<table>
<tr><td rowspan="9">Identification</td><td>Subject</td><td colspan="2">CHE 302 Heat transfer 6 ECTS</td></tr>
<tr><td>Department</td><td colspan="2">Mechanical Engineering</td></tr>
<tr><td>Program</td><td colspan="2">Undergraduate</td></tr>
<tr><td>Term</td><td colspan="2">Spring 2024</td></tr>
<tr><td>Instructor</td><td colspan="2">Dr. Mehdi Kiyasatfar</td></tr>
<tr><td>E-mail:</td><td colspan="2">mkiyasatfar@khazar.org</td></tr>
<tr><td>Phone:</td><td colspan="2"></td></tr>
<tr><td>Classroom/hours</td><td colspan="2"></td></tr>
<tr><td>Office hours</td><td colspan="2"></td></tr>
<tr><td>Prerequisites</td><td colspan="3">Thermodynamics</td></tr>
<tr><td>Language</td><td colspan="3">English</td></tr>
<tr><td>Compulsory/Elective</td><td colspan="3">Compulsory</td></tr>
<tr><td>Required textbooks and course materials</td><td colspan="3">Heat Transfer J.P. Holman, 10th Edition, McGraw-Hill, 2010.
Fundamentals of Heat and Mass Transfer F.P., Incropera, and D.P., DeWitt, T.L. Bergman, A.S. Lavine, 6th Edition, Wiley, 2007.</td></tr>
<tr><td>Course website</td><td colspan="3"></td></tr>
<tr><td>Course outline</td><td colspan="3">Heat transfer explains the flow of thermal energy due to gradient in temperature and the subsequent temperature distribution and changes. Heat can transfer to and from objects through three processes: conduction, convection, and radiation.
The fundamentals of heat transfer and its applications, the classification of heat transfer technology and different heat transfer methods, and the needs for augmentation and its benefits are the subjects this course.</td></tr>
<tr><td>Course objectives</td><td colspan="3">This course is designed to provide students with the basic principles and applications of heat transfer to engineering problems.</td></tr>
<tr><td>Learning outcomes</td><td colspan="3">On successful completion of this course students will be able to:

1. Ability to formulate governing partial differential equation(s) and necessary boundary (and initial) conditions for any thermal problem.
2. Ability to determine the temperature and heat flux distribution using energy conservation and/or Fourier heat law.
3. Ability to determine the heat flux and temperature distribution in steady-state one-dimensional problems using thermal resistance concept.
4. Ability to use numerical and/or graphical techniques to find temperature distribution in two- and three-dimensional problems.
5. Ability to apply analytical techniques to find the temperature distribution in
6. transient conduction problems.
7. Ability to use the energy transport equation to determine the temperature and heat flux distribution in laminar flow.
8. Ability to determine the heat flux in turbulent flows using empirical equations.
9. Ability to estimate the heat transfer rate for different heat exchangers.</td></tr>
<tr><td rowspan="7">Teaching methods</td><td colspan="2">Lecture</td><td>x</td></tr>
<tr><td colspan="2">Group discussion</td><td>x</td></tr>
<tr><td colspan="2">Experiential exercise</td><td>x</td></tr>
<tr><td colspan="2">Tutorials once a month on weekends</td><td>--</td></tr>
<tr><td colspan="2">Case analysis and assignments</td><td>x</td></tr>
<tr><td colspan="2">Course paper</td><td>--</td></tr>
<tr><td colspan="2">Others</td><td>--</td></tr>
<tr><td rowspan="7">Evaluation</td><td>Methods</td><td>Date/deadlines</td><td>Percentage (%)</td></tr>
<tr><td>Midterm Exam</td><td></td><td>20</td></tr>
<tr><td>Lab Report</td><td>During the semester</td><td>10</td></tr>
<tr><td>Quiz</td><td>During the semester</td><td>10</td></tr>
<tr><td>Assignment</td><td>During the semester</td><td>20</td></tr>
<tr><td>Final Exam</td><td></td><td>40</td></tr>
<tr><td>Total</td><td></td><td>100</td></tr>
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Policy	▪ **Ethics** 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. ▪ **Preparation for class** 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. • **Withdrawal (pass/fail)** This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is normally 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. ▪ **Cheating/plagiarism** 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. ▪ **Professional behavior guidelines** The students shall behave in a way to create a favorable academic and professional environment during the class hours. ▪ **Attendance** Students who attend the sessions will get 5 marks. For three absence student loses 1 mark. ▪ **Quiz** There will be quizzes for checking understanding of content during class. We are not going to give make up for a missing Quiz due to any reason other than medical report. ▪ **Assignment** There will be a homework assignment for every chapter composed of problems. ▪ **Lab report** Each experiment has a report describing abstract, introduction, procedure, readings, results, discussion, and analysis, and conclusion.

Tentative Schedule

Week	**Date/Day (tentative)**	**Topics**	**Textbook/Assignments**
1		Syllabus & Introduction. Mechanism of Heat Transfer. Factors Affecting Heat Transfer. Engineering Applications.	Chap 1
2		Conduction Heat Transfer. Thermal Conductivity. Convection Heat Transfer. Radiation Heat Transfer. Dimensions and Units.	Chap 1
3		Steady-State Conduction: One Dimension -The Plane Wall. Insulation and R Values.	Chap 2

4		Radial Systems. The Overall Heat-Transfer Coefficient. Critical Thickness of Insulation.	Chap 2
5		Heat-Source Systems: Cylinder with Heat Sources. Conduction-Convection Systems. Fins. Thermal Contact Resistance.	Chap 2
6		Solve problems. Lab	
7		Steady-State Conduction (Multiple Dimensions) Mathematical Analysis of Two-Dimensional. Heat Conduction: Graphical Analysis. The Conduction Shape Factor. Numerical Method of Analysis. Numerical Formulation in Terms of Resistance Elements. Gauss-Seidel Iteration.	Chap 3
8		Solve problems – Review. **Midterm**	
9		Unsteady-State Conduction: Lumped-Heat-Capacity System. Transient Heat Flow in a Semi-Infinite Solid. Convection Boundary Conditions.	Chap 4
10		Unsteady-State Conduction: Multidimensional Systems. Transient Numerical Method. Thermal Resistance and Capacity Formulation.	Chap 4
11		Principles of Convection: Viscous Flow. Inviscid Flow. Laminar Boundary Layer on a Flat Plate.	Chap 5
12		Principles of Convection: Energy Equation of the Boundary Layer. The Thermal Boundary Layer. The Relation Between Fluid Friction and Heat Transfer.	Chap 5
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
14		Natural Convection Systems: Free-Convection Heat Transfer on a Vertical Flat Plate. Free Convection from Vertical Planes and Cylinders. Free Convection from Horizontal Cylinders. Free Convection from Horizontal Plates.	Chap 7
15		Solve problems. Lab	
16		**Final Exam**	