CHEM 431 Organic Molecular Structure Determination-CR /DE-2019-10-25

- The workflow icon is no longer available. Please click on the Page Status after the orange circle icon near the page title. *

Form Information

The page you originally access is the global template version. To access the template document that progresses through the workflow, please complete the following steps:

First Step: **ONLY** change the bracketed text in the proposal name to match one of the following naming formats. **You should remove the brackets as you do so.**

- For a course revision proposal: **SWST 201 Sidewalk Construction and Planning-CrsRvs-2019-09-02**
- For a course deletion proposal, you may modify the page code: **SWST 217 Construction of Cobblestone Sidewalks-CrsDel-2019-09-02**
- For a course revision that includes a new request for distance education approval, you may modify the page code: **SWST 440 Computer-Aided Sidewalk Design-CR/DE-2019-09-02**

Note - you generally do not need to request DE approval again if the course is already on the approved list: CLICK HERE TO SEE ALL APPROVED DE COURSES

Second Step: Click **"SAVE"** on bottom right

- ***DO NOT TYPE ANYTHING INTO THE FIRST PAGE OTHER THAN THE TEXT IN BRACKETS***
- ***Please be sure to remove the Brackets while renaming the page***

Third Step: Make sure the word ***DRAFT*** is in yellow at the top of the proposal

Fourth Step: Click on "**EDIT CONTENTS**" (*not EDIT*) and start completing the template. When exiting or when done, click **"SAVE"** (*not Save Draft*) on bottom right

When ready to submit click on the **Page Status** link next to the orange circle icon and hit approve. It will then move to the chair as the next step in the workflow.

**Indicates a required field*

Proposer*	Justin Fair	**Proposer Email***	jfair@iup.edu
Contact Person*	Justin Fair	**Contact Email***	jfair@iup.edu
Proposing Department/Unit*	Chemistry	**Contact Phone***	7-4477

Course Level*	undergraduate-level

Course Revisions

(Check all that apply;fill out categories below as specified; i.e. if only changing a course title, only complete Category A)

Category A:	Category B: class_lab_hour_change course_revision credit_hour_change distance-education ** Teacher Education: Please complete the Teacher Education section of this form (below)* ** Liberal Studies: Please complete the Liberal Studies section of this form (below)* ** Distance Education: Please complete the Distance Education section of this form (below)* *Check the **APPROVED DE Course List** - ON THE I-WIKI DOCUMENTS PAGE before completing the Distance Education (DE) section. If the course is already approved for Distance Education, you DO NOT need to do another DE proposal.*

Rationale for Proposed Changes (All Categories)

(A) Why is the course being revised/deleted:* *Please be specific - this should be have more detail than the Summary for the Senate.*	The main reason this course is being revised is to add the DE to it. The revision was suggested since the course has not been updated in some time. We are also updating class hours to be in line with the number of credits available and adding a focus to emphasize how the material is currently used in the chemical industry. DE will be used in Spring 2020. Please note that the prerequisites are needed to be sure students can identify organic molecules, their functional groups and molecular properties.
(B) University Senate Summary of Rationale*	*Please enter a single paragraph summary/rationale of changes or proposal for University Senate.* The main reason this course is being revised is to add the DE to it. The revision was suggested since the course has not been updated in some time. We are also updating class hours to be in line with the number of credits available (lab has not been apart of this course for over a decade).
(C) Implications of the change on the program, other programs and the Students:*	It provides more flexibility for the department to reach more students. No effect on outer programs.

Current Course Information*	
Category A	
(D) Current Prefix*	CHEM
Proposed Prefix	CHEM
(E) Current Number*	431
Proposed Number	431
(F) Current Course Title*	Organic Molecular Structure Determination
Proposed Course Title	Organic Molecular Structure Determination
(G) Current Prerequisite(s)	CHEM 231-332 (332 may be taken concurrently)
Proposed Prerequisite(s)	CHEM 231-332 (332 may be taken concurrently) *Note: if the current prerequisite is being dropped, you must state that clearly here: "Prerequisite is being changed to none." If it is being kept, you should repeat it here. Please do not leave either prerequisite field blank. If both the current and proposed rerequisites are 'none', please write 'none' in both boxes.*
(H) Current Catalog Description	Gives the student experience in systematic identification of various classes of organic compounds by both chemical and physical methods.
Proposed Catalog Description	Examines modern and advanced methods of elucidation of the structures of organic molecules, including NMR, MS, and IR . Discusses the fundamental physical and chemical principles of each method. Focuses on structure determination by interpretation of data (spectra), either individually or combined. Emphasizes structure determination as currently applied in the chemical industry.
If changing Category A, no further action required.	
Category B (if no change, leave blank)	
(I)Repeatable Course This is only required for a course that can be repeated multiple times, such as an Independent Study or Internship. It does **not** refer to the D/F repeat process.	NO If YES, please complete the following: Number of Credits that May be Repeated: Maximum Number of Credits Allowed to be Repeated:

Proposed Repeatable Course	NO If YES, please complete the following: Number of Credits that May be Repeated: Maximum Number of Credits Allowed to be Repeated:
(J) Number of Credits	Class Hours per week:4 Lab Hours:var Credits:3
Proposed Number of Credits	Class Hours:3Lab Hours:0Credits:3
(K) Current Course Student Learning Outcomes (SLOs)	1. Classify and identify characteristic masses, absorption wavenumbers, and chemical shifts of common organic functional groups and atoms found in organic compounds 2. Elucidate the identity or structure of organic compounds using single or multiple spectroscopic techniques.
(L) Proposed Course Student Learning Outcomes (SLOs) For each outcome, describe how the outcome will be achieved	Note that the text box in the table expands

SLO #	Outcome	How the outcome is assessed
1	Classify and identify characteristic masses, absorption wavenumbers, and chemical shifts of common organic functional groups and atoms found in organic compounds	Homework, discussion, quizzes, exams
2	Elucidate the identity or structure of organic compounds using single or multiple spectroscopic techniques.	Homework, discussion, quizzes, exams
3	Analyze and plan for the success of an industrial chemical process using spectral determination.	Written reports, exams

(M) Previous Brief Course Outline *(It is acceptable to copy from old syllabus)*	*As outlined by the federal definition of a "credit hour", the following should be a consideration regarding student work - For every one hour of classroom or direct faculty instruction, there should be a minimum of two hours of out of class student work.* **Mass Spectroscopy** 1. Introduction and theory 2. Instrumentation 3. Ionization methods 4. Mass analyzers 5. Interpretation of EI mass spectra 6. Mass spectra of some chemical classes **Infrared Spectroscopy** 1. Introduction and theory 2. Instrumentation 3. Interpretation of spectra 4. Characteristic group absorptions of organic bonds **Proton Nuclear Magnetic Resonance Spectroscopy** 1. Introduction and theory 2. Instrumentation 3. Chemical shift 4. Spin-spin coupling, multiplets and spin systems 5. Exchangeable protons on oxygen, sulfur, and nitrogen 6. Coupling of protons to other nuclei (F, D, P, Si, and C) 7. Chemical equivalence 8. Magnetic equivalence 9. Rigid systems, three coupling constants 10. Weekly and strongly coupled systems 11. Chirality 12. Magnitude of vicinal and geminal coupling constants 13. Selective spin decoupling: Double resonance 14. Nuclear overhauser effect 15. Interpretation of spectra **Carbon Nuclear Magnetic Resonance Spectroscopy** 1. Introduction and theory 2. Instrumentation 3. Chemical shift 4. Spin-spin coupling, multiplets and spin systems **Two Dimensional Nuclear Magnetic Resonance Spectroscopy** 1. Introduction and theory 2. Correlation spectroscopy 3. COSY 4. HMQC 5. HMBC 6. TOCSY 7. ROESY 8. VGSE **Multinuclear Magnetic Resonance Spectroscopy** 1. Nitrogen 2. Fluorine 3. Silicone 4. Phosphorous

(N) Brief Course Outline *(Give sufficient detail to communicate the content to faculty across campus. It is not necessary to include specific readings, calendar or assignments)*	*As outlined by the federal definition of a "credit hour", the following should be a consideration regarding student work - For every one hour of classroom or direct faculty instruction, there should be a minimum of two hours of out of class student work.* **A: The Spectroscopy Endgame** 1. Overview of structural spectroscopy 2. The spectrum is continuous 3. Yes, your mass matters 4. Structural isomers are more straightforward while stereoisomers are the devil 5. Thinking of spectroscopy as a puzzle **B: Nuclear Magnetic Resonance (NMR) Spectroscopy** 1. Excitation of atomic nuclei 2. Shift happens 3. Coupling effects, the dance begins 4. Matching proton and carbon pairs 5. Correlation spectroscopy, advanced dance moves 6. **First paper detailing a current industrial process utilizing spectroscopy** **C: Mass Spectroscopy** 1. How best to weigh your mass 2. Sample preparation 3. Stripping electrons 4. Measure your mass by many means 5. The more fragile will crack first 6. Mass defects and isotopes 7. Putting it all together for spectra interpretation 8. Interpretation with NMR and MS **D: Infrared Spectroscopy** 1. Good vibrations 2. Liquids vs. solids 3. Group frequencies for ALL active functional groups 4. Spectra interpretation 5. Interpretation with IR, NMR AND MS 6. **Second paper detailing a proposed spectroscopic method to determine the success of an industrial process** **E: Electronic Absorption Spectroscopy** 1. UV-Vis light absorption 2. Electronic transitions 3. Isolated chromophores 4. Conjugated chromophores 5. Important naturally occurring chromophores: Amino acids, peptides, proteins, nucleic acids, and polynucleotides. 6. Spectra interpretation 7. Interpretation with UV-Vis, IR, NMR, AND MS

Distance Education Section

- Complete this section only if adding Distance Education to a New or Existing Course

If Completing this Section, **Check the Box to the Right:**	**NOTE: you must check this box if the Course has previously been approved for Distance Education** distance-education

Course Prefix /Number	CHEM
Course Title	Organic Molecular Structure Determination
Type of Proposal	*See CBA, Art. 42.D.1 for Definition* online
Brief Course Outline	*Give an outline of sufficient detail to communicate the course content to faculty across campus. It is not necessary to include specific readings, calendar or assignments* *As outlined by the federal definition of a "credit hour", the following should be a consideration regarding student work - For every one hour of classroom or* *direct faculty instruction, there should be a minimum of two hours of out of class student work.* **A: The Spectroscopy Endgame** 1. Overview of structural spectroscopy 2. The spectrum is continuous 3. Yes, your weight matters 4. Structural isomers are more straightforward while stereoisomers are the devil 5. Thinking of spectroscopy as a puzzle **B: Nuclear Magnetic Resonance (NMR) Spectroscopy** 1. Excitation of atomic nuclei 2. Shift happens 3. Coupling effects, the dance begins 4. Matching proton and carbon pairs 5. Correlation spectroscopy, advanced dance moves 6. **1st paper detailing a current industrial process utilizing spectroscopy** **C: Mass Spectroscopy** 1. How best to weigh your mass 2. Sample preparation 3. Stripping electrons 4. Measure your weight by many means 5. The more fragile will crack first 6. Mass defects and isotopes 7. Putting it all together for spectra interpretation 8. Interpretation with NMR and MS **D: Infrared Spectroscopy** 1. Good vibrations 2. Liquids vs. solids 3. Group frequencies for ALL active functional groups 4. Spectra interpretation 5. Interpretation with IR, NMR AND MS 6. **2nd paper detailing a proposed spectroscopic method to determine the success of an industrial process** **E: Electronic Absorption Spectroscopy** 1. UV-Vis light absorption 2. Electronic transitions 3. Isolated chromophores 4. Conjugated chromophores 5. Important naturally occurring chromophores: Amino acids, peptides, proteins, nucleic acids, and polynucleotides. 6. Spectra interpretation 7. Interpretation with UV-Vis, IR, NMR, AND MS
Rationale for Proposal (Required Questions from CBA)	

How is/are the instructor (s) qualified **in the Distance Education delivery** **method as well as the discipline?**	I have taught CHEM 105: The Forensic Chemistry of CSI for multiple years via distance education for multiple years and have taught CHEM 481/581 online. I hold a PhD in Chemistry from the University of Connecticut and have been a professor in the Chemistry Department at IUP since 2009. I am eligible to teach graduate courses. My main teaching responsibilities include Organic Chemistry I and II, College Chemistry II, and Forensic Chemistry of CSI. My scholarship has a focus in organic synthesis with a particular interest in a majority of the course topics. I have used many self-made multimedia to enhance my course offerings including adaptive quizzes in the LMS, YouTube videos, Camtasia, SCORM content, screen capture, enhanced mechanistic drawings, and video explanations.
For each outcome in the course, describe **how the outcome will be achieved using** **Distance Education technologies.**	Objective #1 - Classify and identify characteristic masses, absorption wavenumbers, and chemical shifts of common organic functional groups and atoms found in organic compounds How objective #1 will be met: Assigned readings from the text, supplemental materials, course videos will be used to provide context and showcase applications currently used in the chemical industry. Quizzes, located on the learning management system, will be used to help keep students on track with required reading and lectures. The "Open Book" midterm and final exam will assess the material which will be scanned and turned in on the learning management software. The exam will include questions such as essay, long answer, and elucidation insight mainly, but may also include no more than 20% multiple choice. Objective #2 - Elucidate the identity or structure of organic compounds using single or multiple spectroscopic techniques. How objective #2 will be met: Assigned readings from the text, supplemental materials, course videos will be used to provide context and showcase applications currently used in the chemical industry. Quizzes, located on the learning management system, will be used to help keep students on track with required reading and lectures. The "Open Book" midterm and final exam will assess the material which will be scanned and turned in on the learning management software. The exam will include questions such as essay, long answer, and elucidation insight mainly, but may also include no more than 20% multiple choice. Objective #3 - Analysis of and planning for the success of an industrial chemical process using spectral determination. How objective #3 will be met: Students will be required to complete a guided search of the relevant literature (i.e. Organic Process Research & Development) and written report on a spectroscopic method used in the chemical industry to access a chemical process. A second written report will formulate their own industrial process, using either MS, IR, or NMR, to determine the outcome of the process. Students will be provided with appropriate levels of chemical processes. In-depth feedback will be provided on the first assignment to provide guidance and assessment on their scientific writing ability. Turnitin will be used to provide feedback.
How will the instructor-student and **student-student interaction take place?** **(if applicable)**	The learning management system provides multiple opportunities for students to interact with the instructor and with other students through an online class discussion board. Students will also interact with the instructor through completion of online tests and quizzes using email will also have access to the instructor throughout the course for additional questions and assistance. Online office hours will be made available. There will be an emphasis on the editing and review of the written report.
How will student achievement be evaluated?	The course is divided into main units. Weekly quizzes will be given to encourage students to keep up with the material. These quizzes will include multiple-choice, long answer and matching questions. After mass spectroscopy, infrared spectroscopy and at the end of the course, tests will be administered. Due to the nature of the course management system's inability to accurately allow drawing and critical answers, exams will be supplied as a pdf that the students will download and print. Students will complete the exam, scan, and upload the exam before the deadline. Typically, three days will be given to complete the exam. Academic honesty statements will be included on each of the tests where they will sign. Students will write two reports on spectroscopic applications in the industry. The goal of the report is to develop an in-depth understanding of industrial applications while strengthening professional writing skills. Detailed rubrics will be provided to students and utilized by the instructor for all assignments.
How will academic honesty for tests **and assignments be addressed?**	The course syllabus will include the university academic integrity policy. The expectation for academic integrity and the penalty for dishonesty will be clearly stated. Quizzes will use timed tests, a random selection of questions, limit on attempts, and feedback only after quizzes end. Written papers will use Turnitin. All of the above examples are methods the instructor can instill to prevent academic dishonesty. Academic integrity will be described in the course syllabus as follows: Academic Honesty Policy: Shall be in accordance with the Indiana University of Pennsylvania Honesty Policy (IUP Student Handbook- Academic Integrity Policy and Procedures, see http://www.iup.edu/registrar/catalg/acapolicy) .

Liberal Studies Section

- Complete this section only for a new Liberal Studies course or Liberal Studies course revision

If Completing this Section, Check the Box to the Right:	**NOTE: you must check this box if the Course/Program has previously been approved for Liberal Studies**

Liberal Studies Course Designations (Check all that apply)	
Learning Skills:	
Knowledge Area:	
Liberal Studies Elective	*Please mark the designation(s) that apply - must meet at least one*

Expected Undergraduate Student Learning Outcomes (EUSLOs)

Map the Course Outcome to the **EUSLO's**

Map each course outcome to the appropriate EUSLOs tha apply. Fill in the course outcome number

See https://www.iup.edu/liberal/faculty-and-staff/euslos/ for additional information regarding mapping EUSLOs

Informed Learners demonstrate:	**Course SLO #**
• the ways of modeling the natural, social and technical worlds	
• The aesthetic facets of human experience	
• the past and present from historical, philosophical and social perspectives	
• the human imagination, expression and traditions of many cultures	
• the interrelationships within and across cultures & global communities	
• the interrelationships within and across disciplines	
Empowered Learners demonstrate:	**Course SLO #**
• effective oral and written communication abilities	
• ease with textual, visual and electronically-mediated literacies	
• problem solving skills using a variety of methods and tools	
• information literacy skills including the ability to access, evaluate, interpret and use information from a variety of sources	

	• the ability to transform information into knowledge and knowledge into judgement and action
	• the ability to work within complex systems and with diverse groups
	• critical thinking skills including analysis, application and evaluation
	• reflective thinking and the ability to synthesize information and ideas

Responsible Learners demonstrate:	**Course SLO #**
• intellectual honesty	
• concern for social justice	
• civic engagement	
• an understanding of the ethical and behavioral consequences of decisions and actions on themselves, on society, and on the physical world	
• an understanding of themselves and a respect for the identities, histories and cultures of others	

How will each outcome be measured (note should mirror (L) Student Learning Outcomes* (SLO) from the course proposal

Narrative on how the course will address the Selected Category Content

Course SLO #	Assessment Tool to be used to measure the outcome
1	
2	
3	

All Liberal Studies courses are required to include perspectives on cultures and have a supplemental reading.

Please answer the following questions.

Liberal Studies courses must include the perspectives and contributions of ethnic and racial minorities and of women whenever appropriate to the subject matter. Please explain how this course will meet this criterion.

Liberal Studies courses require the reading and use by students of at least one non-textbook work of fiction or non-fiction or a collection of related articles. Please describe how your course will meet this criterion.	

Teacher Education Section

- Complete this section only for a new Teacher Education course or Teacher Education course revision

If Completing this Section, **Check the Box to the Right:**	**NOTE: you must check this box if the Course/Program has previously been approved for Teacher Education related items**
Course Designations:	
Key Assessments	
	For both new and revised courses, please attach (see the program education coordinator): • The Overall Program Assessment Matrix • The Key Assessment Guidelines • The Key Assessment Rubric **File** **Modified** No files shared here yet. • Drag and drop to upload or browse for files
Narrative Description of the **Required Content**	*How the proposal relates to the Education Major*

Please scroll to the top and click the Page Status if you are ready to take action on the workflow.
Please submit an ihelp if you have any questions http://ihelp.iup.edu