



## MATE 404 Metallic Materials

### Course Description and Practice

Code	Course Name	Term	Theory + Recit. + Lab.	Credits	ECTS
MATE 404	Metallic Materials	8	3 + 0 + 0	3	5
<b>Pre-requisite Course(s)</b>		MATE 202			
<b>Course Type</b>	Compulsory	<b>Language of the Course</b>		English	

### Course Catalogue Description

Concept of steel standards, classification of standard steels, factors determining quality in metallic materials; effect of microstructure on mechanical properties, structural steels, HSLA steels, advanced high strength steels, die and tool steels, corrosion of metals, stainless steels, cast irons. Nonferrous metals and alloys; Al, Cu, Mg, Ti and Ni alloys, introduction to powder metallurgy, welding of metallic materials, examples of metallic material selection for industrial and daily usage.

<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>▪ To introduce to the metallurgical and materials engineering students the concept, selection and applications of standard steels, cast irons, nonferrous metals and alloys used in today's modern industry.</li> </ul>
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<b>Course Book</b>	No recommended textbook exists; reference books and handouts are used.
<b>Other Sources</b>	<ul style="list-style-type: none"> <li>▪ <i>Materials Handbook</i>, Vol 1, 10<sup>th</sup> Edition, Properties and Selection: Irons, Steels and High Performance Alloys, ASM</li> <li>▪ <i>Engineering Materials, Properties and Selection</i>, International Edition, 8th Edition, K. Budinski, Prentice Hall, 2005</li> <li>▪ <i>Steels: Microstructured Properties</i>, R.W.K.Honeycombe &amp; H.K.D.H.Bhadeshia, Edward Arnold, 1995</li> <li>▪ <i>Engineering Properties of Steels</i>, ASM, 1982</li> <li>▪ <i>Metallic Materials in Engineering</i>, C. H. Samans, Macmillan, New York, 1963</li> <li>▪ <i>Engineering Materials and Their Applications</i>, R.A. Flinn and P.K. Trojan, Houghton Mifflin Co., 3rd edition, 1986</li> </ul>

### Covered Topics

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| <ul style="list-style-type: none"> <li>▪ Review of the properties of solid materials (2 h.)</li> <li>▪ Classification of steels and steel standards (4 h.)</li> <li>▪ Carbon and low alloy steels (3 h.)</li> <li>▪ HSLA steels and dual phase steels (3 h.)</li> <li>▪ Tool, mold and die steels (3 h.)</li> <li>▪ <b>Midterm I</b></li> <li>▪ Corrosion and oxidation of metals (4 h.)</li> <li>▪ Stainless Steels (3 h.)</li> </ul> | <ul style="list-style-type: none"> <li>▪ Cast irons (3 h.)</li> <li>▪ Al, Cu, Mg, Ni, Ti and their alloys (8 h.)</li> <li>▪ <b>Midterm II</b></li> <li>▪ Precious metals, refractory metals &amp; others (2 h.)</li> <li>▪ Metallic coatings (1 h.)</li> <li>▪ Powder metallurgy (2 h.)</li> <li>▪ Welding of Metallic Materials (2 h.)</li> <li>▪ Student term project presentations (2 h.)</li> </ul> |
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**Attendance Requirement:** A first time taker has to attend at least 70% of the lectures.

### Grading Policy

Two Midterms (18% each), Final Exam (34%), Term Project Report (9%), Term Project Presentation (9%), Assignments (3%), Attendance & Class Participation (9%)

### Contribution to Professional Component

Mathematics and Basic Sciences	
Basic Occupational Courses (Engineering)	
Expertise/Field Courses (Engineering Design)	<b>X</b>
Courses on Communication and Management Skills (Social Sciences)	

**Course Learning Outcomes vs. Program Outcomes Correlation Table**

Scale: "5"=very strong; "4"= strong; "3"= medium; "2"=some; "1"= poor; "-"= NA

<b>MATE 404 Course Learning Outcomes</b>		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	Awareness of the importance of ferrous and nonferrous metallic materials in our lives and in engineering applications.	2	2	1	2	2	1	5	5	1	1	1	4
CLO2	Knowledge about standards and importance of standardization, awareness of steel, cast iron and non-ferrous metallic materials standards.	5	2	1	4	2	1	5	5	4	5	1	1
CLO3	Ability to establish correlations between composition, processing, microstructure, property and performance of metallic materials.	5	5	1	2	2	1	5	5	1	1	1	1
CLO4	Understanding of the advantageous and disadvantageous properties of ferrous and nonferrous metallic materials and material selection for an application.	4	4	2	4	2	1	5	5	1	1	1	2
CLO5	Ability to prepare a term project report and to give an oral presentation on a topic assigned within the scope of the course.	2	2	2	2	2	1	5	5	3	5	1	2

**Metallurgical and Materials Engineering Program Outcomes**

PO1	Knowledge in mathematics, science, and Metallurgical and Materials Engineering, and an ability to apply the theoretical and applied knowledge gained in these areas to model and solve complex engineering problems and material systems.
PO2	Understanding of the science and engineering principles regarding the structure, properties, processing, and performance of material systems.
PO3	Ability to detect, identify, formulate, and solve complex engineering problems; ability to select and use appropriate analysis and modeling methods for this purpose.
PO4	Ability to design and select material for a system, component, product or a process under realistic conditions and constraints to meet desired needs; ability to apply modern design and material selection methods for this purpose.
PO5	Ability to select, use and improve the techniques, skills, and modern engineering tools necessary for Metallurgical and Materials Engineering practice; ability to effectively use information technology.
PO6	Ability to design and conduct experiments, collect data, and use statistical and computer methods to analyze and interpret results for the investigation of complex engineering problems or Metallurgical and Materials Engineering specific research subjects.
PO7	Ability to function effectively in self-disciplinary and multidisciplinary teams; ability to work alone.
PO8	Ability to use Turkish to communicate effectively in oral and written means; knowledge of at least one foreign language, ability for effective report writing and understanding written reports, ability to prepare design and production reports, make effective presentations, give and take clear and understandable orders/directions.
PO9	Recognition of the need for, and an ability to engage in, life-long learning; ability to access information, follow developments in science and technology
PO10	Awareness of acting according to ethical principles, awareness of professional and ethical responsibilities; knowledge of standards used in engineering applications.
PO11	Knowledge on business life practices such as project management, risk management, change management; awareness of entrepreneurship, innovation, and sustainable development.
PO12	Recognition of the impact of metallurgical and materials engineering solutions on health, environment and security in global and societal context, recognition of the legal consequences of engineering solutions.