



# Chemistry 860: Selected Topics in Physical Chemistry

## Instrument Design & Fabrication

### Spring 2024

## General Course Information

### **\*Course Subject, Number and Title**

CHEM 860 — SELECTED TOPICS IN PHYSICAL CHEMISTRY

### **\*Credits**

2 credits

### **\*Course Designations and Attributes**

Grad 50% - Counts toward 50% graduate coursework requirement

### **\*Course Description**

The goal of this course is to provide a practical introduction to mechanical design and fabrication as it applies to research and instrumentation in chemistry. This course is designed for graduate students whose research involve building or modifying instrument components and who are interested in using the chemistry student maker space and/or the professionally staffed chemistry machine shop. The course will consist of a combination of lectures, discussions, demonstrations, and hands-on exercises. Each student will get a chance to work on a project related to their research.

Course topics and learning objectives:

- 1) Safe and proper operation of the chemistry student machine shop tools
  - a. Power tools: mills, lathe, drill press, band saw, etc.
  - b. Hand tools and measuring tools
- 2) Learn how to use a CAD program (Autodesk Inventor) to assist component design
  - a. 3D parts and assemblies
  - b. Best practices in geometric dimensioning and tolerancing for 2D technical drawings
- 3) Basic considerations and principles of mechanical design and fabrication
  - a. Basic machining operations, processes and capabilities
  - b. Metrology, fits, and tolerances
  - c. Material properties and selections
  - d. Motions and constraints

- e. Surface finishes and treatments
- f. Fasteners, welding, and brazing
- g. Pipes, seals, valves, flow, and vacuum

**\*Requisites**

Graduate/professional standing

**\*Meeting Time and Location**

Friday 11:00-2:00 PM

Room S307 (Chemistry Student Shop)

**\*Instructional Modality**

In-person instruction

**\*Specify How Credit Hours are Met by the Course**

The credit standard for this course is met by an expectation of a total of 90 hours of student engagement with the course learning activities (at least 45 hours per credit), which include regularly scheduled instructor-student meeting times, reading, labs, and other student work as described in the syllabus.

**\*Regular and Substantive Student-Instructor Interaction**

- Participation in regularly scheduled learning sessions, including whole-class meeting and lab session.
- Instructors provide personalized comments for an individual student's assignment and final project.
- Instructors post announcements and send emails about academic aspects of the class.

## Other Course Information

**\*Instructors & Teaching Assistants**

**\*Instructor Title and Name**

Prof. Etienne Garand

**\*Instructor Availability**

By appointment only

**\*Instructor Email/Preferred Contact**

[egarand@wisc.edu](mailto:egarand@wisc.edu)

**\*Course Learning Outcomes**

- 1) Safe and proper operation of the chemistry student machine shop tools.
- 2) Learn usage and best practices of CAD assisted 3D component design, assemblies and 2D technical drawings.
- 3) Basic considerations and principles of mechanical instrumentation design and fabrication.

### **\*Grading**

Course grades will depend upon:

- 1) Participation in classroom discussion and lab activities (50%)
- 2) Final project and presentation (50%). Each student will select a small instrumentation/mechanical design project related to their research upon discussion with Prof. Garand. They will then design and produce the necessary 3D components and assemblies as well as 2D technical drawings for each part. At the end, each student will give a short presentation explaining their design choices.

Final grades will not be curved.

### **\*Required Textbook, Software & Other Course Materials**

Student will need a laptop with **Autodesk Inventor 2023**. The educational version of software is freely available to students and licensed for installation on personal computers. Instructions on how to create an Autodesk Educational Community account and download the software can be found at: <https://kb.wisc.edu/techstore/page.php?id=38856>

## **Students' Rules, [Rights & Responsibilities](#)**

See the linked Guide's Rules, Rights and Responsibilities.

### **Diversity & Inclusion Statement**

[Diversity](#) is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

### **Academic Integrity Statement**

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

### **Accommodations for Students with Disabilities Statement**

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy ([UW-855](#)) require the university to provide reasonable accommodations to students with disabilities to access and participate in its academic programs and educational services. Faculty and students share responsibility in the accommodation process. Students are expected to inform faculty [me] of their need for instructional accommodations during the beginning of the semester, or as soon as possible after being approved for accommodations. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to provide reasonable instructional and course-related accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: [McBurney Disability Resource Center](#))

## **[Academic Calendar & Religious Observances](#)**