046

Washington State University
MAJOR CURRICULAR CHANGE FORM - - NEW/RESTORE COURSE

- ☐ **Please attach rationale for your request, a complete syllabus**, and explain how this impacts other units in Pullman and other campuses (if applicable).
- ☐ **Obtain all required signatures with dates.**
- ☐ **Provide original stapled packet of signed form/rationale statement/syllabus PLUS 10 stapled copies of complete packet to the Registrar's Office**, campus mail code 1035.
- ☐ **Submit one electronic copy of complete packet** to wsu.curriculum@wsu.edu.

Requested **Future** Effective Date: Fall 2016 (term/year) Course Typically Offered: Fall

DEADLINES: For fall term effective date: **October 1st**; for spring or summer term effective date: **March 1st**. See instructions.

NOTE: Items received after deadlines may be put to the back of the line or forwarded to the following year. Please submit on time.

☒ **New Course** ☐ **Temporary Course** ☐ **Restore Course**

CHEM	~~529~~ 535	Applied Spectroscopy
course subject/crosslist	course no.	title

3	(3	- 0)	None, Recommended Chem 345, 331, 332, and 425 ~~or equivalent~~ preparation
Credit hrs	lecture hrs per week	lab or studio hrs per week	prerequisite

Description for catalog: Application of optical (UV-visible, Fourier transform infrared, Raman, and fluorescence) and NMR spectroscopies to problem solving in chemical research.

Additional Attributes: Check all that apply.

☐ Crosslisting (between WSU departments)* ☐ Conjoint listing (400/500): _____

☐ Variable credit: _____ ☐ Repeat credit (cum. max. hrs): _____

Special Grading: ☐ S, F; ☐ A, S, F (PEACT only); ☐ S, M, F (VET MED only); ☐ H, S, F (PHARMACY, PHARDSCI only)

☐ Cooperative with UI ☐ Other (please list request): _____

The following items require prior submission to other committees/depts. (SEE INSTRUCTIONS.)

☐ Request to meet Writing in the Major [M] requirement **(Must have All-University Writing Committee Approval.)**

☐ Request to meet UCORE in _____ **(Must have UCORE Committee Approval ›› See instructions.)**

☐ Special Course Fee _____ **(Must submit request to University Receivables.)**

Contact: Scot Wherland **Phone number:** (509) 335-3360 **Campus mail code:** 4630

Email: scot_wherland @wsu.edu **Instructor, if different:** Profs. Mazur and Li

Scot Wherland 3/30/15	Richard Rudd 8/7/15	
Chair/date	**Dean/date**	**All-University Writing Com Date**
Chair (if crosslisted/interdisciplinary)*	**Dean (if crosslisted/interdisciplinary)***	**UCORE Committee Approval Date**
Catalog Subcommittee Approval Date	**GSC or AAC Approval Date**	**Faculty Senate Approval Date**

***If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.**

Rationale for Chem 535

This course has been given as a special topics course and the demand suggests that it should be given its own number. Graduate students doing experimental research need an efficient way to learn how to design spectroscopic experiments and interpret their results using currently available instruments and techniques.

Extended Rationale for the College of Arts and Sciences

1. This course will not affect faculty load or unit resources as it is a renumbering of a current course.

2. This course provides an efficient way for graduate students in chemistry to learn the theoretical foundations of several types of spectroscopy that they will be using in their laboratory work. It emphasizes techniques used by research groups in the department. The course has been offered as a special topics course in the past and had the necessary enrollment.

Campus Impact

This course will only be offered on the Pullman campus because this is the only campus offering a graduate chemistry degree.

SYLLABUS **CHEM 535-Applied Spectroscopy** **Fall 2016**

LECTURES: MWF 11:10 – 12:00 in Fulmer 225.

INSTRUCTORS: Prof. Ursula Mazur, OFFICE: Fulmer VIF N116a; PHONE: 335-5822; Email: umazur@wsu.edu. Office Hours: by appointment

INSTRUCTORS: Prof. Alex Li, OFFICE: Fulmer 171; PHONE: 335-7196; Email: dequan@wsu.edu; Office Hours: by appointment

GRADING: There is one midterm exam covering week 1 through week 7 materials and one another exam covering week 8 through week 15 material. The Final Grade will be 85 % of the average grade earned in the two exams and 15% of the average grade earned on the homework.

Grade (guaranteed minimum grade)	Percentage on exams combined
A	100—92.8%
A-	92.7—85.7%
B+	85.6—78.6%
B	78.5—71.5%
B-	71.4—64.4%
C+	64.3—57.2%
C	57.1—50%
F	below 50%

CREDITS: 3

PREREQUISITES: None, but see recommendation below.

It is recommended that students have completed at least one semester of undergraduate Organic Chemistry, for example CHEM 345, and one semester of Physical Chemistry CHEM 331 but preferably Quantum Chemistry CHEM 332. Quantitative Instrumental Analysis CHEM 425 is not required, but highly desirable.

COURSE DESCRIPTION, OBJECTIVES, AND LEARNING GOALS: This graduate level course provides fundamental and practical aspects of molecular spectroscopy. This course will focus on the material that will be instrumental to routine research activities for those who use nuclear magnetic resonance and optical spectroscopies. The focus will be on using spectroscopy to solve experimental problems and provide interpretation of observed phenomena. Two major emphases will address subject matter in optical spectroscopy (UV-Visible, FT-IR, Raman, and Fluorescence) associated with the electronic/molecular processes, and nuclear magnetic resonance (NMR) associated with structures and dynamics. Theoretical aspects about molecular spectroscopies are not emphasized here because this course aims to apply spectroscopies to solve real-world problems. The following are only a few general outcomes after students have finished the course successfully:

Student Learning Outcomes At the end of this course, students should be able to:	Course Topics/Dates The following topic(s)/dates(s) will address this outcome:	Evaluation of Outcome: This outcome will be evaluated primarily by:
Use spectroscopic techniques to identify and quantify experimental samples	*UV-vis spectroscopy/Week 1 & 2*	*Homework 1 and Exam 1*
Interpret the basic processes associated with molecular phenomena.	*UV-vis spectroscopy and infrared spectroscopy /Week 2 & 3*	*Homework 2 and Exam 1*
Explain the strengths and weaknesses of individual techniques and their applications to organic and inorganic compounds.	UV-vis spectroscopy, infrared spectroscopy, Raman spectroscopy, and fluorescence spectroscopy / Week 1-11	*Homework 1-7 and Exam 1 and Exam 2*
Explain spectra and relate the observations to electronic, molecular and dynamic processes occurring in the samples.	UV-vis spectroscopy, infrared spectroscopy, Raman spectroscopy, fluorescence spectroscopy, and NMR/ Week 1-15	*Homework 1-10 and Exam 1 and Exam 2*
Apply UV-Visible, FT-IR, and Raman and the techniques within those spectroscopic methods to gas, liquid, and solid samples.	UV-vis spectroscopy, infrared spectroscopy, and Raman spectroscopy/ Week 1-7	*Homework 1-5 and Exam 1*
Use optical spectroscopy to study the structure and orientation of molecules adsorbed on surfaces.	Infrared spectroscopy, and Raman spectroscopy/ Week 3-7	*Homework 1-5 and Exam 1*
Use fluorescence energy transfer as yardstick to measure distance at nanometer scales.	Fluorescence spectroscopy/ Week 8-10	*Homework 6 and Exam 2*
Use fluorescence turn-on or turn-off as an active chemical or biological sensing and detection mechanism.	Fluorescence spectroscopy/ Week 9-11	*Homework 7 and Exam 2*
Use NMR techniques to determine and confirm structures.	NMR spectroscopy/ Week 12 and 13	*Homework 8 and 9 and Exam 2*
Use NMR techniques to understand dynamic processes and molecular motions and molecular self-assemblies.	NMR spectroscopy/ Week 14 and 15	*Homework 10 and Exam 2*

TEXTBOOKS: No required textbooks, but the reference textbooks listed below are highly recommended. During the semester, lecture materials for the course will be organized from these textbooks and literature when necessary.

LECTURES: Lectures must be attended regularly and students are responsible for making up the missed materials. Exam questions are based primarily on lecture materials and homework. Students must read the reference textbooks or other reference materials before and after class in order to digest the materials better. The lectures will supplement, enhance (with literature references), and clarify the information from reference textbooks rather than simply reiterate it.

HOMEWORK: There will be 8-10 homework sets and they will be assigned in association with the material presented in the recent week. Homework will be due one week from the date assigned unless specified otherwise. Late homework will not be accepted.

EXAMS: There will be two exams: one midterm and one final. You will be responsible for bringing a calculator and a pencil to all exams. No notes or books are allowed. No make-up exams will be given. If you are unable to take a scheduled exam for reasons beyond your control, you should contact the instructor as soon as possible. These issues will be determined case-by-case by the instructor.

WORKLOAD: It is WSU policy that for every hour of in-class instruction, or equivalent online instruction, that students should expect at least 2 hours of outside class course preparation in the form of reading, course assignments, and review of previous lectures.

ACADEMIC INTEGRITY: Cheating or plagiarism in any form will not be tolerated. Cheating includes, but is not limited to: submitting non-original materials as the student's work or copying another student's work. Plagiarism is an act of using the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author. All incidences of cheating may be reported to the Office of Student Conduct. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). The standards of Conduct for Students can be found at http://conduct.wsu.edu.

ACCOMMODATIONS: Reasonable accommodations are available for students with documented disability. If you have a disability and may need an accommodation to fully participate in the class, please visit the DRC (Washington Building Room 217). Please stop by or call 509-335-3417 to make an appointment with a disability specialist http://www.drc.wsu.edu.

SAFETY ON CAMPUS: WSU has developed resources for the safety of students, faculty, staff and visitors. These are the Campus Safety Plan at http://safetyplan.wsu.edu and the university emergency management at http://oem.wsu.edu/. You should also become familiar with the WSU ALERT site at http://alert.wsu.edu for information about emergencies affecting WSU. It is recommended that you go to the My.WSU portal at https://portal.wsu.edu and **register your emergency contact information** for the Crisis Communication System (CCS).

Schedule **CHEM 535-Applied Spectroscopy** **Fall 2016**

Week	Topics	Instructor	Homework/Exam
8/25-8/29	UV-vis Spectroscopy	Mazur	HW assigned
9/1-9/5	UV-vis Spectroscopy, Labor Day Monday*	Mazur	
9/8-9/12	Infrared Spectroscopy	Mazur	HW assigned
9/15-9/19	Infrared Spectroscopy	Mazur	
9/22-9/26	Infrared/Raman Spectroscopy	Mazur	HW assigned
9/29-10/3	Raman Spectroscopy	Mazur	
10/6-10/10	Raman Spectroscopy	Mazur	Mid-term Exam
10/13-10/17	Fluorescence Spectroscopy	Li	HW assigned
10/20-10/24	Fluorescence Spectroscopy	Li	
10/27-10/31	Fluorescence Spectroscopy	Li	HW Assigned
11/3-11/7	Fluorescence Spectroscopy	Li	
11/10-11/14	NMR, Veteran's Day Tuesday	Li	HW assigned
11/17-11/21	NMR	Li	
11/24-11/28	Thanksgiving Vacation		HW assigned
12/1-12/5	NMR	Li	
12/8-12/12	NMR	Li	HW assigned
12/15-12/19	Final Week		Final Exam

- No lecture on Labor Day (Monday).

Reference textbook for UV-Vis: UV-VIS Spectroscopy and Its Applications, Heinz-Helmut Perkampus, H.C. Grinter, T.L. Threlfall, Springer Lab, 2012.

Reference textbooks for IR and Raman: Infrared and Raman Spectra of Inorganic and Coordination Compounds, Applications in Coordination, Organometallic, and Bioinorganic Chemistry, 6th edition, Kazuo Nakamoto, Wiley, 2009; Infrared and Raman Spectroscopy; Principles and Spectral Interpretation, Peter Larkin, Elsevier, 2011.

Textbook for fluorescence: Principles of Fluorescence Spectroscopy, 3rd edition, Joseph R. Lakowicz, Springer, 2006

Textbook for NMR: Spin Dynamics: Basics of Nuclear Magnetic Resonance, 2nd edition, Malcolm H. Levitt, Wiley, 2008