

ORIGINATOR'S SECTION:

1. College: CoAS CoBA CoE
 Desired Term and Year of Implementation (e.g., Fall 2008): Spring 2009

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 455

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

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

Chem 455 is an advanced undergraduate course for science majors. The focus of this course is enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. The course starts with a review of 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 and it concludes with mechanisms of enzyme regulation. Prerequisites: Chem 341 or Chem 351 with a minimum grade of C (2.0).

9. Why is this course being proposed?

To offer the advanced students in chemistry, biochemistry, and biotechnology with the opportunity to learn advanced aspects of enzymes that cannot be offered in the introductory biochemistry courses Chem 351 and Chem 352. Enzymes play essential roles in metabolism by functioning as biochemical catalysts. They are responsible for speeding up virtually all of the metabolic reactions. Thus, enzymes are vital to human health and several diseases are the result of malfunctioning regulatory enzymes being these the targets for a number of prescription drugs. Thus, this course is of relevance in the biochemical, biomedical, and biotechnological fields and can be of great help to our students in their future careers.

10. 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)
Lecture	3	C-2
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.

See new description att.

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

16. Prerequisite(s): Yes No Chem 341 or Chem 351

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?* Every other year

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:
 Science majors could take this course as an elective.

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.

BIOL Discipline	<u>Attached</u> Signature	_____ Date	_____ Support _____ Oppose
BIOT Discipline	<u>Attached</u> Signature	_____ Date	_____ Support _____ Oppose

SIGNATURES : (COLLEGE LEVEL) :

(UNIVERSITY LEVEL)

1. Originator (please print or type name) JOSE A. MENDOZA 3/11/08
 Date

2. Program Director/Chair [Signature] 3/11/08
 Date

3. College Curriculum Committee [Signature] 4/10/08
 Date

4. College Dean (or Designee) [Signature] 5/12/08
 Date

5. UCC Committee Chair _____ Date

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

7. President (or Designee) _____ Date

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

CHEM 455 Enzymology

Instructor: Jose A. Mendoza, Ph.D.
Office: Science 1, room 317-A
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

Debbie Schwarz

From: Denise Garcia
Sent: Friday, March 28, 2008 1:27 PM
To: Debbie Schwarz
Subject: CHEM 455 Proposal for Review-Part 2

Biology approves this course.

From: Debbie Schwarz
Sent: Thu 3/27/2008 4:16 PM
To: Denise Garcia; Bianca Mothe
Cc: Staci Beavers
Subject: CHEMISTRY Proposal for Review-Part 2

Hi Denise & Bianca,

Here is a another proposal for your review. Thanks for your attention, d

To: Denise Garcia
Biology
Bianca Mothe

From: Curriculum & Academic Policy Committee
College of Arts & Sciences

Date: March 27, 2008

Re: Proposal for Review
CHEM 455 C Form

Good Afternoon,

Attached is a form and supporting document for Chemistry 455.

Please review and indicate your support or your opposition.

You may sign the attached document . Or you may reply with your response.

We appreciate your attention. Please call if you have questions .

Curriculum & Academic Policy Committee
College of Arts & Sciences

Debbie Schwarz

From: Bianca Mothe
Sent: Sunday, March 30, 2008 8:50 PM
To: Debbie Schwarz; Denise Garcia
Cc: Staci Beavers
Subject: Re: CHEMISTRY Proposal for Review-Part 2

Dear Staci, Debbie and Denise:
Looks good to me from the Biotech standpoint.
Bianca

On 3/27/08 4:16 PM, "Debbie Schwarz" <dschwarz@csusm.edu> wrote:

Hi Denise & Bianca,

Here is a another proposal for your review. Thanks for your attention, d

To: Denise Garcia
Biology
Bianca Mothe

From: Curriculum & Academic Policy Committee
College of Arts & Sciences

Date: March 27, 2008

Re: Proposal for Review
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Good Afternoon,

Attached is a form and supporting document for Chemistry 455.

Please review and indicate your support or your opposition.

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We appreciate your attention. Please call if you have questions .

Curriculum & Academic Policy Committee
College of Arts & Sciences
Mark Wallace, Chair
Staci Beavers
Darlene Pina
Sajith Jayasinghe

Debbie Schwarz
College-Wide Curriculum Coordinator
College of Arts & Sciences
California State University

Virginia Mann

From: Sajith Jayasinghe
Date: Wednesday, January 14, 2009 2:52 PM
To: Virginia Mann; Jacqueline Trischman; Jose Mendoza
Cc: David Barsky; Olaf Hansen
Subject: RE: UCC and review of CHEM courses
Attachments: CHEM course descriptions.doc

Virginia,

Sorry about that. I took a look at the revised descriptions and they look fine. In the revised description for CHEM 341 there was an error I corrected. It read " May not be substituted for CHEM 315..." it should read "May not be substituted for CHEM 351...". I also added the 'biological sciences' where it says "(consult department)".

I am attaching the corrected version. I did not see any other problems with the descriptions.

Jay

-----Original Message-----

From: Virginia Mann
Sent: Wed 1/14/2009 12:01 PM
To: Jacqueline Trischman; Sajith Jayasinghe; Jose Mendoza
Cc: David Barsky; Olaf Hansen
Subject: FW: UCC and review of CHEM courses

Hiello Jackie,

The UCC has still not reviewed the four CHEM courses we received at the beginning of Fall 08, as we are awaiting the revised descriptions from you. David had sent you some suggested new wording, which is attached. Please see my Oct. email below, and David's from August. Sorry to be such a nudge - just trying to wrap up loose ends.

Virginia

CHEM 455
Enzymology

Proposed description:

Chem 455 is an advanced undergraduate course for science majors. The focus of this course is enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. The course starts with a review of 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 and it concludes with mechanisms of enzyme regulation.

Prerequisites: Chem 341 or Chem 351 with a minimum grade of C (2.0)

Revised 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. *Prerequisites: CHEM 341 or 351 with a minimum grade of C (2.0).*