California State University San Marcos • NEW COURSE • FORM C CHEM 550

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 550

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

6. Abbreviated Title for PeopleSoft:
(no more than 25 characters, including spaces)
Grad Protein Struct & Func

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.)***

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 450 by the same instructor. May not be taken for credit by students who have received credit for CHEM 450 or CHEM 491B. Prerequisite: A minimum grade of C (2.0) in CHEM CHEM 341 or 351 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/curriculumscheduling/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 CHEM 351 or classified graduate standing.

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MAR 17 2017
BY:

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

[redacted]

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?*** Once a 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:
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 BS Banner: Catalog Revised 3/28/2007

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

RP Teacher ✓

To: CSM Curriculum Committee; University Curriculum Committee
From: Department of Chemistry and Biochemistry: Sajith Jayasinghe
Re: Dual listing of CHEM 450 and CHEM 550

As part of the Master of Science degree in Chemistry (biochemistry option) we are proposing a new graduate course, CHEM 550, titled "Protein Structure and Function". The proposed content of this course is the same as the content offered in our current undergraduate offering of CHEM 450 (also titled "Protein Structure and Function"). We request that CHEM 450 and CHEM 550 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 550. The course description has been written to clearly indicate that the course will be taught together with CHEM 450 and that students receiving credit for CHEM 450 may not receive credit for CHEM 550.

2. Tentative syllabus for CHEM 550. The syllabus clearly indicates the additional assignments expected of graduate students.

3. C-2 form for CHEM 450. The course description of CHEM 450 is being modified to clearly indicate that the course will be taught together with CHEM 550 and that students receiving credit for CHEM 450 may not receive credit for CHEM 550.

4. Syllabus for CHEM 450 to facilitate comparison CHEM 550.

CHEMISTRY 550: 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: TBD
Inst. Office: TBD
Inst. Office hours: TBD
Inst. Phone: TBD
Inst. E-mail: TBD

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 450 by the same instructor. May not be taken for credit by students who have received credit for CHEM 450 or 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.

7. The ability to effectively communicate and present details on the structure and function of selected protein using multiple primary sources.

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 fall of 2016. 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. 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 non-covalent 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 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 the TBD.

Graduate Students: If you are a graduate student and are taking this course for graduate credit you are required to:

1. present the article you selected by your self using the criteria described above
2. write a comprehensive review paper detailing the current research findings on the protein described in the article you selected for presentation. Your review must contain at least 10 references from the primary literature.

Grading (points):

Mid-term Examinations	100	36.4%
Final Examination	75	27.3%
Problem Sets	60	21.8%
Reading Presentation	10	3.6%
Review Article	20	7.3%
Reading Summary/Critiques	10	3.6%
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 review article 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.