CHEM 450

California State University San Marcos • **COURSE CHANGE(S)** • FORM C-2

ORIGINATOR'S SECTION:		
1. College: ☐ CHABSS ☐ CoBA ☐ CoEHHS ☒ CSM	Desired Term and Year of Implementation (e.g., Fall 2008): Fall 2017	
2. Current Course abbreviation and Number: CHEM 450		

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

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

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

CURRENT INFORMATION:	NEW INFORMATION:
	Course abbreviation and Number:
3. Title: Protein Structure + Function	Title: *(Titles using jargon, slang, copyrighted names, trade names, or any non-essential punctuation may not be used.)*
4. Abbreviated Title for Banner *(no more than 25 characters):*	Abbreviated Title for PeopleSoft: *(no more than 25 characters, including spaces)*
5. Number of Units:	Number of Units:
6. Catalog Description: Fundamentals of protein structure including structural motifs, domains, and folding; methods of protein structure determination; structural bioinformatics; and an in-depth consideration of the structure-function relationship in representative proteins involved in important biological functions such as transport, enzyme catalysis, protein-nucleic acid interactions, signal transduction, immunity, and membrane channels and receptors. *May not be taken for credit by students who have received credit for CHEM 491B. Prerequisite: CHEM 341 or 351 with a minimum grade of C (2.0).*	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.)* Fundamentals of protein structure including structural motifs, domains, and folding; methods of protein structure determination; structural bioinformatics; and an in-depth consideration of the structure-function relationship in representative proteins involved in important biological functions such as transport, enzyme catalysis, protein-nucleic acid interactions, signal transduction, immunity, and membrane channels and receptors. *This course may be taught together with CHEM 550 by the same instructor. May not be taken for credit by students who have received credit for CHEM 491B. Prerequisite: A minimum grade of C (2.0) in either CHEM 341 or 351.*

RECEIVED MAR 17 2017 BY:

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)
Lecture		
Activity		
Lab		

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Lab		

8. Grading Method:*	Grading Method:*

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

CURRENT INFORMATION:	NEW INFORMATION:
☐ 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))	☐ 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))
9. If the NP or CP grading system was selected, please explain the need for this grade option.	
10. Course Requires Consent for Enrollment? ☐ Yes ☐ No ☐ Faculty ☐ Credential Analyst ☐ Dean ☐ Program/Department/Director/Chair	**Course Requires Consent for Enrollment?** ☐ Yes ☐ No ☐ Faculty ☐ Credential Analyst ☐ Dean ☐ Program/Department/Director/Chair
11. Course Can be Taken for Credit More than Once? ☐Yes ☐ No If yes, how many times (including first offering)	**Course Can be Taken for Credit More than Once?** ☐Yes ☐ No If yes, how many times (including first offering)
12. Is Course Cross Listed: ☐ Yes ☐ No If yes, indicate which course	**Is Course Cross-listed?** ☐ Yes ☐ 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: ☐ Syllabus ☐ 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 450 be dual listed with CHEM 550 (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) :

S. Jayasinghe 8/4/2016
1. Originator (Please Print) 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

CHEMISTRY 450: Protein Structure and Function

Term: Fall 2016
Prerequisites: CHEM 341/351 (or equivalent with a minimum grade of C (grade point 2.0).
Class time: TBD
Class location: TBD
Instructor: Sajith Jayasinghe (Jay), Ph.D.
Inst. Office: TBD
Inst. Office hours: TBD
Inst. Phone: 760-750-8075
Inst. E-mail: sjayasin@csusm.edu

Course Objective: Fundamentals of protein structure including structural motifs, domains, and folding; methods of protein structure determination; structural bioinformatics; and an in-depth consideration of the structure-function relationship in representative proteins involved in important biological functions such as transport, enzyme catalysis, protein-nucleic acid interactions, signal transduction, immunity, and membrane channels and receptors. *This course will be taught together with CHEM 550 by the same instructor. May not be taken for credit by students who have received credit for CHEM 491B. Prerequisite: CHEM 341 or 351 with a minimum grade of C (2.0).*

Student Learning Outcomes:

Upon completion of this course students should be able to demonstrate:

1. a detailed knowledge of the four levels of protein structure including the forces and interactions that are responsible for protein structure, folding and stability.

2. a detailed knowledge of the techniques involved in protein expression and purification.

3. their knowledge of protein motifs and domains and how these elements dictate protein structure and the classification of proteins based on their structure.

4. an introductory knowledge of the techniques used in determining protein structure such as X-ray crystallography, NMR spectroscopy, EPR spectroscopy, CD spectroscopy, and Fluorescence spectroscopy.

5. a detailed understanding of the relationship between structure and function using representative examples of proteins involved in various biological processes.

6. their knowledge, and ability to use, the tools of structural bioinformatics to predict, analyze, and visualize protein structure and function.

These are general learning outcomes. Students are responsible for everything we discuss in class and available to you through your textbook.

Textbook: There is no required textbook. However, if you would like to have a text book, buy the following book online:

How Proteins Work *by Mike Williamson from Garland Science.*

You may also want to consider finding a used biochemistry textbook (one that was published in the last 5 years) to use as a reference.

Topic List: Below is the topic list for CHEM 450 for the spring semester of 2014. Although every attempt will be made to adhere to this list I reserve the right to adjust this list of topics and/or the time spent on each topic as the semester progresses.

Tentative Schedule of Topics (may be subject to change):

Week Of	Topic	Slides/Reading
Week 1	Introduction to the course Review of proteins and their structure Protein motifs, domains, and their classification according to protein structure.	CHEM450_Introduction.pdf CHEM450_ReviewProteinStructure.pdf CHEM450_MotifsAndDomains.pdf
Week 2/3	Introduction to the Protein Data Bank (PDB). Introduction to Visual Molecular Dynamics (VMD) and the visualization of protein structure.	No slides. In-class Handouts.
Week 4	Overview of Protein Folding Forces that determine protein structure Diseases of Protein Misfolding	CHEM450_ProteinFolding.pdf CHEM450_ForcesInProteinStructure.pdf **Reading Assignment:** Tadeo, X., et. al., Structural Basis for the Amino acid Composition of Proteins from Halophilic Archea., PLOS Biology, 7(12), e1000257.
Week 5	Computational tools in determining protein structure and function: • Protein sequence alignments • Secondary structure prediction • Homology modeling • Fold It	No Slides. In-class Handouts.

TBD	**In-Class Mid Term Examination**	
Week 6	Protein Expresion, Purification, and Characterization	CHEM450_ProteinPurification.pdf
Week 7	Techniques in determining protein structure and function: • Protein Fluorescence Spectroscopy • Protein Circular Dichroism Spectroscopy • Protein EPR spectroscopy • Protein NMR Spectroscopy • Protein X-ray crystallography	CHEM450_TechInProtStrucDetermination.pdf **Reading Assignment:** Koga, N. et.al., Principles for Designing Ideal Protein Structures. 2012. Nature, 491, 222-229.
Week 8	Structure facilitates protein function: the nature of protein-ligand interactions and Control of Protein Function Protein Evolution Case Study in Protein Structure and Function : Transport	CHEM450_ProteinFunction.pdf CHEM450_ProteinEvolution.pdf CHEM450_ProteinFunctionTransport.pdf **Reading Assignments:** Bhattacharya, A.A., et. al., Crystallographic analysis reveals common modes of binding of medium and long-chain fatty acids to human serum albumin. 2000. J. Mol. Biol, 303, 721-732. Hempstead, P.D., et. al., Comparison of the Three-Dimensional Structures of Recombinant Human H and Horse L Ferritins at High Resolution.,J. Mol. Biol., 1997, 268, 424-448.
TBD	**In-Class Mid Term Examination**	
Week 9	Case Study in Protein Structure and Function: Catalysts	CHEM450_ProteinFunctionCatalysis.pdf **Reading Assignment:** Kim, Y., et. al., Structure of Apo- and Monometalated Forms of NDM-1-A highly Potent Carbapenem-Hydrolyzing Metallo-beta-Lactamase, PLOS One, 6(9), e24621. Picot, D., et. al., The X-ray Crystal Structure of the Membrane Protein Prostaglandin H2 Synthase-1.1994. Nature, 367, 243-249.

Week 10	Case Study in Protein Stucture and Function: Cellular Signaling	CHEM450_ProteinFunctionSignalTransduction.pdf **Reading Assignment:** Sudo, Y., et. al., Spectral Tuning In Sensory Rhodopsin 1 from Salinibacter ruber., JBC, 286(12)11328-11336. Rasmussen, S.G.F., et.al., Crystal Structure of the B2Adrenergic Receptor-Gs Protein Complex. Nature, 2011. 477, 549-555.
Week 11	Lipid membranes, membrane protein structure, energetics that determine membrane protein structure, and overview of membrane protein folding. Case Study in Protein Structure and Function: Membrane Channels and Receptors	CHEM450_.LipidMembranesMembraneProt.pdf CHEM450_ ProteinFunctionMembraneTransport.pdf **Reading Assignment:** Doyle, A., et. al., The structure of the Potassoium Channel: Molecular Basis of K+ Conduction and Selectivity. 1998. Science, 280, 69-77. Toyoshima, C., and Nomura, H., Structural changes in the calcium pump accompanying the dissociation of calcium. 2002. Nature, 418, 605-611. Levin, E. J., et.al., Structure and Permeation Mechanism of a Mammalian Urea Transporter. 2012. 109(28), 11194-11199.
Week 12	Case Study in Protein Structure and Function: Defense	CHEM450_ProteinFunctionDefense.pdf **Reading Assignment:** Pejchal, R., Structure and Function of Broadly Reactive Antibody PG16 Reveal an H3 Subdomain that mediates Potent Neutralization of HIV-1., PNAS, 107(25), 11483-11488. Chruszcz, M., t.al., Structural and Immunologic Characterization of Ara h1, a Major Peanut Allergen. 2011. J. Biol. Chem., 286, 39318-39327.

Instructional Modes:

Although there will be traditional lectures during the semester, the class will also be conducted using protein modeling exercises and group discussions.

Reading Assignments and Presentations:

We will be discussing several articles from the primary literature that deals with issues of protein structure/function. Working in groups of 2/3 you will be responsible for reading the article and presenting a summary/critique of the **overall importance of the study, hypothesis tested, methods used, findings, their impact on the field, any future work needed, and the strength and weaknesses of the article. In addition your presentation should provide:**

1. The background (medical, evolutionary, molecular, and biochemical) context for the protein's function in the cell.
2. Features of the protein that are of particular interest.
3. Relationship between the protein's structure and function.
4. Regulation of protein function.
5. The article's use of information (such as the chemical nature of amino acid side chains, types and importance of noncovalent bonds, role of conformational changes, and bioinformatics) that we discussed in class.

The presentation should be 15-20 minutes in length. You are encouraged to prepare some leading questions to encourage classroom participation.

Additional information about preparing this presentation can be found in cougar courses.

After each article presentation ALL STUDENTS must submit a 1-2 page written summary/critique. The summary should contains information pertaining to the 5 points listed above.

Problem Sets: There will be a series of problem sets. Each problem set is due one week after it is posted/handed out.

Exams: There will be two in-class mid-term examinations. The 2 mid-term examinations are scheduled for **TBD**. The exams will be approximately 1 hours in length. You will need a green book for these exams.

There is a comprehensive take home final Examination. You will have one week to complete the exam from the date it is posted on cougar courses.

The final exam is due on **TBD**.

Grading (points):

Mid-term Examinations	100	36.4%
Final Examination	75	27.3%
Problem Sets	60	21.8%
Reading Presentation	10	3.6%
Reading Summary/Critiques	30	10.9%
Total	275	100.0%

Letter grades: Letter grades will be assigned based on the following cutoff values:

Percentage	**Grade**
92% and above	A
90 - 91.9%	A-
88 – 89.9%	B+
82 – 87.9%	B
80 – 81.9%	B-
78 – 79.9%	C+
72 – 77.9%	C
70 – 71.9%	C-
68 – 69.9%	D+
62 – 67.9%	D
60 – 61.9%	D-
59.9% and below	F

Writing Requirement:

The University Writing Requirement will be satisfied upon completion of the research proposal and examinations.

Students with Disabilities:

Students with disabilities who require accommodation must be approved by the Office of Disabled Student Services (DSS). Please contact this office as soon as possible and should meet with the instructor during office hours (or at some other

mutually agreeable time). The DSS office is located in Craven hall 5205. Their telephone number is (760) 750-4905 or TTY (760) 750-4909.

Academic Honesty:

All students are expected to maintain academic honesty. **All submitted work must be your own and must be written in your own words.**

All students should be familiar with the university policies and procedures concerning academic honesty as detailed in the university catalog. An online version of these polices and procedures can also be found at: http://lynx.csusm.edu/policies/procedure_online.asp?ID=187

Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. If you are caught cheating on an exam you will receive a grade of zero. All cases of academic dishonesty will be reported to the dean of students for appropriate action.

Use of Plagiarism Detection Software:

Where appropriate the instructor will use software (TURNITIN) for the detection of plagiarism.

Plagiarized work will not be graded (see above).

Use of Cellular Phones:

All cellular phones must be set to the silent mode. Please refrain from using your cellular phone during class. If you must answer your phone, due to an emergency, please leave the classroom.

Classroom Behavior and Student Code of Conduct:

Students are expected to respect and follow standards of student conduct while in class and on the campus. As your instructor, I have the following expectations concerning your behavior in this class:

1. Promote a courteous learning atmosphere by exhibiting mutual respect and consideration of the feelings, ideas, and contributions of others.
2. Practice consideration for others by maintaining a clean and orderly classroom.
3. Recognize everyone's opportunity to contribute information in a relevant and meaningful manner by not monopolizing discussions, interrupting, interjecting irrelevant, illogical or inappropriate questions or comments.
4. Do not dominate class discussion—give others a chance to contribute!
5. If you must eat in class do so discreetly.