Faculty Senate Course Form

Effective Date: **Fall 2025** Submission Date: 10/28/2024

Department: Chemistry College of: **Arts & Sciences**

Contact Person: Alessandro Martins Prefix: **CHEM**

Create New, Revise, Inactivate, or Reactivate: **New** Course #: **630**

Course Form:
- Used to create new course numbers or new prefixes.
- Used to change Name, Grading, Hours, Description, Reactivate
- Used to inactivate a course from the current catalog. Courses are never deleted. They are made inactive and can be legislated to become active again.

1. Purpose/Justification for the Changes:
Offering new course on Polymerization and Polymer Kinetics based on faculty expertise in the area.

2. Is this related to, and/or affect, any other department/college/unit curricula or programs at Pittsburg State University? ***If "Yes", please provide an explanation. Provide documentation of any discussions (e.g. copies of emails, memos, etc.) that have occurred.***

○ Yes ◉ No

3. Is this course to be considered for General Education?
If "yes" this requirement will need approval of the General Education Committee after the revisions have been approved by Faculty Senate. The General Education Course Approval form will also need to be submitted.

○ Yes ◉ No

4. Will this course be required of any education majors?
If "yes," this requirement will need approval of the Council for Teacher Education before upload to " College Curriculum Legislation" in SharePoint.

○ Yes ◉ No

5. Will additional resources or costs be required?

○ Yes ◉ No

If so, what will be needed?

6. Will any additional course fees be required (e.g. equipment, clothing, travel, licensing, etc.)?
If "yes," complete the Course Fee Form on the Faculty Senate website, it will need to gain approval of the President's Council.

○ Yes ◉ No

7. Objectives/Student Learning Outcomes for NEW courses only, as it will appear in the syllabus:
Attach with upload.

8. Assessment Strategies (e.g. exams, projects, university rubric, etc.), as it will appear in the syllabus:
Attach with upload.

Course Numbers cannot be changed, only created.

	Exsisting	New/Proposed
Title:		Polymerization and Polymer Kinetics
Course Number:		
Credits:		**3**
Grading System:	**Select One**	**A-F, IN**
Pre/Co-Requisite(s):		CHEM225, CHEM335, CHEM336, and CHEM360, or instructor's permission.
Course Description:		This course will offer a detailed exploration of reaction kinetics in polymer science, covering polymerization and degradation kinetics. Topics include step-growth and chain-growth mechanisms, such as free radical, chain transfer, controlled radical (RAFT, ATRP), ionic (anionic, cationic), and ring-opening polymerization. Additionally, students will study degradation mechanisms affected by thermal, chemical, and biological factors, with real-world case studies throughout.

Authorization Sign-Off

Checklist

- ☐ Required fields completed.
- ☐ Syllabus attached for new courses
- ☐ Assignment Strategies Attached

-Approved: Department Chair/Director
Date: Nov 13, 2024 **Signature, Chair/Director:** _____

-Approved: College Curriculum Committee
Date: 12/2/24 **Signature, Committee Chair:** Christopher Childers

-Approved: Dean of College
Date: 12/2/24 **Signature, Dean:** Christopher Childers

-Approved: Council for Teacher Education (if applicable)
Date: _____ **Signature, Council Chair:** _____

-Approved: University Undergraduate Curriculum Committee
Date: _____ **Signature, Committee Chair:** _____

-Approved: Faculty Senate
Date: _____ **Signature, Recorder Faculty Senate:** _____

Originating Departments(s): After completing this form, please upload it to the SharePoint, within the appropriate College folder, "Preliminary Legislation", to allow for review and questions. Any modifications should be saved as "original file name.v2.docx" and uploaded as well.

Following final College Curriculum Committee approval, please apply the appropriate signatures, and send them to your College Administrator.

PITTSBURG STATE UNIVERSITY

Polymerization and Polymer Kinetics

Course Syllabus

Spring 20XX

CHEM 630 (Undergraduate) and CHEM 820 (Graduate)

Instructor: Dr. Alessandro Martins

Office: 105-G Heckert-Wells Hall

e-mail: amartins@pittstate.edu

Phone No: 620-235-4424

Lecture room: XXXX

Lecture time: MN, WD: 12:00-1:15 PM

Description: This course will provide an in-depth study of reaction kinetics as they apply to polymer science, including polymerization and other kinetic processes such as degradation kinetics. Students will explore both step-growth and chain-growth mechanisms and their kinetic behavior. Key topics covered include:

1. Introduction to Chemical Kinetics
2. Step-Growth Polymerization Kinetics: Case studies and examples from real-world applications.
   2.1. Liner polymers
   2.2. Crosslinked networks
   2.3. Copolymers
3. Chain Polymerization Kinetics: Case studies and examples from real-world applications.
   3.1. Free radical polymerization
      3.1.1 Ziegler-Nata Catalysis
      3.1.2 Cross-linking
   3.2. Chain transfer polymerization
   3.3. Controlled radical polymerization
      3.3.1. RAFT, ATRP
      3.3.2. Copolymers
      3.3.3. Metallocene-Catalyzed Polymerization
4. Ionic Polymerization Kinetics: Case studies and examples from real-world applications.
   4.1. Anionic
   4.2. Cationic
   4.3. Ring-opening polymerization (ROP)
5. Others: Case studies and examples from real-world applications.
   5.1. Ring-Opening Metathesis Polymerization (ROMP)
6. Degradation Kinetics: Case studies and examples from real-world applications.
   Overview of polymer degradation mechanisms, including thermal, chemical, and biological factors.

Prerequisite: CHEM-225 General Chemistry II, CHEM-335 Organic Chemistry II, CHEM-336 Organic Chemistry II Laboratory, CHEM-360 Introduction to Polymer Science and Technology, permission of instructor.

Textbooks/Materials (Required):

1. "Principles of Polymerization, 4th Edition." G. Odian. John Wiley & Sons, Inc. ISBN: 978-0471274001
2. "The Elements of Polymer Science & Engineering, Third Edition." A. Rudin and P. Choi. Elsevier. ISBN: 978-0-12-382178-2.
3. "Fundamentals of Polymer Engineering, Third Edition." A. Kumar and R. K. Gupta. CRC Press. ISBN: 978-1498759502
4. "Polymer Reaction Engineering" J. M. Asua. Wiley. ISBN: 978140514442
5. "Handbook of Polymer Degradation, 2nd Edition." S. H. Hamid. CRC Press. ISBN: 978-0824703240.

Note: Selected parts of these textbooks will be excellent guides for further study. The instructor reserves the right to extract and modify from these textbooks and other sources for a better student learning experience.

Course objectives: The primary objectives of this course are designed to provide students with a robust and comprehensive understanding of reaction kinetics in the context of polymer science. By the end of the course, students will achieve the following:

1. **Understand Fundamental Concepts**: Students will be able to comprehend the fundamental principles of chemical kinetics as they relate to polymer science, including key terms, definitions, and the underlying theories governing reaction rates.
2. **Analyze Step-Growth Polymerization**: Students will develop the ability to analyze step-growth polymerization kinetics, including understanding the mechanisms involved, the different types of polymers (linear, crosslinked, and copolymers), and be able to evaluate real-world case studies that illustrate their applications.
3. **Explore Chain Polymerization Kinetics**: Students will demonstrate an understanding of chain polymerization kinetics, including free radical polymerization and controlled radical mechanisms (e.g., RAFT, ATRP). They will also learn about the role of catalysts and chain transfer processes, supported by relevant case studies.
4. **Evaluate Ionic Polymerization Kinetics**: Students will gain insights into ionic polymerization kinetics—including both anionic and cationic mechanisms—and their applications in producing specific polymers. They will be expected to engage with case studies that exemplify these processes.
5. **Investigate Unique Polymerization Methods**: Students will explore additional polymerization methodologies, such as ring-opening metathesis polymerization (ROMP), enabling them to evaluate the advantages and disadvantages of various synthesis methods through practical case studies.
6. **Examine Degradation Kinetics**: Students will understand the various mechanisms of polymer degradation, including thermal, chemical, and biological factors. They will be equipped to analyze

how these degradation processes impact polymer materials' physical properties and longevity, supported by real-world examples.

7. **Apply Knowledge to Practical Scenarios**: Throughout the course, students will engage in case studies and practical scenarios, applying their knowledge of polymerization and degradation kinetics to solve complex problems in polymer science. This application-oriented approach will enhance their critical thinking and problem-solving skills relevant to the field.
8. **Communicate Scientific Concepts Effectively**: Students will develop their ability to communicate complex scientific concepts and findings clearly and effectively in written and oral formats, fostering skills essential for professional success in polymer science.

By fulfilling these objectives, students will become adept in polymerization and degradation kinetics' theoretical and practical aspects, preparing them for further study or professional careers in polymer science and engineering. Students will Understand the fundamental principles of chemical kinetics as they apply to polymer reactions. Understanding that the kinetics of polymerization is vital for achieving the desired properties in polymer production.

Course Requirements: Regular participation and note-taking are crucial for completing coursework successfully. Students must attend classes regularly and stay updated with the lecture material to stay caught up. Much of the exam materials for which performance will be evaluated will be based on slides presented and explanations given in the class. Understanding the course material will depend heavily upon understanding the preceding material. Understanding the subject matter is strongly encouraged over mere memorization of facts since the latter will almost certainly guarantee a poor performance in the course and application of the knowledge acquired in the subsequent career. Therefore, the goal of each exam will be to evaluate understanding of the course material instead of mere memorization. This means that each student will ultimately be expected to utilize the basic principles taught in the course to solve new problem situations.

Evaluation of Performance: The grade in this course will be determined by a series of examinations. These exams will be given during class and will cover material discussed since the previous exam. Exams will be closed books, closed notes, and any other helping tool unless differently specified by the instructor. No makeup exams will be given unless prior permission is granted for absence. Showing up late for an exam will result in an automatic 10% reduction in score, and no extra time will be allowed. Grades will be based on the following system:

Four exams: 100%. Each exam: 25%, including a "final" exam: all exams are equal.

The overall letter grade for the course will be determined using the following relative scale:

A $\geq 90\%$

B 80-89%

C 70-79%

D 60-69%

F $< 60\ \%$

Tentative Calendar: Tentative course calendar for the spring semester of 2025 will be presented on Canvas before the beginning of the course and will be regularly updated during the semester. Please do not make any travel plans that conflict with your exam schedule.

Note that the schedule and examination topics given in the Course calendar in the first class are approximate only and subject to modification as necessary during the course occurrence. The material covered in each examination will be announced in the lecture class.

Academic Misconduct: No help will be allowed during exams, and using any materials, information sources (unless expressly stated by the instructor), or substitute person will be considered cheating. "Collaborative efforts" to answer exam questions are strictly forbidden since your answers must result from individual efforts. As defined above, evidence of cheating will result in a grade of zero for that exam for the first offense, even if the cheating activity involves only one question. In the second instance of such activity, the instructor will proceed with formal charges against the student to affect at least a failing grade in the course. **Please consult the policy on Student Academic Dishonesty.**

Please consult The PSU academic honesty policy, which can be found at the following URL address:

(http://www.pittstate.edu/office/registrar/syllabus-supplement.dot

Other: Students are expected to dress and behave according to generally accepted societal norms of decency for all course events, including classes and exams. Wearing sunglasses, sleeping, or disturbing other students in the class is not permitted. Use of cell phones, tablets, computers, or any other communication device during the class period is not allowed. Any of the above will result in ejection from the class after ONE warning.

Disclaimer: The instructor reserves the right to revise the content of this syllabus (including the Course Content and Calendar) as needed throughout the semester for a better learning experience for the students.