California State University San Marcos • NEW COURSE • FORM C CHEM 556

ORIGINATOR'S SECTION:

1. College:
☐ CHABSS ☐ CoBA
☐ CoEHHS ☒ CSM

Desired Term and Year of Implementation (e.g., Fall 2008):
Fall 2017

2.Course is to be considered for G.E.? (If yes, also fill out appropriate GE form*) ☐ Yes ☒ No

3. Course will be a variable-topics (generic) course? ☐ Yes ☒ No
("generic" is a placeholder for topics)

4. Course abbreviation and Number:* CHEM 556

5. Title: ***(Titles using jargon, slang, copyrighted names, trade names, or any non-essential punctuation may not be used.)***
Synthetic Biochemistry

6. Abbreviated Title for PeopleSoft:
(no more than 25 characters, including spaces)
Synthetic Biochemistry

7. Number of Units: 2

8. Catalog Description: ***(Not to exceed 80 words; language should conform to catalog copy. Please consult the catalog for models of style and format; include all necessary information regarding consent for enrollment, pre- and/or corequisites, repeated enrollment, crosslisting, as detailed below. Such information does not count toward the 80-word limit.)***

This course compares and contrasts cell-based and cell-free approaches to making and engineering commodity small molecules and genetically-encoded biopolymers using naturally-existing or biologically-inspired enzymes. Both templated and non-templated synthetic systems will be explored. Specific applications which will be discussed include biofuels production, drug discovery, protein engineering, and structural biophysics. *Prerequisites: A minimum grade of C (2.0) in CHEM 401 (or equivalent) and either CHEM 341 or CHEM 351 (or equivalent) or classified graduate standing.*

9. Why is this course being proposed?
This course is being proposed as part of the new Masters in Chemistry program.

10. Mode of Instruction*
For definitions of the Course Classification Numbers:
http://www.csusm.edu/academic_programs/curriculumscheduling/catalogcurricula/DOCUMENTS/Curricular_Forms_Tab/Instructional%20Mode%20Conventions.pdf

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture	2	C-02
Activity		
Lab		

11. Grading Method:*
☒ Normal (N) *(Allows Letter Grade +/-, and Credit/No Credit)*
☐ Normal Plus Report-in-Progress (NP) *(Allows Letter Grade +/-, Credit/No Credit, and Report-in-Progress)*
☐ Credit/No Credit Only (C)
☐ Credit/No Credit or Report-in-Progress Only (CP)

12. If the (NP) or (CP) grading system was selected, please explain the need for this grade option.

13. Course Requires Consent for Enrollment? ☐ Yes ☒ No

☐ Faculty ☐ Credential Analyst ☐ Dean ☐ Program/Department - Director/Chair

14. Course Can be Taken for Credit More than Once? ☐ Yes ☒ No
If yes, how many times? (including first offering)

15. Is Course Crosslisted: ☐ Yes ☒ No

If yes, indicate which course and check "yes" in item #22 below.

16. Prerequisite(s): ☒ Yes ☐ No CHEM 401 (or equivalent) and either 341 or 351 (or equivalent) or classified graduate standing.

17. Corequisite(s): ☐ Yes ☒ No

18. Documentation attached:

RECEIVED
MAR 17 2017

* If Originator is uncertain of this entry, please consult with Program/Department Director/Chair.

☐ Syllabus ☒ Detailed Course Outline

19. If this course has been offered as a topic, please enter topic abbreviation, number, and suffix:*

20. How often will this course be offered once established?* In a 2.5 to 3-year rotation of elective courses

PROGRAM DIRECTOR/CHAIR - COLLEGE CURRICULUM COMMITTEE SECTION:
(Mandatory information – all items in this section must be completed.)

21. Does this course fulfill a requirement for any major (i.e., core course or elective for a major, majors in other departments, minors in other departments)? ☒ Yes ☐ No

If yes, please specify:
Elective in the Masters of Science in Chemistry: Intended for Biochemistry option, but serves as an elective course in the chemistry option as well.

22. Does this course impact other discipline(s)? *(If there is any uncertainty as to whether a particular discipline is affected, check "yes" and obtain signature.)* ☐ Yes ☒ No

If yes, obtain signature(s). Any objections should be stated in writing and attached to this form.

Discipline _____ _____ _____Support _____Oppose
Signature Date

Discipline _____ _____ _____Support _____Oppose
Signature Date

SIGNATURES : (COLLEGE LEVEL) :

K. Hamadani 8/4/2016
1. Originator (please print or type name) Date

8/9/16
2. Program Director/Chair Date

12/14/16
3. College Curriculum Committee Date

12/14/16
4. College Dean (or Designee) Date

(UNIVERSITY LEVEL)

5. UCC Committee Chair Date

6. Vice President for Academic Affairs (or Designee) Date

7. President (or Designee) Date

Office of Academic Programs Banner: BS Catalog Revised 3/28/2007

* If Originator is uncertain of this entry, please consult with Program/Department Director/Chair.

RP Tracker ✓

Course Outline: Chem 556 Synthetic Biochemistry

Course Description: This course compares and contrasts cell-based and cell-free approaches to making and engineering commodity small molecules and genetically-encoded biopolymers using naturally-existing or biologically-inspired enzymes. Both templated and non-templated synthetic systems will be explored. Specific applications which will be discussed include biofuels production, drug discovery, protein engineering, and structural biophysics. Prerequisites: CHEM 341 or 351, CHEM 201 (or equivalent), and CHEM 401 or equivalent.

Students will be responsible for delivering presentations on topics selected from the literature and generating novel research proposal ideas. The proposals will be evaluated for creativity, feasibility, and impact. Recent discoveries and applications from both the scientific literature and industry will be featured throughout the course.

Course Learning Outcomes

- Describe the major pathways by which biological systems make and evolve small molecules and biopolymers.
- Examine how scientists have begun to harness and adapt these natural biosynthetic pathways for the production of designer molecules *in vivo* (e.g. synthetic or chemical biology).
- Examine how scientists have begun to harness and adapt these natural biosynthetic pathways for the production of designer molecules *in vitro*.
- Appreciate the advantages, limitations, and complementary nature of the *in vitro* and *in vivo* approaches mentioned above.
- Appreciate the different applications for which templated (i.e. genetically-encoded) and non-templated synthetic biochemistry tools are most well suited.
- Recognize the challenges involved in efforts aimed at designing artificial minimalistic cells and organisms.

Text: A collection of research articles and excerpts from selected texts will be made available in the form of a course reader. The following textbooks will also be made available to the class by the instructor:

- Introduction to Bioorganic Chemistry and Chemical Biology, by David Van Vranken and Gregory A. Weiss, *Garland Science*, 2012

Attendance: This course is discussion-based and relies heavily on the use of class notes for quizzes rather than texts. For these reasons, attendance is essential to do well in the class.

Examination: An open notes essay- and problem-based final exam will be given.

Quizzes: Eight quizzes are anticipated for the semester. The 15-minutes quizzes will be based on readings and class notes since the last quiz. Goals in this course include the ability to discuss important aspects of study in natural products biosynthesis and to have a good set of notes to take with you.

Grading: The course will be graded based on the following criteria

Presentation & Discussion	200 points	
Quizzes	120	(8 quizzes x 15 points each)
Participation	40	
Final Exam	100	
Total Possible Points	460	

Topics:

Week 1-3	Using aptamers to control transcription and translation; Chemical synthesis of proteins; Incorporating unnatural amino acids into proteins *in vitro* and *in vivo*; Directed evolution of enzymes;
Week 4-5	The combinatorial nature of DNA and RNA
Week 6-8	Biosynthesis of Natural Products; Combinatorial and diversity-oriented synthesis; Chemical genetics; Small molecule/ drug discovery; Small-molecule target identification; Drug mechanism; Drug design
Week 9-10	Chemical control of signal transduction in various applications
Week 11	Glycobiology
Week 12-14	Student Presentations
Week 15	Review

Presentation

Part 1: Oral. Students will choose from a list of topics to study in more detail and present to the class. Students will choose one paper that would be a good introduction to the topic for classmates. Paper will be submitted to instructor at least 3 class sessions before scheduled oral presentation. The paper will be distributed to the class one week before the discussion. Students will prepare 3-5 thought-provoking questions for the class to incorporate into the presentation.

Part 2: Written. A 5-6 page paper (1.5 – double spaced, 12 pt. font, ¾" – 1" margins) is due within two weeks of oral presentation. Five points per day will be deducted for late papers. The paper should be written as a review of your topics, complete with abstract.