

Crystallography and Diffraction - Course Syllabus

Course Number: MSE301

Course Title: Crystallography and Diffraction

Academic Semester: Spring **Academic Year:** 2015/ 2016
Semester Start Date: Jan 24, 2016 **Semester End Date:** May 19, 2016

Class Schedule: Monday & Wednesday, 9am-10.30am

Classroom Number:

Instructor(s) Name(s): Aurelien Manchon
Email: aurelien.manchon@kaust.edu.sa
Office Location: Bdg 3, room 3232

COURSE DESCRIPTION FROM PROGRAM GUIDE

The objective of this course is to present the basic concepts needed to understand the crystal structure of materials. Fundamental concepts including lattices, symmetries, point groups, and space groups will be discussed and the relationship between crystal symmetries and physical properties will be addressed. The theory of X-ray diffraction by crystalline matter along with the experimental x-ray methods used to determine the crystal structure of materials will be covered. Application of X-ray diffraction to proteins, electron diffraction and neutron diffraction will be briefly discussed.

GOALS AND OBJECTIVES

At the end of this course students should be able to:

- Define concepts such as lattice, point and space groups
- Be familiar with Bragg's Law and explain its relation to crystal structure
- Identify and describe different diffraction methods
- Interpret and assign X-ray and electron diffraction patterns

REQUIRED KNOWLEDGE

Students are expected to have successfully completed, or be familiar with the contents of, Fundamentals of Materials Science (KAUST 200-level class).

REFERENCE TEXTS

C. Hammond, The Basics of Crystallography and Diffraction, Oxford University Press, 2009

METHOD OF EVALUATION

Graded content
Quiz (every other week): 10% Mid-term: 30% Final exam: 30% Homework: 2 x 15%

COURSE REQUIREMENTS

Assignments

The student is expected to prepare the class by reading the relevant chapter or related documents delivered in class. These readings will be assessed through regular quizzes every other week that amount to 10% of the final grade. On top of that, the final grade will be equally distributed between a mid-term exam, a final exam and two homework.

Course Policies

Students should attend all sessions (frequent absence will be penalized in up to 5% of final grade).

Additional Information

Proposed course outline (indicative only):

Materials and materials properties

The periodic table of the elements and interatomic bonds

What is a crystal structure?

Lattices and symmetries

Reciprocal lattice

Crystal symmetry

Point groups

Plane groups and space group

Diffraction of light – principles

X-ray diffraction: geometry

X-ray diffraction: intensity

Electron diffraction

Neutron diffraction

About crystal structures and diffraction patterns

Practical aspects of X-ray diffraction

Practical aspects of electron diffraction

NOTE

The instructor reserves the right to make changes to this syllabus as necessary.