

Learning outcomes Identification	Subject	CHE 313 Heat and Mass Transfer – 6 ECTS
	Department	Chemical Engineering
	Program	Bachelors
	Term	Fall 2026
	Instructor	Babak Rustamzade
	E-mail:	babakrustamzade@gmail.com
	Phone	
	Classroom/hours	
	Office hours	
Prerequisites	• Engineering Mathematics • Fundamentals of Thermodynamics • Heat and material balances calculations	
Language	English	
Compulsory/Elective	Required	
Description	Heat and mass transfer are fundamental concepts that chemical engineers use to design and optimize industrial processes. This course will explore the principles of conduction, convection, and radiation in heat transfer, as well as diffusion and mass transport mechanisms. Students will learn to analyze and design processes where the efficient transfer of heat and mass is crucial, such as heat exchangers, evaporators, and reactors. The course emphasizes practical applications in industrial settings, aiming to equip engineers with the tools to improve energy efficiency and enhance process performance.	
Required textbooks and course materials	Main textbook: 1. “Heat and Mass Transfer” by Yunus A. Cengel Dr. , Afshin J. Ghajar; 11th edition, 2014	
Course objectives	The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and mechanisms of heat and mass transfer and their applications in engineering systems. The course introduces the basic concepts of heat transfer and develops students’ ability to analyze thermal processes occurring through conduction, convection, and radiation. Students will learn how heat is transferred through different materials and fluids, how temperature gradients influence energy transport, and how different operating conditions affect the rate of heat transfer. Particular attention will be given to heat conduction in solids, convective heat transfer between surfaces and moving fluids, and thermal radiation between surfaces. Students will also study the principles, classification, operation, and performance of heat exchangers, including the methods used to evaluate heat-transfer efficiency and overall thermal performance. The course further introduces the fundamentals of mass transfer, including diffusion, concentration gradients, and transport of chemical species between phases. Students will develop the ability to apply heat and mass transfer principles to practical engineering problems and to understand their importance in chemical processes, energy systems, separation operations, industrial equipment, and process design.	

Learning outcomes	By the end of this topic, a successful student should be able to: 1. Apply the fundamental principles of conduction, convection, and radiation to analyze heat transfer in different systems. 2. Formulate and solve heat transfer problems involving steady-state and transient conduction in one and multiple dimensions. 3. Design and analyze heat exchangers. 4. Evaluate and model mass transfer processes, including diffusion and convection, in various systems. 5. Use analytical and numerical methods to solve heat and mass transfer equations for real-world engineering problems.		
Teaching methods	Lecture		X
	Assignments		X
	Assisted work		X
	Assisted lab work		
	Others		X
Evaluation	Methods	Date/deadlines	Percentage (%)
	Quiz	Week 4 and 11	20
	Activity		5
	Midterm Exam	TBA	25
	Case Study	Week 13	10
	Final Exam		40
	Total		100
Policy	• Activity For a variety of reasons, participation in a classroom context is essential. It is essential to the learning process, promotes teamwork, and aids in the general success of both the individual students and the class. The main point will be the level of student interaction during classes. • Case Study/Report Students will be presented with an opportunity to work on a real-life case in an oil and gas plant. They must use their critical analysis and engineering knowledge to understand the case and try to solve it by applying what they learnt during the thermodynamics course. They must present a report that consists of 8-12 pages or a presentation to explain their results, findings, and reasonings. • Quiz A consistent method of gauging your understanding of the content covered in class is through quizzes. They assist you and your teacher in evaluating your comprehension of important ideas and identifying any areas that can benefit from more explanation. Each quiz will be marked based on 10 points. There will be two quizzes. • Withdrawal (pass/fail) The School Science and Engineering grading guidelines are carefully adhered to throughout this course. To pass, a student must typically receive a mark of at least 60%. Failure to achieve this benchmark will result in the student failing the course. • Cheating/plagiarism Any form of plagiarism or cheating on a test, quiz, or project will result in the cancellation of the assignment. In this scenario, the student will receive a score of zero (zero) without any further consideration. • Illness A student with an illness may miss a quiz or presentation. This might be because the student needs to go to the hospital, recover at home, or attend regular medical appointments. In this case, the student must inform the instructor in advance about		

	the illness and must present a document from their doctor. After considering the situation, the instructor may set a new date for the quiz or project presentation. Only one opportunity will be given to the student. The students who don't inform the instructor in advance will not be given a chance to retake the quiz or give a presentation. • Professional behavior guidelines During class hours, students are expected to conduct themselves in a way that fosters a positive academic and professional atmosphere. Discussions without permission and unethical conduct are absolutely forbidden. • Ethics In class, students must not be late. During class, mobile phones must be put away and turned off.
Use of Artificial Intelligence Tools	The use of Generative Artificial Intelligence (GAI) tools within this course is permitted solely for educational, research, and individual learning purposes and must remain consistent with the University's principles of academic integrity. GAI tools may be used as supplementary resources to support learning and research; however, all submitted work must reflect the student's own understanding, critical thinking, and academic contribution. Any use of GAI must be appropriately disclosed in the relevant assignment, project, presentation, or other academic material. Students are fully responsible for evaluating and verifying the accuracy, reliability, and appropriateness of all AI-generated content included in their work.

	Tentative Schedule	
Weeks	Topics	Pages
1	Basics of Heat Transfer	Pages 25-39
2	Heat Conduction Equation	Pages 41-65
3	Steady Heat Conduction	Pages 84-138
4	Transient Heat Conduction	Pages 140-162
5	Fundamentals of Convection	Pages 165-179
6	Internal and External Forced Convections	Pages 185-209
7	Midterm Exam	
8	Natural Convection	Pages 231-256
9	Boiling and Condensation	Pages 259-276
10	Heat Exchangers	Pages 301-320
11	Fundamentals of Thermal radiation	Pages 325-339
12	Radiation Heat Transfer	Pages 345-366
13	Mass Transfer I	Pages 412-443
14	Mass Transfer II	Pages 472-490
15	General review	
Final Exam		