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	**RAC 300**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	3		**Semester of Deliver**	5	
Administering Department	PM		**College**	TEMO	
Module Leader	Omar Mohammed yousif		**e-mail**	Omar.m.yousif@ntu.edu.iq	
Module Leader's Acad. Title	Ass.Lecture		**Module Leader's Qualification**	M.S.C.	
Module Tutor	available		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/10/2023 01/2/2024		**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, Thermal conductivity –convection heat transfer –Radiation heat transfer 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, power plants . 4. Introducing students how calculation Overall Heat Transfer Coefficient 5. Introducing students study the heat conduction through a large plane wall cylinder and sphere as one dimension steady state case and a multilayer plane walls, cylinders, and spheres medium under steady conditions and unsteady conditions . 6. Providing the student with practical and technical experience in calculating the heat transfer from finned surfaces. 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 Introduce the student Basic Concepts convection heat transfer , viscous flow ,inviscid flow ,laminar boundary layer on flat plate . 9. Introducing students study Forced convection –Empirical relations for pipe and flow over flat plate and across tube banks , Empirical relation for free convection on a vertical and horizontal flat plate , vertical and horizontal cylinders . 10. Introduce the student Type of heat exchanger ,The log mean temperature difference Heat exchangers-The overall heat transfer coefficient . 11. Introduce the student Basic Concepts Radiation heat transfer ,physical mechanism ,Radiation Radiation shape factor, relation between shape factors ,heat exchange between non-black bodies, Infinite parallel planes –radiation shields.
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. 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. 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 . 8. The ability to design heat exchangers.
Indicative Contents المحتويات الإرشادية	After studying this chapter, the student is expected to master the following knowledge and skills: . 1-Basic Concepts of Heat Transfer, and Heat Transfer Mechanisms [10 hrs] 2-Steady State One Dimensional Heat Conduction in a Large Plane Wall, and in a Cylinder [15 hrs] 3-Conduction through Multilayer Plane Wall Overall Heat Transfer Coefficient, Critical Radius of Insulation [15 hrs] 4-Unsteady State One Dimensional heat transfer . [5 hrs] 5-Studying the heat transfer from finned surfaces [10 hrs] 6-force and free convection [20 hrs]. 7- design heat exchangers[15 hrs] . 8- Solve problem of Radiation heat transfer [20 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) خلال الفصل للطالب الحمل الدراسي المنتظم	107	**Structured SWL (h/w)** للطالب أسبوعيا الحمل الدراسي المنتظم	7
Unstructured SWL (h/sem) خلال الفصل الحمل الدراسي غير المنتظم للطالب	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**	3	10% (10)	3, 5 and 8	LO #1, #3, #5 and #8
	Assignments	3	10% (10)	2, 6 and 12	LO #2, #4 ,#6 and #7
	Projects / Lab.	10	20% (20)	Continuous	All
	Report				
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	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	Overall Heat Transfer Coefficient, Critical Radius of Insulation, Thermal Contact Resistance.
Week 4	Heat transfer from finned surfaces.
Week 5	Transient Heat Conduction, (Lumped System Analysis), Two-Dimensional Steady Heat Conduction
Week 6	Fundamentals of convection –viscous flow –inviscid flow –laminar boundary layer on flat plate , The thermal boundary layer –turbulent flow in the tube .
Week 7	Empirical Equations of Forced convection for Laminar and Turbulent Flow on Flat Plate , across cylinders and sphere
Week 8	Empirical Equations of Forced convection for Laminar and Turbulent Flow across cylinders and sphere
Week 9	Empirical Equations of Forced convection for Laminar and Turbulent Flow inside pipes and ducts .
Week 10	Empirical relation for free convection on a vertical and horizontal flat plate , vertical and horizontal cylinders

Week 11	Introduction to Heat Exchangers, Kinds of Heat Exchangers, The Overall Heat Transfer Coefficient
Week 12	Fouling Factor , The Log Mean Temperature Difference Method
Week 13	The Effectiveness of the heat Exchangers, The Performances for Difference Kinds of the Heat Exchangers
Week 14	Heat Radiation, Introduction, Basic Concepts, Characteristics of Radiation, The View Factor Radiation Heat Transfer Between Two Black Surfaces
Week 15	Radiation Heat Transfer Between Two Gray Surfaces, Radiation Shields and The Radiation Effect
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
RAC 300	**Heat Transfer**	**8**	**5**
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	**4**	**107**	**93**
Description			
Heat transfer describes the flow of heat (thermal energy) due to temperature differences and the subsequent temperature distribution and changes. The study of transport phenomena concerns the exchange of momentum, energy, and mass in the form of conduction, convection, and radiation. These processes can be described via mathematical formulas. The fundamentals for these formulas are found in the laws for conservation of momentum, energy, and mass in combination with constitutive laws, relations that describe not only the conservation but also the flux of quantities involved in these phenomena. For that purpose, differential equations are used to describe the mentioned laws and constitutive relations in the best way possible. Solving these equations is an effective way to investigate systems and predict their behavior. Heat transfer science is important in engineering application to determination of the rate of heat transfer at specified temperature difference .To estimate the cost ,the feasibility ,and the size of equipment necessary to transfer a specified amount of heat in a given time a detailed heat transfer analysis must be made .The dimensions of boilers, heaters ,refrigerators ,and heat exchangers depend not only on amount of heat to be transmitted but also on the rate at which the heat is to be transferred under given conditions .The successful operation of equipment components such as turbine blades or the walls of combustion chambers depends on the possibility of cooling certain metal parts by continuously removing heat from surface at rapid rate .A heat transfer analysis must also be made in the design of electric machines ,transformers and bearings to avoid conditions that will cause overheating and damage the equipment .These examples show the importance to understand the basic modes of heat transfer . It is necessary to know the three modes of heat transfer: conduction, convection, and radiation, and to qualitatively understand the mechanism of these modes .			