



# ÇANKAYA UNIVERSITY

## Department of Inter-Curricular Courses

### Syllabus

Department			
Course Code & Course Name	MSE 426 Thermal Processing of Materials		
Number of Weekly Lecture Hours	3 Hours	Course Credit / AKTS	3 0 3 / 5.00
Academic Year & Semester	2024 Spring		
Instructor	Prof. Dr. Ziya ESEN		
E-mail	ziyaesen@cankaya.edu.tr	Room &Phone	/ NB-16
Office Hour	-	Course Web Site	www.mse426.cankaya.edu.tr

#### Course Description

Property changes due to heat treatment. Iron-carbon system. Solubility. Austenitizing, transformation of austenite, Microstructure development. Microstructure-property relationship. I-T and C-T diagrams, annealing, normalizing, hardening, CCR (critical cooling rate). Actual cooling rate, quenching media, size and mass effect. Hardenability and applications of hardenability data in plain carbon and alloy steels. Tempering. Secondary hardening, temper embrittlement, austempering. Case hardening (flame&induction hardening, carburizing, nitriding, etc.). Formation and effect of residual stresses, application of martempering.

#### Course Objectives

The aim of this course is to provide a conceptual framework for understanding the behavior of metallic materials (steels, cast irons and non-ferrous alloys) by emphasizing important relations between internal structure and properties. Explain principles of heat treatment procedures for metals and alloys; explain the effect of heat treatment parameters on microstructure and on mechanical properties. Perform a heat treatment procedure to obtain desired properties considering the microstructure. Provide information about techniques and effect of surface processing techniques.

#### Learning Outcomes

1. Consider effect of heat treatment parameters (austenitization temp., time, quenching medium, etc.) on microstructure and final physical properties of metals
  2. Design and conduct heat treatment for steels and some non ferrous alloys to obtain desired properties
  3. Apply techniques to practice heat treatment of metals and use physical metallurgy
  4. Differentiate the effect of different surface processing techniques
  5. Design and conduct various surface processing experiments
- Apply materials characterization knowledge to the specifics of metal heat treating.

#### Computer Usage

None

#### Use of Generative Artificial Intelligence

None

Course Outline	
Week	Topic(s)
1	Classification of Engineering Materials
2	Classification of Ferrous Alloys , Iron-iron carbide metastable equilibrium phase diagram (Invariant reactions; Properties of phases)
3	Iron-iron carbide metastable equilibrium phase diagram
4	Heat treatment of steels
5	Heat treatment of steels
6	Alloy Steels
7	Midterm I
8	Tool and Die Steels
9	Surface Hardening Methods for Steels
10	Stainless Steels
11	Cast Irons
12	Heat treatment procedures applied to common non-ferrous alloys
13	Non-ferrous metals and alloys
14	Overview

Grading Policy								
Assesment Tool	Quantity	Percentage (%)	Assessment Tool	Quantity	Percentage (%)	Assessment Tool	Quantity	Percentage (%)
Midterm	1	25	Term Project	1	35	Final	1	40

Reference Books				
Author(s)	Title	Publisher	Publication Year	ISBN
-Avner, S. H,	Introduction to Physical Metallurgy, 2nd Edition.,	McGraw-Hill, New York,	1974,	0070024995.
- Romesh C. Sarma,	Principles of Heat Treatment of Steels,	New Age International Ltd.,	1996,	81-224-0869-9

Attendance requirements
At least 50% attendance is required

Teaching Policy
Face to face

Laboratory, Studio and Courtroom Use
One hour each week will be laboratory work