

Identification	Subject	ME351, Material Science, 6 ECTS
	Department	Mechanical Engineering
	Program	Undergraduate
	Term	Spring 2026
	Instructor	Pusta Jalalova
	E-mail:	puste.jalalova@khazar.org
	Phone:	
	Classroom/hours	
	Office hours	
Prerequisites	General Chemistry	
Language	English	
Compulsory/Elective	Compulsory	
Required textbooks and course materials	<p>Textbook: Materials Science and Engineering, An Introduction (10th edition), W. D. Callister and D. G. Rethwisch, 2017</p> <p>Recommended Reading: Introduction to Materials Science for Engineers, 8th Edition, by J. F. Shackelford, Pearson, 2016. Engineering Materials 1: An Introduction to Properties, Applications and Design, 4th Edition, M.F. Asby and D. R. Jones, Elsevier 2012.</p> <p>All required materials will be provided by lecturer.</p>	
Course outline	This course introduces the fundamental principles of materials science, including material classification, crystal structures, defects, diffusion, and phase transformations. It covers the mechanical properties and strengthening mechanisms of metals, with a focus on steels, aluminum alloys, and polymers. Special attention is given to the Iron-Carbon Equilibrium Diagram and advanced high-strength materials.	
Course objectives	<p>Course aims to teach:</p> <ul style="list-style-type: none"> • An understanding of the classification and properties of engineering materials. • About crystal structures, defects, and their impact on material behavior. • Diffusion mechanisms and their role in material transformations. • The Iron-Carbon Equilibrium Diagram and its applications in steel hardening. • Phase transformations and strengthening mechanisms in metals. • The properties and applications of advanced high-strength steels, aluminum alloys, and polymers. 	
Learning outcomes	<p>Upon successful completion, students will be able to:</p> <ul style="list-style-type: none"> • Classify materials based on their composition and properties. • Describe and analyze crystal structures and defects. • Explain the principles of diffusion and plastic deformation. • Interpret and apply the Iron-Carbon Equilibrium Diagram. • Differentiate between equilibrium and non-equilibrium 	

	<p>phase transformations.</p> <ul style="list-style-type: none"> Identify and compare strengthening mechanisms in metallic materials. Evaluate the mechanical and physical properties of aluminum alloys and polymers. 		
Teaching methods	Lecture		x
	Group discussion		x
	Experiential exercise		-
	Tutorials once a month on weekends		-
	Case analysis and assignments		x
	Course paper		-
	Others		-
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Attendance & Activity	At each lesson	5
	Quiz (4 quizzes)	During the semester	20
	Assignment	During the semester	5
	Final Exam		40
	Total		100
Policy	<ul style="list-style-type: none"> Ethics Copy of 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 grading policy of the School of 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. 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 the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly discouraged. Quiz Quizzes constitute 20 marks out of the total 100 marks for this 		

	<p>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 focus on conceptual understanding and basic problem-solving related to materials science topics. Full credit will be awarded only for clearly explained answers, appropriate use of materials terminology, and properly justified final results.</p> <ul style="list-style-type: none"> ▪ Assignment Students will be assigned one project by the lecturer on topics related to materials science. The project will involve a study of material properties, processing methods, or applications, and will be presented by the students. The project presentation will be evaluated, and up to 5 marks will be awarded based on the technical content, quality of analysis, organization, and clarity of presentation. ▪ Exam The midterm and final examinations will assess the materials science topics covered during the course as outlined in the syllabus, with a focus on students understanding of fundamental material behavior, structure–property relationships, and their ability to analyze and solve related engineering problems.
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Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/Assignments
1		Classification and main characteristics of materials	Lesson 1.pptx, Chap 1
2		Crystal structure of metals, analysis of crystal structures	Lesson 2.pptx, Chap 2,3
3		Imperfections in real crystals – Crystal defects	Lesson 3.pptx, Chap 2,3
4		Theoretical basis of plastic deformation	Lesson 4.pptx, Chap 6,7
5		Transport phenomena – Diffusion	Lesson 5.pptx, Chap 5
6		Materials Phase Diagram Analysis	Lesson 6.pptx, Chap 9
7		The Iron-Carbon Equilibrium Diagram: Construction and meaning of the diagram	Lesson 6.pptx, Chap 9
8		Review - Preparation for exam Midterms Exam	
9		Hardening of steels	Lesson 7.pptx, Chap 10
10		Non-equilibrium phase transformations of steels	Lesson 8.pptx, Chap 10

11		Strength and strengthening of metallic materials	Lesson 9.pptx, Chap 10
12		Advanced high strength steels	Lesson 10.pptx, Chap 10
13		Aluminium alloys	Lesson 11.pptx, Chap 11,12
14		Polymers	Lesson 12.pptx, Chap 14,15,16
15		Review - Preparation for exam	Lesson 13.pptx Lesson 14.pptx
16		Final Exam	

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