



# MSE 307 MATERIALS CHARACTERIZATION II

## FALL 2016



<b>INSTRUCTOR</b>	Assist. Prof. Dr. İlkay Kalay <b>Office:</b> N-B15 <b>E-mail:</b> ikalay@cankaya.edu.tr <b>Office Hours:</b> Wednesday 9:20-11:10*
<b>TA</b>	Ezgi Butev <b>Office:</b> N-C09 <b>E-mail:</b> ebutev@cankaya.edu.tr    Emre Yilmaz <b>Office:</b> N-C08 <b>E-mail:</b> emreyilmaz@cankaya.edu.tr <i>*Use e-mails as much as possible out of office hours</i>
<b>SCHEDULE</b>	<b>Lecture:</b> Tuesday, 14:20-17:10 <b>Laboratory:</b> Section 1: Thursday, 09:20-11:10    Section 2: Thursday, 15:20-17:10    Section 3: Friday, 15:20-17:10

### COURSE DESCRIPTION

This course is a four credit course emphasizing properties of X-rays and electron beams, spectroscopy, fundamentals of crystallography, diffraction, direction of diffracted beam; diffraction under non-ideal conditions, crystal structure determination, intensities of diffracted beam, precise parameter measurement, phase diagram determination, order-disorder transitions, characterization of amorphous materials, design of material characterization procedures.

### ANNOUNCEMENTS

Check course website, <http://mse307.cankaya.edu.tr/> frequently for announcements about the course, lecture notes, laboratory manuals, homework assignments and etc.

### TEXTBOOK

"Elements of X-ray Diffraction" by B.D. Cullity and Stock S.R. , Pearson Education, 2003. (ISBN-13:9780131788183)

### GRADING

<b>Midterm I</b>	20 %
<b>Midterm II</b>	25 %
<b>Laboratory</b>	10 %
<b>Quiz</b>	10 %
<b>Term Paper</b>	5 %
<b>Final Examination</b>	30 %
<b>TOTAL</b>	100 %*

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

### COURSE OUTLINE

Week	Topics Covered	Chapters
1	Introduction Properties of X-rays & Electron Beam: Electromagnetic spectrum, continuous and characteristic spectrum, absorption and detection of x-rays	CH.1
2	Properties of X-rays & Electron Beam: Electromagnetic spectrum, continuous and characteristic spectrum, absorption and detection of x-rays cont.	CH. 1
3	Properties of X-rays & Electron Beam: Electromagnetic spectrum, continuous and characteristic spectrum, absorption and detection of x-rays cont.	CH. 1
4	Geometry of Crystals: Lattices, crystal planes and directions, stereographic projection, reciprocal lattice	CH. 2
5	Geometry of Crystals: Lattices, crystal planes and directions, stereographic projection, reciprocal lattice cont.	CH. 2
6	Geometry of Crystals: Lattices, crystal planes and directions, stereographic projection, reciprocal lattice cont.	CH. 2
7	Intensity of Diffracted Beam I: Scattering by an electron, atomic scattering factor, structure factor (scattering from unit cell)	CH. 4
8	Intensity of Diffracted Beam I: Scattering by an electron, atomic scattering factor, structure factor (scattering from unit cell) cont.	CH. 4
9	Direction of Diffracted Beam: Bragg's Law, Diffraction under non-ideal conditions	CH. 3
10	Intensity of Diffracted Beam I: Scattering by an electron, atomic scattering factor, structure factor (scattering from unit cell) cont.	CH. 4
11	Intensity of Diffracted Beam II: Geometric (Lorentz) factors, absorption factor, temperature factor, intensity calculations	CH. 4
12	Intensity of Diffracted Beam II: Geometric (Lorentz) factors, absorption factor, temperature factor, intensity calculations cont.	CH. 4
13	Advance uses of X-ray diffraction	
14	Design of Materials Characterization Procedure	

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



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### Laboratory Sessions

Week	Topics Covered
1	No Laboratory
2	Production and Detection of X-rays, Continuous and Characteristics Spectra, Filtering of X-rays
3	Elemental Analysis by EDX by X-ray Fluorescence
4	No Laboratory Preliminary Report 1 (Elemental Analysis by EDX) must be submitted to your lab assistant by October 20.
5	Stereographic Projection
6	Exercises on Stereographic Projection
7	Spreadsheet analysis of X-ray diffraction (Reciprocal Lattice) You can bring your own laptops-notebooks
8	Qualitative Phase Analysis
9	Cell Size Determination Report 2 (Qualitative Phase Analysis by XRD) must be submitted to your lab assistant by before the lab session.
10	Determination of Crystal Structure Report 3 (Cell Size Determination using XRD) must be submitted to your lab assistant by before the lab session.
11	Exercises on Structure Factor Calculation Report 4 (Determination of Crystal Structure) must be submitted to your lab assistant by before the lab session.
12	Quantitative Phase Analysis
13	Final (Term Paper) must be submitted to your lab assistant.
14	Review of Experiments

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