**Course Syllabus – CHEM 410**

**Course Information**

Course Number: CHEM 410 FA20
Course Name: Modern Organic Synthesis
Term: Fall 2020
Start Date: 09/8/2020
End Date: 12/11/20120
Credits: 3.0

**Meeting Days / Times**

Tuesdays and Thursdays, 9:00-10:30am PT / 12:00-1:30pm ET
(See Calendar in Canvas for the most up-to-date schedule.)

**Location**

Online via Zoom

**Course Managers**

| Role | Last Name | First Name | Email Address |
|---|---|---|---|
| Course Director | Krishnamurthy | Ramanarayanan | rkrishna@scripps.edu |
| Course Director | Shenvi | Ryan | rshenvi@scripps.edu |
| TA | Chekshin | Nik | chekshin@scripps.edu |
| TA | Hill | Sarah | shill@scripps.edu |

**Course Description**

An introductory section of this course on Modern Organic Synthesis composes a half a quarter course with an exhaustive survey of oxidations, reductions, nucleophilic additions, chemistry of enolates, alkene synthesis, ring forming reactions, and synthetic analysis.

**Program Learning Outcomes**

By the end of the program, students will have accomplished these objectives:
PLO1: Published research story.
PLO2: Generate creative approaches and methodologies for complex scientific questions.

PLO3: Master a potent set of technical research skills.
PLO4: Possess strong communication skills.

**Course Learning Outcomes**

By the end of this course, students will be able to:
CLO1: Conformational analysis and its effects on organic reactivity.
CLO2: Oxidations, cycloadditions, and reductions employed in organic synthetic chemistry.
CLO3: Transition states and their effect on enolate chemistry.
CLO4: Ring forming reactions and stereoselective alkene synthesis.
CLO5: Stereoelectronic effects in organic chemistry.
CLO6: Ultimately, students are expected to be able to develop and solve reasonable mechanisms for the above reactions.

**Background Preparation (Prerequisites)**

Students are strongly encouraged to review background material relevant to this course that is presented in the provided lecture notes. A list of relevant references has also been provided. It is assumed that all students have completed at least one undergraduate course in organic chemistry. An advanced course would be beneficial, but not required.

**Course Materials**

Required: Carey & Sundberg (2010). *Advanced organic chemistry: Part B: Reactions and synthesis*. ISBN: 978-0387683546.
Required: Boger (1999). *Modern organic synthesis: Lecture notes*.
Useful to consult: Corey & Cheng (1995). *The logic of chemical synthesis* . ISBN: 978-0471115946.

**Course Requirements**

Grades will be based on the following:

- 40%: problem sets. One from Professor Krishnamurthy worth 20% and one from Professor Shenvi worth 20%. Supports all of the learning outcomes. These assignments will give students an opportunity to test their developing understanding of the principles.
- 20%: total synthesis outline. From Professor Krishnamurthy. Clearly demonstrate that all presented course material has been mastered.
- 40%: final exams. One from Professor Krishnamurthy worth 20% and one from Professor Shenvi worth 20%. Demonstrate mastery of course material and its application to problem solving.

**Attendance Statement**

Students are expected to attend all classes. Students who are unable to attend class must seek permission for an excused absence from the course director or teaching assistant. Unapproved

absences or late attendance for three or more classes may result in a lower grade or an "incomplete" for the course. If a student has to miss a class, he or she should arrange to get notes from a fellow student and is strongly encouraged to meet with the teaching assistant to obtain the missed material.

**Scientific and Professional Ethics**

The work you do in this course must be your own. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. You must explicitly acknowledge when your work builds on someone else's ideas, including ideas of classmates, professors, and authors you read. If you ever have questions about drawing the line between others' work and your own, ask the course professor who will give you clear guidance. Exams must be completed independently. Any collaboration on answers to exams, unless expressly permitted, may result in an automatic failing grade and possible expulsion from the Graduate Program.

**Technology Requirements and Support**

For issues related to Canvas, please contact the Graduate Office by email at: gradprgm@scripps.edu or by phone at: 858-784-8469.

**Course Grading**

Grading is in accordance with the academic policies of the Skaggs Graduate School. The breakdown of grading is as follows:

- Problem Sets: 40%
- Total Synthesis Outline: 20%
- Final Exams: 40%

| Grade Point | Letter Grade | |
|---|---|---|
| 4.00 | A | Outstanding achievement. Student performance demonstrates full command of the course subject matter and evinces a high level of originality and/or creativity that far surpasses course expectations. |
| 3.67 | A- | Excellent achievement. Student performance demonstrates thorough knowledge of the course subject matter and exceeds course expectations by completing all requirements in a superior manner. |
| 3.33 | B+ | Very good work. Student performance demonstrates above-average comprehension of the course subject matter and exceeds course expectations on all tasks as defined in the course syllabus. There is notable insight and originality. |

| | | |
|---|---|---|
| 3.00 | B | Satisfactory work. Student performance meets designated course expectations and demonstrates understanding of the course subject matter at an acceptable level. |
| 2.67 | B- | Marginal work. Student performance demonstrates incomplete understanding of course subject matter. There is limited perception and originality. |
| 2.33 | C+ | Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree. |
| 2.00 | C | Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree. |
| 0.00 | I | Incomplete is assigned when work is of passing quality but is incomplete for a pre-approved reason. Once an incomplete grade is assigned, it remains on student's permanent record until a grade is awarded. |
| 0.00 | P | Satisfactory work. Student performance demonstrated complete and adequate understanding of course subject matter. Course will count toward degree. |
| 0.00 | F | Unacceptable work/Failure. Student performance is unacceptably low level of knowledge and understanding of course subject matter. Course will not count toward degree. Student may continue in program only with permission of the Dean. |
| 0.00 | W | Withdrew from the course with Dean's permission beyond the second week of the term. |

- All courses will be recorded and maintained in the student's permanent academic record; only courses that apply towards the degree will appear on the academic transcript. Non-credit or audited courses will not appear on the transcript.
- 4 core courses taken for a letter grade (pass = B- or higher for a core course)
- 2 elective courses taken pass/fail (pass = A, B, C for an elective)

Because students are encouraged to take electives outside their area of expertise, a "C" letter grade is passing.

**Course Schedule:**

| Date | Details |
|---|---|
| Mon Sep 7, 2020 | Labor Day (No Class) |
| Tue Sep 8, 2020 | Conformational Analysis (Krishnamurthy) |
| Thu Sep 10, 2020 | Kinetics, Thermodynamics, and Reaction Mechanisms (Krishnamurthy) |
| Fri Sep 11, 2020 | Graduate Student Symposium (No Class) |
| Tue Sep 15, 2020 | Oxidation Reactions (Krishnamurthy) |
| Thu Sep 17, 2020 | Oxidation Reactions (Krishnamurthy) |
| Tue Sep 22, 2020 | Reduction and Nucleophilic Reactions (Krishnamurthy) |
| Thu Sep 24, 2020 | Reduction and Nucleophilic Reactions (Krishnamurthy) |
| Tue Sep 29, 2020 | Hydroboration/Oxidation (Krishnamurthy) |
| Thu Oct 1, 2020 | Enolate Generation and Alkylation (Krishnamurthy) |
| Tue Oct 6, 2020 | Aldol Reaction (Krishnamurthy) |
| Thu Oct 8, 2020 | TBD (Krishnamurthy) |
| Tue Oct 13, 2020 | Metalation Reactions (Krishnamurthy) |
| Thu Oct 15, 2020 | Final Exam #1 (Krishnamurthy) |
| Tue Oct 20, 2020 | Carbocationic cyclizations (Shenvi) |
| Thu Oct 22, 2020 | Radical cyclizations (Shenvi) |
| Tue Oct 27, 2020 | Electrocyclizations (Shenvi) |
| Thu Oct 29, 2020 | [4+2] cycloadditions (Shenvi) |
| Tue Nov 3, 2020 | [2+2] cycloadditions (Shenvi) |
| Thu Nov 5, 2020 | Dipolar cycloadditions (Shenvi) |
| Tue Nov 10, 2020 | [1,3], [1,5], [1,7] and [2,3] rearrangements (Shenvi) |
| Thu Nov 12, 2020 | [3,3] rearrangements (Shenvi) |
| Tue Nov 17, 2020 | More [3,3] Sigmatropic Rearrangements |
| Thu Nov 19, 2020 | Group Transfer |
| Tue Nov 24, 2020 | Olefin Synthesis (Shenvi) |
| Thu Nov 26, 2020 | Thanksgiving Holiday (No Class) |
| Fri Nov 27, 2020 | Thanksgiving Holiday (No Class) |
| Tue Dec 1, 2020 | Final Exam #2 (Shenvi) |