ÇANKAYA UNIVERSITY
MSE 310-Kinetics and Microstructural Evolution
(2017-2018 Spring)

Methods of Instruction	Theor.	Appl.	Lab.	Total	Credit	ECTS Credit
	56	0	-	56	(4 0 4)	5
Semester	Spring 2018 – 2019					
Instructor	Assoc. Prof. Dr. Ziya Esen, Materials Science and Engineering Dept. Room: NB-16, e-mail: ziyaesen@cankaya.edu.tr					
Assistant	Ezgi Bütev, Materials Science and Engineering Dept. NC-09, ebutev@cankaya.edu.tr					
Schedule	Lecture Hours : Monday 09:20-11:10 ; 13:20-15:10					

Course Description

Interfaces: classification, geometry and energy of interfaces, grain boundary segregation, Mobility of interfaces.Fundamentals of diffusion, kinetics of reaction including nucleation, growth and phase transformations. Normal grain growth. Homogeneous and heterogeneous nucleation. Transformation kinetics (TTT diagrams), precipitation in age hardenable alloys. Recovery and recrystallization.

Course Objective

This course aims to give some fundamental information to students for designing simple heat treating processes to develop microstructure in single phase metals and material properties. This course also aims to provide knowledge about the structure and thermodynamics of surfaces and interfaces like free surfaces, high and low angle grain boundaries, coherency and incoherency of interfaces and motion of boundaries, kinetics of reactions in the solid state and Arrhenius equation, nucleation phenomena in phase transformations, structure of cold worked alloys, mechanisms and kinetics of recovery and recrystallization processes, It also give information about calculating the equilibrium shapes of surfaces, kinetics of grain growth, recovery, recrystallization and other thermally activated reactions.

Textbook				
Author(s)	Title	Publisher	Publication Year	ISBN
John D. Verhoeven	Fundamentals of Physical Metallurgy	Wiley, John & Sons	1975	0471906166

Reference Books				
Author(s)	Title	Publisher	Publication Year	ISBN
D.A.Porter, K.E.Easterling and Mohamed Sherif	Phase Transformations in Metals and Alloys, Third Edition	Van Nostrand Reinhold International	2009	1420062107
Robert E Reed-Hill, Reza Abbaschian	Physical Metallurgy Principles	R E Reed-Hill/Abbaschian	1991	0534921736

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Attendance

70% attendance of all lecture hours and 80% attendance of all laboratory hours is required by the university's regulations. Absence from a quiz, lab. or an examination will result in zero grade.

Grading Policy

Quiz+HW……	10%
Midterm I&II……	50% (25% each)
Final……	40%

Course Outline	
Week	Topic(s)
1	Interfaces; Classification, geometry and energy of interfaces
2	Interfaces; Equilibrium shapes of interfaces (in single and two phase materials); Grains and grain boundary segregation
3	Interfaces; Interface mobility and grain growth
5	Diffusion (Atomic Mechanisms of Diffusion , Interstitial Diffusion ,Substitutional Diffusion Atomic Mobility; Diffusion along Grain boundaries, Surfaces and Dislocations)
6	Introduction to kinetic theory
7	Diffusional Transformations in Solids (Homogenous and heterogenous nucleation)
8	Diffusional Transformations in Solids (precipitate growth)
9	Diffusional Transformations in Solids (Transformation Kinetics: TTT Diagrams)
10	Diffusional Transformations in Solids (Precipitation in Age-Hardening Alloys,Spinodal Decomposition, Particle Coarsening)
11	Diffusional Transformations in Solids (Precipitation in Age-Hardening Alloys,Spinodal Decomposition, Particle Coarsening)
12	Recovery and Recrystallization (Stored energy of cold working and its release during annealing)
13	Recovery and Recrystallization (Mechanisms and kinetics of recovery, Nucleation and kinetics of recrystallization)
14	Recovery and Recrystallization (Control of recrystallization temperature and grain size, Hot working, texture development and secondary recrystallization)