

ORIGINATOR'S SECTION:	
1. College: <input type="checkbox"/> CHABSS <input type="checkbox"/> CoBA <input type="checkbox"/> CoEHHS <input checked="" type="checkbox"/> CSM	Desired Term and Year of Implementation (e.g., Fall 2008): Fall 2017
2. Current Course abbreviation and Number: CHEM 455	

Enzymology


TYPE OF CHANGE(S). Check ☒ all that apply.

Course Number Change	<input type="checkbox"/>	Delete Prerequisite	<input type="checkbox"/>	Other Prerequisite Change	<input type="checkbox"/>
Course Title Change	<input type="checkbox"/>	Add Corequisite	<input type="checkbox"/>	Grading Method Change	<input type="checkbox"/>
Unit Value Change	<input type="checkbox"/>	Delete Corequisite	<input type="checkbox"/>	Mode of Instruction Change (C/S Number)	<input type="checkbox"/>
Description Change	<input checked="" type="checkbox"/>	Add Consent for Enrollment	<input type="checkbox"/>	Consider for G.E. If yes, also fill out appropriate GE form.	<input type="checkbox"/>
Add Prerequisite	<input type="checkbox"/>	Delete Consent for Enrollment	<input type="checkbox"/>	Cross-list	<input type="checkbox"/>

Information in this section— both current and new — is required only for items checked (☒) above.

NEW INFORMATION:

CURRENT INFORMATION:

3. Title:	Course abbreviation and Number:
4. Abbreviated Title for Banner (no more than 25 characters):	Title: (Titles using jargon, slang, copyrighted names, trade names, or any non-essential punctuation may not be used.)
5. Number of Units:	Abbreviated Title for PeopleSoft: (no more than 25 characters, including spaces)
6. Catalog Description: 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. <i>Prerequisites: CHEM 341 or 351 with a minimum grade of C (2.0).</i>	Number of Units:
	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 <u>not</u> 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 555 by the same instructor. <i>Prerequisites: CHEM 341 or 351 with a minimum grade of C (2.0).</i>

7. Mode of Instruction* (See pages 17-23 at <http://www.calstate.edu/cim/data-elem-dic/APDB-Transaction-DED-SectionV.pdf> for definitions of the Course Classification Numbers)

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)	Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture			Lecture		
Activity			Activity		
Lab			Lab		

8. Grading Method:*

- ☐ Normal (N) (Allows Letter Grade +/-, and Credit/No Credit)
☐ Normal Plus Report-in-Progress (NP) (Allows Letter Grade

Grading Method:*

- ☐ Normal (N) (Allows Letter Grade +/-, and Credit/No Credit)
☐ Normal Plus Report-in-Progress (NP) (Allows Letter Grade

CURRENT INFORMATION:**NEW INFORMATION:**

+/-, Credit/No Credit, and Report-in-Progress) <input type="checkbox"/> Credit/No Credit Only (C) <input type="checkbox"/> Credit/No Credit or Report-in-Progress Only (CP))	+/-, Credit/No Credit, and Report-in-Progress) <input type="checkbox"/> Credit/No Credit Only (C) <input type="checkbox"/> Credit/No Credit or Report-in-Progress Only (CP))
9. If the NP or CP grading system was selected, please explain the need for this grade option.	
10. Course Requires Consent for Enrollment? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Faculty <input type="checkbox"/> Credential Analyst <input type="checkbox"/> Dean <input type="checkbox"/> Program/Department/Director/Chair	Course Requires Consent for Enrollment? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Faculty <input type="checkbox"/> Credential Analyst <input type="checkbox"/> Dean <input type="checkbox"/> Program/Department/Director/Chair
11. Course Can be Taken for Credit More than Once? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how many times (including first offering)	Course Can be Taken for Credit More than Once? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how many times (including first offering)
12. Is Course Cross Listed: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, indicate which course	Is Course Cross-listed? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, indicate which course and check "yes" in item #17 below.
13. Prerequisite(s):	Prerequisite(s):
14. Corequisite(s):	Corequisite(s):
15. Documentation attached: <input type="checkbox"/> Syllabus <input type="checkbox"/> Detailed Course Outline	

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

16. 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 for Chemistry and Biochemistry Majors

17. Does this course change impact other discipline(s)? *(If there is any uncertainty as to whether a particular discipline is affected, check "yes" and obtain signature.)* Check "yes" if the course is cross-listed. ☐ 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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18. Reason(s) for changing this course:

We are requesting that CHEM 455 be dual listed with CHEM 555 (a new course being proposed for the Master of Science in Chemistry (option in biochemistry). The course description is being modified to align with dual listing.

SIGNATURES : (COLLEGE LEVEL) :

J. Inschman 11/30/2016
 1. Originator (Please Print) _____ Date _____
 [Signature] 12/2/16
 2. Program Director/Chair _____ Date _____
 [Signature] 12/14/16
 3. College Curriculum Committee _____ Date _____
 [Signature] 12/14/16
 4. College Dean (or Designee) _____ Date _____

(UNIVERSITY LEVEL)

_____ Date _____
 5. UCC Committee Chair
 _____ Date _____
 6. Vice President for Academic Affairs (or Designee)
 _____ Date _____
 7. President (or Designee)

CHEM 455 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 consent of instructor.

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.

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.

	<u>Points</u>	<u>%</u>	<u>Date</u>
Exam # 1	35 points	17.5 %	TBA
Exam # 2	35 “	17.5 %	TBA
Exam # 3	35 “	17.5 %	TBA
Exam # 4	35 “	17.5 %	TBA
Report	10 “	5 %	
Final Exam	50 points	25 %	TBA
Total	200 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, adenylation, disulphide reduction

C. Allosteric regulation

- (1) sigmoidal kinetics
- (2) symmetry model
- (3) concerted model
- (4) kinetics and functions of allosteric enzymes
 - (a) phosphofructokinase
 - (b) glycogen phosphorylase