### PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE (50000-60000 LEVEL)

#### DEPARTMENT: Chemistry  
EFFECTIVE SESSION: Spring 2016

**INSTRUCTIONS:** Please check the items below which describe the purpose of this request:

1. New course with supporting documents (complete proposal form)
2. Add existing course offered at another campus
3. Expired of a course
4. Change in course number
5. Change in course title
6. Change in course credit type

#### PROPOSED:
- **Subject Abbreviation:** CHIM
- **Course Number:** 53000
- **Long Title:** Molecular Electrochemistry
- **Short Title:** Molecular Elect.

#### EXISTING:
- **Subject Abbreviation:** CHIM
- **Course Number:** 5300

#### TERMS OF OFFICE:
- **Check All That Apply:**
  - Fall
  - Spring
  - Summer

#### CAMPUS INVOLVED:
- Central
- ContEd
- Ft. Wayne
- Tech Stewart
- W. Lafayette
- Indianapolis

#### CREDIT TYPE:
- **1. Fixed Credit Cr. Hrs.:** 3
- **2. Variable Credit Range:**
  - Minimum Cr. Hrs.:
    - (Check One):
      - Yes
      - No
  - Maximum Cr. Hrs.:
    - Yes
    - No

#### COURSE ATTRIBUTES:
- **Check All That Apply:**
  - 0. Registration Approval Type
  - 1. Pass/No Pass Only
  - 2. Satisfactory/Unsatisfactory Only
  - 3. Repeatability
  - 4. Course by Examination
  - 5. Fee: Lab
  - 6. Course by Examination
  - 7. Variable Title
  - 8. Honors
  - 9. Full Time Instructors
  - 10. Off Campus Experience

#### SCHEDULE TYPE:
- **Lecture:**
- **Recitation:**
- **Presentation:**
- **Laboratory:**
- **Lab Prep:**
- **Studio:**
- **Distance:**
- **Clinic:**
- **Experiential:**
- **Research:**
- **Ind. Study:**
- **Field Study:**
- **Prac/Observ:**

#### COURSE DESCRIPTION (INCLUDE REQUIRED/RESTRICTIONS):

**See Attached.**

**COURSE LEARNING OUTCOMES:**

**See Attached.**

---

**Signature Page:**

- **Indianapolis Department Head:**
  - Date: 11/16
  - Signature: [Signature]

- **Indianapolis School Dean:**
  - Date: 12/16
  - Signature: [Signature]

- **Faculty Director of Graduate Studies:**
  - Date: 4/2/16
  - Signature: [Signature]

- **IU-Pui Associate Dean for Graduate Education:**
  - Date: 4/2/16
  - Signature: [Signature]

- **Tribute Date:**
  - 3/1/16
  - [Signature]

- **West Lafayette Department Head:**
  - Date: 4/2/16
  - Signature: [Signature]

- **West Lafayette School Dean:**
  - Date: 4/2/16
  - Signature: [Signature]

- **Graduate Council Secretary:**
  - Date: 4/2/16
  - Signature: [Signature]

---

**OFFICE OF THE REGISTRAR**

(Grad Form 40G [Excel format] - Does not include the Graduate Council's required supporting document. See pdf version of Form 40G)
CHM 53800

Course Description: P: CHM 53300. The course is intended to provide molecular aspects of genetic engineering in prokaryotic and eukaryotic systems and in-depth understanding of the industrial and the medicinal applications of biotechnology.

Course Learning Outcomes: To provide basic understanding of the structure, the function, and the biosynthesis of proteins and nucleic acids; to provide basic theoretical and practical understanding of genetic engineering and its applications; to introduce students to the diagnostic and therapeutic aspects of biotechnology; to understand pros and cons of biotechnology.
Supporting Document to the Form 40G
for a New Graduate Course

To: Purdue University Graduate Council
From: Faculty Member: Ronald S. Friedman

Department: Chemistry
Campus: Indiana University-Purdue University Fort Wayne

Date: June 8, 2016
Subject: Proposal for New Graduate Course

Contact for information if questions arise:
Name: Ronald S. Friedman
Phone: 260-481-6067
Email: friedman@ipfw.edu
Address: Department of Chemistry, IPFW, Fort Wayne, IN 46805

Course Subject Abbreviation and Number: CHM 53800

Course Title: Molecular Biotechnology

Course Description:
The course is intended to introduce students to the structure and functions of nucleic acids and to the nucleic acid-based technologies applicable to eukaryotic and prokaryotic systems. The topics covered in this course will include: recombinant DNA technologies, site-directed mutagenesis and protein engineering, protein expression in eukaryotic and prokaryotic systems, nucleic acids as tools in molecular diagnostics and in the development of therapeutics, transgenic animals and plants, bioinformatics and genomics. The course will also include projects based on current research published in high impact journals related to the above listed topics.

Semesters Offered:
For the benefit of graduate student plan of study development, how frequently will this prototype be offered? Which semesters?
The course will be offered during the spring semester each academic year.
A. Justification for the Course:

Provide a complete and detailed explanation of the need for the course (e.g., in the preparation of students, in providing new knowledge/training in one or more topics, in meeting degree requirements, etc.), how the course contributes to existing majors and/or concentrations, and how the course relates to other graduate courses offered by the department, other departments, or interdisciplinary programs.

Justify the level of the proposed graduate course (500- or 600-level) including statements on, but not limited to: (1) the target audience, including the anticipated number of undergraduate and graduate students who will enroll in the course; and (2) the rigor of the course.

- The Chemistry Department at IPFW currently offers two biochemistry lecture courses. The first of the two biochemistry courses, CHM 53300, provides an introduction to the structure and chemistry of biomolecules and to the mechanistic and kinetic aspects of enzymes. The other course (CHM 53400) comprehensively covers the metabolic aspects of carbohydrates, lipids, proteins, and nucleic acids. The two biochemistry courses are populated by students majoring in chemistry with the biochemistry option as well as by many undergraduate and graduate students of biology. Another advanced course in biochemistry is needed in order to provide students the knowledge and the training in aspects of molecular biology and biotechnology which are not covered by the two biochemistry courses currently offered by the department. This need became even stronger when the department started working on a new BS degree in biochemistry.

- The introduction of CHM 53800 will be an important step forward. The course will equip students with the basic training in the rapidly expanding field of biotechnology and will better prepare students for graduate programs in biochemical sciences and for jobs in biotech and related companies.

- The proposed course is an advanced course in a specialized area of biochemistry. Registration in this course will require CHM 53300 as a pre-requisite. The course is primarily intended for the proposed biochemistry degree program. It is, however, expected that biology undergraduate and graduate students will also register for this course as they currently do for CHM 53400. The course will be as rigorous as CHM 53400. In addition to the usual quizzes/tests/exams, the students will also be required to critically read and analyze an assigned research article, write a comprehensive report on the research described in that article, and give an in-class presentation. This is described in more detail below.

- The students will be assigned an original recent research paper published in a journal such as: Nature Biotechnology, Protein Engineering Design and Selection, Applied Microbiology & Biotechnology, Biotechnology & Bioprocess
Engineering, and Journal of Biotechnology. The students will be expected to read the assigned paper and prepare a comprehensive report. In their report they will be expected to write about the aims and objectives of the research described, the pros and cons of different techniques used, critical evaluation of the results described and a discussion of the conclusions reached in the paper. They will also be expected to write a narrative of proposed future research on that topic. The tests and exams conducted in the course will also be comprised of a subset of questions based on research data.

- Use the following criteria:
  * Graduate Council policy requires that courses at the 50000 level in the Purdue system should be taught at the graduate level and meet four criteria: a) the use of primary literature in conjunction with advanced secondary sources (i.e., advanced textbooks); b) assessments that demonstrate synthesis of concepts and ideas by students; c) demonstrations that topics are current, and; d) components that emphasize research approaches/methods or discovery efforts in the course content area (reading the research, critiquing articles, proposing research, performing research). Such courses should be taught so that undergraduate students are expected to rise to the level of graduate work and be assessed in the same manner as the graduate students.

- Anticipated enrollment
  - Undergraduate 10
  - Graduate 5

B. Learning Outcomes and Method of Evaluation or Assessment:

Describe the course objectives and student learning outcomes that address the objectives (i.e., knowledge, communication, critical thinking, ethical research, etc.). Expand lists and sub lists as needed.

- Objectives and Student Learning Outcomes
  - Course objectives:
    - To introduce students to:
      - The molecular basis of replication, transcription, and translation.
      - DNA recombinant technologies.
      - Protein engineering and its applications.
      - The diagnostic and therapeutic applications of biotechnology.
  - Learning outcomes:
    - Students who successfully complete the course should be able to:
      - Explain the concepts and important applications of biotechnology.
      - Develop protocols for the preparation of recombinant DNA.
      - Perform genetic engineering of a protein using various mutational techniques.
• Participate in a scientific discussion in the field of biotechnology.
• Propose research in a biotechnology related field.

• Methods of Evaluation

Describe the methods of evaluation or assessment of student learning outcomes. (Include evidence for both direct and indirect methods.) Expand table rows as needed.

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Methods of Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain the concepts and important applications of biotechnology.</td>
<td>Quizzes/examinations/homework/ingroup exercises</td>
</tr>
<tr>
<td>Develop protocols for the preparation of recombinant DNA.</td>
<td>Quizzes/examinations/homework/ingroup exercises</td>
</tr>
<tr>
<td>Perform genetic engineering of a protein using various mutational techniques.</td>
<td>Quizzes/examinations/homework/ingroup exercises</td>
</tr>
<tr>
<td>Participate in a scientific discussion in the field of biotechnology.</td>
<td>Project and oral presentation.</td>
</tr>
<tr>
<td>Propose research in a biotechnology-related field.</td>
<td>Project and oral presentation.</td>
</tr>
</tbody>
</table>

• Grading Criteria

Grading criteria (select from checklist); include a statement describing the criteria that will be used to assess students and how the final grade will be determined. Add and delete rows as needed.

<table>
<thead>
<tr>
<th>Grading Criteria (replace with check for all that apply)</th>
<th>Weight Toward Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>12%</td>
</tr>
<tr>
<td>In-class examinations</td>
<td>35%</td>
</tr>
<tr>
<td>Homework</td>
<td>12%</td>
</tr>
<tr>
<td>Project</td>
<td>6%</td>
</tr>
<tr>
<td>Oral presentation</td>
<td>6%</td>
</tr>
<tr>
<td>In-class group exercises</td>
<td>6%</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----</td>
</tr>
<tr>
<td>Final examination</td>
<td>23%</td>
</tr>
</tbody>
</table>

- **Methods of Instruction**

Identify the method(s) of instruction and describe how the methods promote the likely success of the desired student learning outcomes. Add and delete rows as needed.

<table>
<thead>
<tr>
<th>Hours per Week</th>
<th>Method of Instruction (replace with check for all that apply)</th>
<th>Contribution to Outcomes</th>
</tr>
</thead>
</table>
| 2.5            | Lectures                                                      | The lectures, by introducing students to the course material, will contribute to the following learning outcomes:  
- Concepts and applications of biotechnology.  
- Theory and applications of DNA recombinant technologies.  
- Genetic engineering of proteins using different mutational techniques. |
|                | Projects                                                      | • Scientific discussion of current topics in biotechnology.  
• Critical evaluation of research and review of literature. |
|                | Oral presentation                                             | • Scientific discussion of current topics in biotechnology.  
• Critical evaluation of research and review of literature. |
|                | In-class group exercises                                      | • All of the above outcomes |
C. Prerequisite(s):

List prerequisites and/or experiences/background required. If no prerequisites are indicated, provide an explanation for their absence. Add bullets as needed.

- CHM 53300: Introductory Biochemistry

D. Course Instructor(s):

Provide the name, rank, and department/program affiliation of the instructor(s). Is the instructor currently a member of the Graduate Faculty? (If the answer is no, indicate when it is expected that a request will be submitted.) Add rows as needed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Dept.</th>
<th>Graduate Faculty or expected date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eric Tippmann</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td>Yes</td>
</tr>
<tr>
<td>Peng Jing</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td>Yes</td>
</tr>
<tr>
<td>Mohammad Qasim</td>
<td>Associate Professor</td>
<td>Chemistry</td>
<td>Yes</td>
</tr>
</tbody>
</table>

E. Course Outline:

Provide an outline of topics to be covered and indicate the relative amount of time or emphasis devoted to each topic. If laboratory of field experiences are used to supplement a lecture course, explain the value of the experience(s) to enhance the quality of the course and student learning. For special topics courses, include a sample outline of a course that would be offered under the proposed course. (This information must be listed and may be copied from syllabus).

<table>
<thead>
<tr>
<th>Topics</th>
<th># of lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replication, transcription, and translation.</td>
<td>2</td>
</tr>
<tr>
<td>Recombinant DNA technology.</td>
<td>2</td>
</tr>
<tr>
<td>Chemical synthesis, amplification, and sequencing of DNA.</td>
<td>2</td>
</tr>
<tr>
<td>Bioinformatics, genomics, and proteomics.</td>
<td>2</td>
</tr>
<tr>
<td>Manipulation of gene expression in prokaryotes.</td>
<td>3</td>
</tr>
<tr>
<td>Heterologous protein production in eukaryotes.</td>
<td>2</td>
</tr>
<tr>
<td>Directed mutagenesis and protein engineering.</td>
<td>3</td>
</tr>
<tr>
<td>Molecular diagnostics and protein therapeutics.</td>
<td>1</td>
</tr>
<tr>
<td>Genetic engineering of plants.</td>
<td>2</td>
</tr>
<tr>
<td>Transgenic animals.</td>
<td>1</td>
</tr>
<tr>
<td>Human molecular genetics.</td>
<td>3</td>
</tr>
</tbody>
</table>
• Human gene therapy and genetic editing.
• miRNA and siRNA.
§ based on two-75 minute lectures per week.

F. Reading List (including course text):

A primary reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

A secondary reading list or bibliography should include material students may use as background information.

Primary Reading List


Secondary Reading List


G. Library Resources

Describe any library resources that are currently available or the resources needed to support this proposed course.

• Library resources will primarily be used for obtaining access to research articles. Helmke library at IPFW subscribes to a very large number of E-journals. In rare cases where an E-journal is not available, the library has an efficient documentary delivery
system for unavailable journals.

H. Course Syllabus
(While not a necessary component of this supporting document, an example of a course syllabus is available, for information, by clicking on the link below, which goes to the Graduate School's Policies and Procedures Manual for Administering Graduate Student Program. See Appendix K.