CHEM 4810: Materials Science 1
The University of Toledo
College of Natural Sciences and Mathematics
CHEM 4810 – 001 CRN 47569

Instructor: Nikolas Podraza
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Office Hours: Tuesday 2:30-4:00 PM (MH)
Wednesday 9:30-11:30 AM (MH)
Wednesday 2:00-4:00 PM (R1)
Thursday 2:30-3:30 PM (MH)
Office Location: McMaster Hall Room 5017
R1 Room 2100E
Office Phone: 419-530-4905 or 3708
Term: Fall 2018
Class Location: McMaster Hall
Room 4012
Class Day/Time: Tuesday and Thursday
10:00-11:50 AM
Credit Hours: 4

COURSE/CATALOG DESCRIPTION
A generic materials science approach to the study of crystalline structure and defects (point, line and planar) in crystalline materials. The mechanisms and kinetics of diffusion in the condensed state.

COURSE OVERVIEW
Survey of topics relevant to Materials Science. This course is the first in a two semester sequence surveying topics in materials science for undergraduate students in physics, chemistry, or related fields. It and its counterpart, CHEM 4820: Materials Science 2, may be taken independently or in any order.

Topical Outline:
1) Interatomic Bonding
2) Crystallography
3) Crystal Structures
4) Structure Determination
5) Structural Disorder
6) Point Defects
7) Line Defects
8) Planar Defects
9) The Effects of Defects on Properties
10) Fundamental Equations of Diffusion
11) Mechanisms of Diffusion
12) Kinetics of Diffusive Processes
13) Structure Sensitive Diffusion Processes
14) Surface Diffusion
15) Experimental Methods
Assume about 1/3 of the semester for topics 1-5, 1/3 for topics 6-9, and 1/3 for 10-15.

STUDENT LEARNING OUTCOMES
The students will learn about the structure of condensed matter systems, the defects present in real materials, and how impurities can diffuse within condensed matter.

PREREQUISITES AND COREQUISITES
None.
REQUIRED TEXTS AND ANCILLARY MATERIALS
There is no required text. A recommended reading list and course notes will be provided.

TECHNOLOGY REQUIREMENTS
None

UNIVERSITY POLICIES
Policy Statement on Non-Discrimination on the basis of Disability (ADA)
The University is an equal opportunity educational institution. Please read The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

Academic Accommodations
The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.

COURSE EXPECTATIONS
Attendance and Participation will consist of students showing up to class, reading any required assignments, and participating in classroom discussions. Students are highly encouraged to consider how the topic matter applies to their own areas of interest.

Exams will be open notes. Each exam will consist of about 9 problems in topics 1-5 (on 10/4/2018), 6-9 (on 11/1/2018), and 10-15 (on 12/11/2018), respectively. The midterms will be in-class, the final will be from 10:15-12:15 during Tuesday of finals week. Prior to the exams, there will be a review day where students will give a short 5 minute presentation on one aspect of the exam topics. Making a suitable presentation counts toward each exam score, equal to an exam question. For example, if there are 9 questions on an exam and you do not make a review presentation on your assigned day, you can only score a maximum of 90% on that exam.

GRADING
Grades will be based on two midterm exams and a final exam weighted equally.

Letter grade scale is:
A: 93-100%  D+: 67-69%
A-: 90-92%   D: 63-66%
B+: 87-89%   D-: 60-62%
B: 83-86%    F: 0-59%
B-: 80-82%
C+: 77-79%
C: 73-76%
C-: 70-72%
TENTATIVE COURSE SCHEDULE
Dates by topic and learning objective. Assessment methods (exams) are listed.

Lectures:
8/28, 8/30: Interatomic Bonding—bonding types and fundamentals.
9/4, 9/6: Crystallography—lattice systems, point groups, space groups, symmetry.
9/18, 9/20: Diffraction—characterization of crystal structures by diffraction methods.
9/25, 9/27: Point Defects—types and stability in crystal structures; impact on properties.
10/9, 10/16: Line Defects—types and stability in crystal structures; impact on properties.
10/18, 10/23: Plane Defects—types and stability in crystal structures; impact on properties.
10/25, 11/6, 11/8: Drift and Diffusion—theoretical formalism of how defects and impurities propagate within crystal structures.
11/27, 11/29: Low Dimensional Diffusion—diffusion along line and plane defects.

Review Days and Exams:
10/2: Midterm 1 Review Day (Structure: Interatomic Bonding, Crystallography, Crystal Structures, Diffraction)
10/4: Midterm 1 (Structure: Interatomic Bonding, Crystallography, Crystal Structures, Diffraction)
11/1: Midterm 2 (Defects: Point, Line, and Plane Defects; Impact on Properties)
12/6: Final Exam Review Day (Diffusion: Drift and Diffusion, Mechanisms, Characterization)
12/11: Final Exam Due