

**San José State University**  
**Department of Chemistry**  
**Organotransition Metal Chemistry, Chem 218, Fall, 2018**

<b>Instructor:</b>	Prof. Madalyn Radlauer
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<b>Office Hours:</b>	Monday 1 pm – 2 pm Wednesday 4 pm – 5 pm Friday 10 am – 11 pm or by appointment
<b>Class Days/Time:</b>	MW 6:00 pm – 7:15 pm
<b>Classroom:</b>	DH 415
<b>Prerequisites:</b>	CHEM 112B and CHEM 145 (with grades of "C" or better; "C-" not accepted) or similar (one full year of organic chemistry and one term of inorganic chemistry) or instructor consent. <i>Note: This course has been designed with the understanding that many students many not have background knowledge of inorganic chemistry. Thus, even if you do not have the prerequisite, you will likely be given permission to take the course. That said, please inform Dr. Radlauer if during the semester you feel your background is insufficient for the material being covered.</i>

### Course Website

Course materials such as the syllabus, handouts, assigned papers, assignment instructions, etc. can be found on [Canvas](https://sjsu.instructure.com/) (https://sjsu.instructure.com/). You are responsible for regularly checking with the messaging system in Canvas to learn of any updates.

**Course Description** (from the [University Catalog](http://info.sjsu.edu/web-dbgen/splash/catalog.html): http://info.sjsu.edu/web-dbgen/splash/catalog.html)

Structure and reaction chemistry of compounds which contain transition metal-carbon bonds. Applications to catalytic processes and to organic synthesis.

### Course Goals and Learning Objectives

The goal of this course is to introduce students to organometallic chemistry focusing on the reactivity of organotransition metal complexes.

#### Graduate Program Learning Objectives (PLO)

Upon successful completion of this program, students will be able to:

PLO 1: Demonstrate an advanced understanding of selected topics in chemistry.

PLO 2: Demonstrate information literacy skills for acquiring knowledge of chemistry, both as a student and as a life-long learner.

PLO 3: Communicate effectively, verbally and written, for the purposes of conveying chemical information to both professional scientists and to the public.

### Course Learning Objectives (CLO)

Upon successful completion of this course, students will be able to:

CLO 1: Classify organometallic complexes based on ligand types and electron count and relate those to predicted reactivity, spectroscopic analysis, and structural characterization.

CLO 2: Appraise proposed mechanisms for reactions involving organometallic complexes by recognizing fundamental reaction types/steps and analyzing kinetic data.

CLO 3: Design experiments to interrogate the structure, bonding, and reactivity of organometallic complexes.

CLO 4: Collect (peer-reviewed) papers on an organometallic chemistry topic, critically evaluate that literature, discuss those papers with their scientific colleagues, and develop a perspective on that area of research.

### Texts/Readings

**Textbook** (required for course readings)

*There is no required textbook for this course.*

**Other Textbooks** (not required, these may provide further clarification of various topics)

[Organotransition Metal Chemistry: From Bonding to Catalysis](#) by John Hartwig

[The Organometallic Chemistry of the Transition Metals](#) by Robert H. Crabtree

[Inorganic Chemistry](#) by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr

[Chemical Applications of Group Theory](#) by F. Albert Cotton

[Symmetry and Spectroscopy](#) by Daniel C. Harris and Michael D. Bertolucci

*These texts are on reserve at the King Library. They can also be checked out from Professor Radlauer during office hours and borrowed until the next class period.*

### Library Liaison

*You will need to use SciFinder and other databases to access the literature for this course. You should have a student library account with the King Library that allows you access the library electronic databases. If you plan to access the library services from off-campus, you may need to obtain a password and/or proxy to do so. Check the Library website for information. The reference Librarian for Chemistry is Yen Tran and her email is [yen.tran@sjsu.edu](mailto:yen.tran@sjsu.edu).*

## Course Requirements and Assignments

Graded work will include participation in class (including group activities), two problem sets, one in-class midterm exam, two in-class discussions that you will lead, pre-class questions for the discussions, and a final term paper, which all contribute to the course learning outcomes. Dates for the exam and due dates for the problem sets and term paper are in the Course Schedule below. Exams and assignments in the course will be weighted as shown below:

<b>Assignments</b>	<b>Points</b>
In-class Participation	150
Problem Sets (100 points each)	200
Midterm Exam	200
Leading Class Discussions (100 points each)	200
Pre-class Questions	50
Term Paper	200
<b>Total</b>	<b>1000</b>

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

## Final Examination or Evaluation

Logistics:

Your term paper will serve as your final exam for the course. You must pick a topic by September 26, 2018. You must meet with me to discuss your plans for the term paper between September 27<sup>th</sup> and October 3<sup>rd</sup>. You must also meet with me once between November 12<sup>th</sup> and November 21<sup>st</sup> to go through your current draft and discuss the progress you have made on the term paper. For both meetings, I will send out a survey to sign up for meeting times. You will have the opportunity to send me a draft the week before it is due for general comments. The term paper itself will be due during our final exam period: 5:15 pm – 7:30 pm on Wednesday, December 12, 2018.

Content:

Your term paper should be a brief historical perspective, your personal perspective on the significance (or lack thereof) of the topic, and a critical evaluation of the seminal work. It should address unresolved issues and your own perspective on open research questions and opportunities. A literature review alone will not receive top marks, I am looking for you to evaluate the literature and form your own opinions based on the work that has been done in that area of research. To ensure that you have thoroughly searched the literature, your term paper must include a minimum of 15 references. It should be between 5 and 10 pages in length (double-spaced) and include figures. There will be a detailed rubric posted to Canvas.

## Grading Information

### Determination of Grades

Points will be distributed as described in Course Requirements and Assignments above. I will not curve, though I may, at the end of the course, linearly shift the scale. I will only shift it to benefit you. The course grade will be determined from the resulting average of the point total as follows:

<u>Percentage of Total Points</u>	<u>Final Course Grade</u>
96 and above	A+
92 to 95.9	A
88 to 91.9	A-
84 to 87.9	B+
80 to 83.9	B
76 to 79.9	B-
72 to 75.9	C+
68 to 71.9	C
64 to 67.9	C-
60 to 63.9	D+
56 to 59.9	D
52 to 55.9	D-
less than 52	F

### **In-class Participation**

Throughout the semester, there will be a variety of in-class quizzes, group activities, group discussions, and full-class discussions. In order to achieve the course learning objectives, you will need to be an active participant in these aspects of the course. Thus, 15% of your grade will be based on your participation. Part of this grade will reflect whether you follow classroom protocol (below).

### **Classroom Protocol**

Be on time to class; class starts at 6:00 pm sharp. Device use in class should be limited to taking notes. No device use is allowed during the midterm exam. I hope that the classroom will serve as an environment that will promote learning and the development of new ideas, as well as be a safe and respectful community. Behavior that interferes with the normal academic function in a classroom is unacceptable. Students exhibiting this behavior will be asked to leave the class. The university has a [brochure on student conduct](http://www.sjsu.edu/studentconduct/docs/ENGLISH%20Brochure.pdf) that you can view at <http://www.sjsu.edu/studentconduct/docs/ENGLISH%20Brochure.pdf>

### **Problem Sets**

Problem sets will be due by the beginning of class on their due date. Late assignments will not be accepted. Problem sets can be done in groups, but each student must turn in their own individual work. Working in groups does not mean copying down each other's answers. Please do your own work.

### **Classroom discussions and Pre-class questions**

In the latter half of the semester (after the midterm exam), the class structure will change from one primarily involving lecture and related activities to one involving primarily critical discussion of literature. For these classes, I will assign 1 to 2 papers to be read before each class period. These papers will be posted at least a week ahead of time. It is expected that everyone will read these papers. Everyone will be required to post 1 question per paper to Canvas by 24 h before class. In addition, 2 or 3 students will be assigned to each class date and they will make a presentation for leading the discussion. To lead these discussions effectively, you may want to examine resources/papers in addition to those that are assigned. You should coordinate with the other person/people assigned to the same discussion date. Note that you are always welcome to come discuss your papers with me in office hours (or by making an appointment) ahead of class. You will be assigned 2 discussions to co-lead. I will aim to make one of those closely related to your term paper topic. The rubric for grading will be discussed on the first day of class and will be available for reference on Canvas.

## Problem Sets

Problem sets will be due by the beginning of class on their due date. Late assignments will not be accepted. Problem sets can be done in groups, but each student must turn in their own individual work. Working in groups does not mean copying down each other's answers. Please do your own work.

## Missed Exams and Group Activities

If an exam, quiz, group activity, or class discussion is missed without a legitimate excuse, a score of 0 will be entered for that assignment. If an acceptable excuse is provided, then the grade will be the average of your other grades in that assignment category. In no case will a make-up exam or in-class activity be given. Contact me *in advance* if you will miss class for a legitimate activity. As the final exam is a term paper which you will have ample time to work on prior to our assigned final exam time, there will be no rescheduling or extensions.

## Exam Regrades

To qualify for an exam regrade, you must take the exam in ink and not use white-out. Do not write on your exams that are submitted for a regrade. Submitting a modified exam for regrading is a serious breach of academic integrity. Regrades must be submitted within one week of the exam being handed back to you. Regrade requests must include a written description of what you feel was graded incorrectly. One exception to all of the above: if an arithmetic error in your point tally has occurred, simply write "tally error" as your explanation and I will check the point tally.

## Email policy

I receive a lot of emails, so to be sure that I see your email, all Chem 218 emails should have Chem 218 in the subject line. I will do my best to respond to class-related emails within 1 business day of receiving them, however, keep in mind that this may not always be possible, especially during high volume times (around exams). Please try not to wait until the last minute to ask questions via email. I may also be slower to respond to emails late at night or over the weekends. Office hours are the best way to get timely answers to more complicated questions.

## University Policies

The Office of Graduate and Undergraduate Programs hosts university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc." You will find all syllabus related University Policies and resources information listed on [GUP's Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.

## Consent for Recording of Class and Public Sharing of Instructor Material

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course. Please come to office hours to discuss this if you feel you need to record anything.

- "You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material."
- "Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent."

## **Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](#). Students should be aware of the current deadlines and penalties for dropping classes ([Late Drop Information](#) can be found at <http://www.sjsu.edu/aars/policies/latedrops/policy/>). Information about the latest changes and news is available at the [Advising Hub](#).

## **Accommodation to Students' Religious Holidays**

[University Policy S14-7](#) states that San José State University shall provide accommodation on any graded class work or activities for students wishing to observe religious holidays when such observances require students to be absent from class. It is the responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor, in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed.

## **Academic Integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy F15-7](#) requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. Visit the [Student Conduct and Ethical Development website](#) for more information.

## **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](#) requires that students with disabilities requesting accommodations must register with the [Accessible Education Center \(AEC\)](#) to establish a record of their disability.

## **SJSU Counseling and Psychological Services**

The SJSU Counseling and Psychological Services is located on the corner of 7<sup>th</sup> Street and San Carlos in the new Student Wellness Center, Room 300B. Professional psychologists, social workers, and counselors are available to provide confidential consultations on issues of student mental health, campus climate, or psychological and academic issues on an individual, couple, or group basis. To schedule an appointment or learn more information, visit [Counseling and Psychological Services website](#) at <http://www.sjsu.edu/counseling>

# Organotransition Metal Chemistry, Chem 218, Fall 2018, Course Schedule

The tentative course calendar below includes weekly course content, problem set due dates, the midterm exam date, and dates related to the term paper. Dates may be subject to change, but prior to this, fair notice will be given during class and through Canvas. The topics covered in the latter half of the course may also change, especially if members of the class are particularly interested in a topic that is not currently on the list.

## Tentative Course Schedule

Class	Week	Date	Topics, Readings, Assignments, Deadlines
1	1	W 8/22	<i>First day of classes</i> In-class survey, introduction to course, types of ligands
2	2	M 8/27	Electron counting strategies and practice, ways we spectroscopically and structurally characterize organometallic complexes
3	2	W 8/29	Ligand substitution – mechanisms and a great example of an application of electron counting
	3	M 9/3	<i>Labor Day – No class</i>
4	3	W 9/5	Kinetics experiments and how they help us determine the mechanism
5	4	M 9/10	Back to ligand substitution – kinetics and trans effects
6	4	W 9/12	<b>Problem Set #1 Due</b> Oxidative addition
7	5	M 9/17	Reductive elimination
8	5	W 9/19	Migratory insertions
9	6	M 9/24	Eliminations
10	6	W 9/26	<b>Term Paper Topic Due</b> Nucleophilic and electrophilic attack on ligands
11	7	M 10/1	Defining “catalyst” and putting the fundamental reaction steps together into a catalytic mechanism, Part I
12	7	W 10/3	<b>Problem Set #2 Due</b> Putting the fundamental reaction steps together into a catalytic mechanism, Part II
13	8	M 10/8	C-H activation and kinetic isotope effect, Part I
14	8	W 10/10	<b>Midterm Exam</b>
15	9	M 10/15	C-H activation and kinetic isotope effect, Part I
16	9	W 10/17	Sigma bond metathesis
18	10	M 10/22	Carbenes and olefin metathesis, Part I
19	10	W 10/24	Olefin metathesis, Part II
20	11	M 10/29	Olefin polymerization
21	11	W 10/31	Olefin oligomerization
22	12	M 11/4	Pd-catalyzed cross coupling reactions and transmetalation
23	12	W 11/7	Other cross coupling reactions

Class	Week	Date	Topics, Readings, Assignments, Deadlines
	13	M 11/12	<i>Veteran's Day, observed – No class</i>
24	13	W 11/14	Carbonylation and hydroformylation, Part I
25	14	M 11/19	Carbonylation and hydroformylation, Part I
	14	W 11/21	<i>Thanksgiving Break – No class</i>
26	15	M 11/26	Hydrogenations, Part I
27	15	W 11/28	Hydrogenations, Part II
28	16	M 12/3	Dehydrogenations
29	16	W 12/5	Oxidations, Part I
30	17	M 12/10	Oxidations, Part II
	<b>Final Exam</b>	W 12/12	<b>Term Paper Due</b> – to my office (DH 517) within our assigned exam time, 5:15 pm – 7:30 pm
		F 12/21	<i>Grades available</i>