all Heat Transfer Coefficient [15 hrs] Critical Radius of Insulation. [10 hrs] Thermal Contact Resistance [15 hrs] Studying the heat transfer from finned surfaces [15 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	107	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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, 4 ,7 and 10, 14	LO #1, #3 and #6, #7
	Assignments	4	10% (10)	3, 6 and 9, 12	LO #2, #4 and #5
	Projects / Lab.	15	20% (20)	Continuous	All
	Report				
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #3
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction, Basic Concepts of Heat Transfer, Heat Transfer Mechanisms
Week 2	Steady State One Dimensional Heat Conduction in a Large Plane Wall, and in a Cylinder. Conduction through Multilayer Plane Wall, and Cylinder.
Week 3	Over all Heat Transfer Coefficient, Critical Radius of Insulation, Thermal Contact Resistance.
Week 4	The Fins
Week 5	Transient Heat Conduction, (Lumped System Analysis), Two-Dimensional Steady Heat Conduction
Week 6	Introduction to Heat Transfer by Convection, Review to the Fluid Flow
Week 7	Non-Dimensional Group Numbers Analysis, Non- Dimensional Convection Method
Week 8	Analytical Solution for Heat Convection Heat Transfer for Laminar And Turbulent Flow, One Dimensional Steady State Force Convection Heat Transfer on Flat Plate
Week 9	Empirical Equations for Forced Convection Heat Transfer (Laminar and Turbulent Flow), Natural Convection Heat Transfer
Week 10	Empirical Equations for Natural Convection Heat Transfer, Introduction to Heat Exchangers, Kinds of Heat Exchangers, The Overall Heat Transfer Coefficient,
Week 11	Fouling Factor , The Log Mean Temperature Difference Method, The Effectiveness of the heat Exchangers, The Performances for Difference Kinds of the Heat Exchangers
Week 12	Heat Radiation, Introduction, Basic Concepts, Characteristics of Radiation, The View Factor Radiation Heat Transfer Between Two Black Surfaces
Week 13	Radiation Heat Transfer Between Two Gray Surfaces, Radiation Shields and The Radiation Effect
Week 14	MASS TRANSFER, boiling, condensing, evaporation
Week 15	Mass Convection, Mass Diffusion
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Temperature measurements
Week 2	Lab 2: Thermal conductivity.
Week 3	Lab 3: Calibration of thermo-couple
Week 4	Lab 4: Flow across tube banks
Week 5	Lab 5: Heat exchangers
Week 6	Lab 6: Critical Heat Flux
Week 7	Lab 7: Heat Transfer through the Lagged Pipe
Week 8	Lab 8: Thermal Conductivity of Insulating Powder
Week 9	Lab 9 Heat Transfer from a Pin-Fin Apparatus
Week 10	Lab 10: Heat Transfer through Composite Wall
Week 11	Lab 11: Heat Transfer in Forced Convection
Week 12	Lab 12: Parallel Flow / Counter Flow Heat Exchanger
Week 13	Lab 13: Heat Transfer in Natural Convection
Week 14	Lab 14: Thermal Conductivity of Metal Rod
Week 15	Lab 15: Emissivity Measurement Apparatus

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	. Heat transfer By : J.P. Holman, Heat and mass transfer By: YunusA.Gengel,	Yes
Recommended Texts	. Fundamentals of heat and mass transfer By: Incropera	yes
Websites	https://www. Heat transfer handbook By: Bijan	

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.

Undergraduate Courses 2023-2024

Code	Course/Module Title	ECTS	Semester
(RE 300)	Heat Transfer	8	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	93	107
Description			

Knowing the students, the main scientific principle in the field of heat transfer and its application in the Refrigeration, Cooling, and air conditioning fields.
After this course the students will be able to:

1. Knowing the student, the main scientific principle in the field of heat transfer and its mechanisms
2. Study the heat conduction through a large plane wall and cylinder as one-dimension steady state case. This chapter deals with the theoretical and mathematical aspects of heat conduction.
3. Investigate the steady state one dimensional heat conduction in a cylinder and sphere, and estimate the critical radius of insulation for them.
4. Studying the effect of thermal resistance to heat conduction through multilayer at the interface of two layers.
5. Studying the transient heat conduction
6. Studying numerically the two-dimensional steady heat conduction
7. Study the mechanism of heat transfer through a fluid in the presence of bulk fluid motion.
8. Study the Non-Dimensional Group Numbers which are in used in the convection heat transfer.
9. External and internal forced convection heat transfer introduced with the used of empirical equation instead of the complicity of the analytical solution.
10. Natural convection heat transfer introduced as empirical equations.
11. Studding the methods of the exchange heat between two fluids that are at different temperatures while keeping them from mixing with each other.
12. Studding the effect of conduction, convection and radiation heat transfer within the heat exchangers collected in one overall heat transfer coefficient, and studding the effect of fouling.
13. Studding the effect of radiation heat transfer, which is involves the emission of the internal energy of the object.
14. Studding the principle of radiation heat transfer.
15. Studding the radiation heat transfer between two black surfaces, and radiation heat transfer between two gray surfaces