



# MSE 409 PHASE TRANSFORMATIONS FALL 2018



**INSTRUCTOR** Assist. Prof. Dr. İlkalay Kalay  
**Office:** N-B115 **E-mail:** ikalay@cankaya.edu.tr **Office Hours:** Monday 11:20-12:10 / Wednesday 13:20-14:10\*  
 \*Use e-mails as much as possible out of office hours

**SCHEDULE** **Lecture:** Tuesday, 14:20-16:10 Thursday, 11:20-12:10

## COURSE DESCRIPTION

This course is a three-credit course emphasizing diffusion from phenomenological and atomistic approach, precipitation, free energy-composition diagrams, precipitation transformations, solid-state nucleation, precipitation kinetics, coarsening, eutectoid transformation and discontinuous precipitation, martensitic transformations, crystallography, thermodynamics and types of martensites, bainite transformation.

## ANNOUNCEMENTS

Check course website, <http://mse409.cankaya.edu.tr/> frequently for announcements about the course, lecture notes, laboratory manuals, homework assignments and etc.

## TEXTBOOKS

1. J. D. Verhoven, Fundamentals of Physical Metallurgy, John Wiley and Sons, 1975.
2. D.A.Porter, K.E.Easterling, M. Sherif, Phase Transformations in Metals and Alloys, Third Edition, Van Nostrand Reinhold International, 2009.

## REFERENCE BOOK

1. Robert E Reed-Hill, R. Abbaschian, Physical Metallurgy Principles, R E Reed-Hill/Abbaschian, 1991.

## GRADING

<b>Midterm I</b>	25 %
<b>Midterm II</b>	25 %
<b>Homework +Quiz</b>	10 %
<b>Final Examination</b>	40 %
<b>TOTAL</b>	100 %*

\*Minimum of 70 % attendance in class is mandatory.

## COURSE OUTLINE

Week	Topics Covered
1	Introduction
2	Diffusion: Phenomenological and atomistic approach Diffusion Substitutional Diffusion, Driving force and Mobility, Easy path Diffusion
3	Diffusion: Phenomenological and atomistic approach Diffusion Fick's laws, Steady state diffusion
4	Diffusion: Phenomenological and atomistic approach Diffusion Nonsteady state diffusion;Carburizing
5	Diffusion: Phenomenological and atomistic approach Mechanisms of substitutional and interstitial diffusion, Temperature dependence
6	Diffusion controlled growth (Diffusional Transformations in Solids) Homogeneous and Heterogeneous Nucleation
7	Diffusion controlled growth (Precipitate Growth: Plate - like precipitates)
8	Diffusion controlled growth (Pearlite Growth) and TTT diagrams
9	Precipitation from a Supersaturated Solid Solution Coarsening of precipitates
10	Diffusion controlled growth(Single Phase Growth; Equiaxed , Plate - like precipitates)
11	Diffusion controlled growth (Eutectoid Transformation; Morphology, Nucleation)
12	Diffusion controlled growth (Pearlite Growth) and TTT diagrams
13	Martensitic Transformations (Crystallography of Twinning; Crystallography of Martensitic Transformations)
14	Martensitic Transformations(Thermodynamics of Martensitic Transformations) Some Characteristics of Martensitic Transformations and bainite transformations

**Attendance:** Minimum of 70 % attendance in class is mandatory.