California State University San Marcos • NEW COURSE • FORM C CHEM 555

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 555

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

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

7. Number of Units: 3

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.)***

Focuses on enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. Includes a review of basic enzymatic concepts, enzyme kinetics of single substrate reactions, enzyme inhibition and multi-substrate enzyme systems, mechanisms of enzyme catalysis, active site studies, the description of specific well-characterized enzymes, and mechanisms of enzyme regulation. *This course may be taught together with CHEM 455 by the same instructor. May not be taken for credit by students who have received credit for CHEM 455. Prerequisites: CHEM 341 or 351 with a minimum grade of C (2.0) 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. CHEM 550 will serve as a required core course in the option in biochemistry.

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

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture	3	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 341 or 351 or classified graduate standing.

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

17. Corequisite(s): ☐ Yes ☒ No

18. Documentation attached:
☐ 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?* once every year or every 3rd semester

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:
Core course in the Biochemistry option of the Masters of Science in Chemistry, and an elective in the chemistry option.

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 _____ Signature _____ Date _____ Support _____ Oppose

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SIGNATURES : (COLLEGE LEVEL) :

S. Jayasinghe 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: PS Catalog Revised 3/28/2007

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

RP ____ Tracker ✓

To: CSM Curriculum Committee; University Curriculum Committee
From: Department of Chemistry and Biochemistry: Sajith Jayasinghe
Re: Dual listing of CHEM 455 and CHEM 555

As part of the Master of Science degree in Chemistry (biochemistry option) we are proposing a new graduate course, CHEM 555, titled "Enzymology". The proposed content of this course is the same as the content offered in our current undergraduate offering of CHEM 455 (also titled "Enzymology"). We request that CHEM 455 and CHEM 555 be dual listed to reflect the similarity in their course content.

Due to limited resources it would be difficult to for us to offer separate undergraduate and graduate courses in the same subject. Dual listing these two courses we enable us to provide a robust set of graduate courses for our new Masters Program.

To facilitate your approval of this dual listing we have submitted the following:

1. C-form for CHEM 555. The course description has been written to clearly indicate that the course will be taught together with CHEM 455 and that students receiving credit for CHEM 455 may not receive credit for CHEM 555.

2. Tentative syllabus for CHEM 555. The syllabus clearly indicates the additional assignments expected of graduate students.

3. C-2 form for CHEM 455. The course description of CHEM 455 is being modified to clearly indicate that the course will be taught together with CHEM 555 and that students receiving credit for CHEM 455 may not receive credit for CHEM 555.

4. Syllabus for CHEM 450 to facilitate comparison with CHEM 555.

CHEM 555 Enzymology

Instructor: Jose A. Mendoza, Ph.D.
Office: Science 2, room 335
Office Hours: TBA
Contact Info: Telephone: (760)-750-4180; E-mail: jmendoza@csusm.edu

Catalog Course Description
This course has been designed to teach the student majoring in science all the major aspects of the study of enzymes. The course focuses on the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell.

Expanded Course Description
Chemical reactions within the cell rarely occur without the presence of a catalyst, known as an enzyme. The focus of this course is enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. The course starts with a review of the basic enzymatic concepts. Then, it moves to enzyme kinetics of single substrate reactions, enzyme inhibition and multi-substrate enzyme systems. The course continues with mechanisms of enzyme catalysis, active site studies, and the description of specific well-characterized enzymes. Because many enzymes play key regulatory roles in metabolism, the course concludes with mechanisms of enzyme regulation.

Prerequisite
CHEM 341 or CHEM 351 with a minimum grade of C (2.0) or classified graduate standing. This course is dual-listed with CHEM 455. Course learning objectives in the subject area will be the same, but additional depth of understanding is expected for graduate students as a result of additional work assigned. In addition, graduate students will present papers to the class at the end of each topic, incorporating what was learned about the topic and outlining what was done in the research that applied to that topic.

Required Text
No single textbook is sufficient for the material but the best overall reference text is:
"Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding", 2nd ed. (1999), Alan Fersht, W.H. Freeman & Co. New York, NY. A copy of this text will be placed on reserve for reference purposes. Also, the following related texts will be placed on reserve as resources and to provide background information on the various topics discussed in the course: "Fundamentals of Enzymology", 2nd ed. (1995), Nicolas Price & Lewis Stevens, Oxford Univ. Press, New York, NY. "Understanding Enzymes", 2nd ed. (1985) Trevor Palmer, J. Wiley & Sons, N.Y. A copy of the lecture notes, including illustrations, will be made available to you for each lecture topic.

Course Learning Objectives
The major learning objective of the course is to understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. To achieve this, the students are expected to learn enzymology by remembering and understanding the:

- equations of enzyme kinetics (memory and critical thinking).
- methods used in enzyme kinetics (memory and critical thinking).

- principles of enzyme inhibition (critical thinking).
- mechanisms of enzyme catalysis (critical thinking)
- most well-characterized enzymes (memory and critical thinking)
- mechanisms of enzyme regulation (memory and critical thinking).

Course Requirements
There will be four partial exams, a comprehensive final exam and a written report, as well as presentations by graduate students.

Grading Criteria
Your grade will be based on points accumulated on the various course requirements as described below. The final exam will not be returned. However, upon request, students will be allowed to review it.

	Points	%	Date
Exam # 1	35 points	16.5 %	TBA
Exam # 2	35 "	16.5 %	TBA
Exam # 3	35 "	16.5 %	TBA
Exam # 4	35 "	16.5 %	TBA
Report	10 "	5 %	
Presentation	10	5%	
Final Exam	50 points	24 %	TBA
Total	210 points	100 %	

The course grades will be assigned according to the following scheme:

Percentage	Grade	Percentage	Grade
90 or more	A	70.0-72.4	C-
87.5-89.9	B+	67.5-69.9	D+
82.5-87.4	B	62.5-67.4	D
80.0-82.4	B -	60.0-62.4	D-
77.5-79.9	C+	59.9 or less	F
72.5-77.4	C		

Policy on Late Work and/or Missed Exams
Students who miss any exam will be given 24 hours to contact me otherwise they will be assigned a grade of zero on that exam. Make-up tests will only be given if the student has a valid excuse (severe illness, death in the family, etc.). No late reports will be accepted after the deadline. No exceptions will be made.

Writing Requirement
The university writing requirement will be satisfied in the course with the submission of a double-spaced four pages report. This will consist of a brief summary, but more importantly a critique of a peer-review article on an enzymatic topic that will be assigned by the instructor. The report will be graded based on readability (i.e. clarity, organization & grammar) and content. The deadline for its submission is TBA.

Academic Honesty Policy
As required by the Student Academic Honesty Policy students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All written work and oral presentation assignments must be original work. All ideas/material that are borrowed from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated with quotation marks. Students are responsible for honest completion of their work including examinations. There will be no tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole. Incidents of Academic Dishonesty will be reported to the Dean of Students. Sanctions at the University level may include suspension or expulsion from the University

Disabled Students Policy
Students with disabilities who require reasonable accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4200, and can be contacted by phone at (760) 750-4940. Students authorized by DSS to receive reasonable accommodations should meet with me during my office hours in order to ensure confidentiality.

Course Subject Outline

I. ENZYMES AS CATALYSTS (Fersht, Ch. 2; Price, Ch. 1 & 2 & Palmer, Ch. 1 & 16)
A. Overview--proteins as catalysts
B. Enzyme characteristics and properties
C. Enzyme nomenclature/classification
D. Enzyme Purification and Assay
(1) activity measurements
(2) enzyme units
(3) turnover number and properties
(4) purification and purity
(5) initial velocity measurements
(6) assay conditions
(7) methods for measurement
(8) choice of assay method
(9) practical considerations

II. ENZYME KINETICS (Fersht, Ch. 2-4, 6; Price, Ch. 4 & Palmer, Ch. 6-8)
A. Kinetics of single substrate reactions
(1) kinetic concepts
(2) enzyme kinetics
(a) Briggs-Haldane steady-state treatment
(b) Michaelis constant (K_m)

(c) specificity constant
(3) single enzyme kinetics
(4) graphical analysis

B. Enzyme inhibition

(1) Classification
(a) competitive
(b) noncompetitive
(c) uncompetitive
(d) substrate

C. Multi-substrate reactions

(1) convention
(2) mechanisms

D. Substrate binding analysis

(1) derivation
(2) methodology

III. MECHANISMS OF ENZYME CATALYSIS (Fersht, Ch. 2,9; Price, Ch.5 & Palmer, Ch. 10, 11)

A. Reaction Mechanisms and Catalysis

(1) proximity effect
(2) acid-base catalysts
(3) electrostatic
(4) functional groups
(5) structural flexibility

B. Active Site Investigations

(1) kinetic studies
(2) detection of intermediates
(3) x-ray crystallographic studies
(4) chemical modification of amino acid side chains
(5) site-directed mutagenesis studies
(6) enzyme engineering

C. Specific enzymes

(1) alcohol dehydrogenase
(2) ribonuclease A
(3) triose phosphate isomerase
(4) amino acyl tRNA synthetases
(5) carbonic anhydrase

IV. ENZYME REGULATION (Price, Ch. 6)

A. Partial Proteolysis

B. Phosphorylation, adenylylation, disulphide reduction

C. Allosteric regulation

(1) sigmoidal kinetics