

<b>Identification</b>	<b>Subject</b>	CHE302, Heat transfer, 6 ECTS
	<b>Department</b>	Mechanical Engineering
	<b>Program</b>	Undergraduate
	<b>Term</b>	Spring 2026
	<b>Instructor</b>	Dr. Mehdi Kiyasatfar
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	<b>Phone:</b>	
	<b>Classroom/hours</b>	
	<b>Office hours</b>	
<b>Prerequisites</b>	Thermodynamics, Differential equations	
<b>Language</b>	English	
<b>Compulsory/ Elective</b>	Compulsory	
<b>Required textbooks and course materials</b>	1- Heat Transfer J.P. Holman, 10th Edition, McGraw-Hill, 2010. 2- Fundamentals of Heat and Mass Transfer F.P., Incropera, 10th Edition, Wiley, 2018.	
<b>Course website</b>		
<b>Course outline</b>	<p>Heat transfer describes the transport of thermal energy driven by temperature gradients and the resulting temperature distributions and variations. Thermal energy is transferred to and from objects through three fundamental modes: conduction, convection, and radiation.</p> <p>This course covers the fundamentals of heat transfer and their engineering applications, classification of heat transfer technologies, various heat transfer methods, and an introduction to heat transfer augmentation techniques and their benefits.</p>	
<b>Course objectives</b>	<p>This course is designed to provide students with a comprehensive understanding of the fundamental principles of heat transfer, including conduction, convection, and radiation, along with their engineering applications. Emphasis is placed on the analysis and solution of practical thermal problems through analytical methods and engineering correlations. By the end of the course, students will be able to apply heat transfer concepts to the design and evaluation of thermal systems encountered in mechanical and energy-related engineering applications.</p>	
<b>Learning outcomes</b>	<p>Upon successful completion of this course, students will be able to:</p> <ul style="list-style-type: none"> <li>• Formulate governing partial differential equations and the appropriate boundary and initial conditions for thermal problems.</li> <li>• Determine temperature and heat flux distributions using energy conservation principles and Fourier's law of heat conduction.</li> <li>• Analyze steady-state one-dimensional heat conduction problems using the thermal resistance concept.</li> <li>• Apply numerical and graphical methods to determine temperature distributions in two- and three-dimensional heat conduction problems.</li> <li>• Apply analytical techniques to solve transient heat conduction problems.</li> </ul>	

	<ul style="list-style-type: none"> <li>• Use the energy transport equation to determine temperature and heat flux distributions in laminar flow.</li> <li>• Determine heat transfer rates in turbulent flows using empirical correlations.</li> <li>• Estimate heat transfer rates for different types of heat exchangers.</li> </ul>		
<b>Teaching methods</b>	<b>Lecture</b>		x
	<b>Group discussion</b>		x
	<b>Experiential exercise</b>		x
	<b>Tutorials once a month on weekends</b>		--
	<b>Case analysis and assignments</b>		x
	<b>Course paper</b>		--
	<b>Others</b>		--
<b>Evaluation</b>	<b>Methods</b>	<b>Date/deadlines</b>	<b>Percentage (%)</b>
	<b>Midterm Exam</b>		30
	<b>Attendance &amp; Activity</b>	At each lesson	5
	<b>Quiz (4 quizzes)</b>	During the semester	15
	<b>Assignment</b>	During the semester	10
	<b>Final Exam</b>		40
	<b>Total</b>		100
<b>Policy</b>	<ul style="list-style-type: none"> <li>▪ <b>Ethics</b> Copying other students' work is highly discouraged. All assignments must be handled by the student himself. This is a university policy and violators will be reprimanded accordingly.</li> <li>▪ <b>Preparation for class</b> The structure of this course demands your individual effort outside the classroom for extra practice of many problems within the textbook. After each session, every student needs to put sufficient time to practice and finish the assignments by the predetermined date.</li> <li>• <b>Withdrawal (pass/fail)</b> This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year.</li> <li>▪ <b>Cheating/plagiarism</b> Cheating or other plagiarism in handling the assignments, Mid-term and Final Examinations will lead to course failure. In this case, the student will automatically get zero (0), without any considerations.</li> <li>▪ <b>Professional behavior guidelines</b> The students shall behave in a way to create a favorable academic and professional environment during the class hours.</li> <li>▪ <b>Attendance &amp; Activity</b> Attendance and in-class activity constitute 5 marks out of the total 100 marks for this course. Students who attend and actively participate in class activities will receive these marks. For each unexcused absence, 1 mark</li> </ul>		

	<p>will be deducted from the attendance and activity score.</p> <ul style="list-style-type: none"> <li>▪ <b>Quiz</b> Quizzes constitute 15 marks out of the total 100 marks for this course. Four quizzes will be conducted throughout the semester: two quizzes before the midterm examination and two quizzes before the end of the semester. Quiz questions will primarily be problem-solving in nature, and full credit will be awarded only for step-by-step solutions supported by clear explanations and properly justified final results.</li> <li>▪ <b>Assignment</b> Assignments constitute 10 marks out of the total 100 marks for this course. Students are required to submit assigned homework problems by the specified deadlines. Full credit will be awarded only for complete, well-structured solutions with clear explanations and properly supported final results.</li> <li>▪ <b>Exam</b> The midterm and final examinations will assess the heat transfer topics covered during the course as outlined in the syllabus, with a focus on conceptual understanding and problem-solving skills.</li> </ul>
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**Tentative Schedule**

Week	Date/Day (tentative)	Topics	Textbook/Assignments
1		Syllabus & Introduction. Mechanism of Heat Transfer. Factors affecting Heat Transfer. Engineering applications.	Chap 1-Ref 1
2		Conduction Heat Transfer. Thermal Conductivity. Convection Heat Transfer. Radiation Heat Transfer. Dimensions and Units.	Chap 1-Ref 1
3		<b><u>Quiz-1</u></b> Steady-State Conduction: One Dimension -The Plane Wall. Insulation and R Values.	Chap 2- Ref 1, 2
4		Radial Systems. The Overall Heat-Transfer Coefficient. Critical Thickness of Insulation.	Chap 2-Ref 1, 2
5		Heat-Source Systems: Cylinder with Heat Sources. Conduction-Convection Systems. Fins. Thermal Contact Resistance.	Chap 2- Ref 1, 2
6		<b><u>Quiz-2</u></b> Steady-State Conduction (Multiple Dimensions)	Chap 3- Ref 1

		Mathematical Analysis of Two-Dimensional.	
7		Heat Conduction: Graphical Analysis. The Conduction Shape Factor. Numerical Method of Analysis. Numerical Formulation in Terms of Resistance Elements. Gauss-Seidel Iteration.	Chap 3- Ref 1
8		Review <b>Midterm Exam</b>	
9		Unsteady-State Conduction: Lumped-Heat-Capacity System. Transient Heat Flow in a Semi-Infinite Solid. Convection Boundary Conditions.	Chap 4- Ref 1
10		Unsteady-State Conduction: Multidimensional Systems. Transient Numerical Method. Thermal Resistance and Capacity Formulation.	Chap 4- Ref 1
11		<b>Quiz-3</b> Principles of Convection: Viscous Flow. Inviscid Flow. Laminar Boundary Layer on a Flat Plate.	Chap 5- Ref 1, 2
12		Principles of Convection: Energy Equation of the Boundary Layer. The Thermal Boundary Layer. The Relation Between Fluid Friction and Heat Transfer.	Chap 5- Ref 1, 2
13		Practical Relations for Forced-Convection Heat Transfer: Empirical Relations for Pipe and Tube Flow. Flow Across Cylinders and Spheres. Flow Across Tube Banks. Liquid-Metal Heat Transfer.	Chap 6- Ref 1, 2
14		<b>Quiz-4</b> Natural Convection Systems: Free-Convection Heat Transfer on a Vertical Flat Plate. Free Convection from Vertical Planes and Cylinders.	Chap 7- Ref 1, 2
15		Natural Convection Systems: Free Convection from Horizontal Cylinders. Free Convection from Horizontal Plates.	Chap 7- Ref 1, 2
		<b>Final Exam</b>	

This syllabus is a guide for the course and any modifications to it will be announced in advance.