CHEM 440

California State University San Marcos • NEW COURSE • FORM C

ORIGINATOR'S SECTION:

1. College:	Desired Term and Year of Implementation (e.g., Fall 2008):	
☐ CHABSS ☐ CoBA ☐ CoEHHS X CSM	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 440

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

6. Abbreviated Title for PeopleSoft:
(no more than 25 characters, including spaces)
Protein Struct/Funct Life Sci

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.)***

Introduces the fundamentals of protein structure, protein folding, methods of protein expression and purification, methods of protein structure determination, protein bioinformatics, protein-ligand interactions, and protein function. *Prerequisite: CHEM 341 or 351.*

9. Why is this course being proposed?

The proposed course will offer students in the Professional Science Masters in Biotechnology program to participate in an in-depth discussion of protein structure and function and relevance of these topics to the life science industry. Students in the biotechnology PSM program currently enroll in an equivalent of CHEM 450 (protein structure function) which is intended for biochemistry majors. CHEM 440 will only be offered to students in the biotechnology PSM program and will allow us to tailor the course content to their needs.

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-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.

16. Prerequisite(s): ☒ Yes ☐ No CHEM 341 or 351

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

Tracker___
RP___
PS___

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?* Yearly

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:
Master of Biotechnology (a Professional Science Masters degree)

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.

Biological Sciences — Discipline | Signature | Date | X Support | ____ Oppose

Discipline | Signature | Date | ____ Support | ____ Oppose

SIGNATURES : (COLLEGE LEVEL) :

Sajith Jayasinghe 10-30-17
1. Originator (please print or type name) Date

11/20/17
2. Program Director/Chair Date

11/27/17
3. College Curriculum Committee Date

12/1/17
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: Catalog Revised 3/28/2007

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

CHEMISTRY 440: Protein Structure and Function in The Life Sciences

Term: Fall, 2017
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: SCI II, room 115
Inst. Office hours: Mondays from 10 a.m. - 12 noon.

Inst. Phone: 760-750-8075
Inst. E-mail: sjayasin@csusm.edu

Course Objective: Introduces the fundamentals of protein structure, protein folding, methods of protein expression and purification, methods of protein structure determination, protein bioinformatics, protein-ligand interactions, and protein function.

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

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

3. a detailed understanding of the relationship between structure and function using representative examples of proteins involved in various biological processes .including the importance of proteins in biomedicine and biotechnology.

4. 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 fall semester 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
8/29	Introduction to the course. Review of general topics of organic and biochemistry. Review of proteins and their structure. Protein motifs, domains, and their classification according to protein structure.	
9/12	Protein Synthesis and Post Translational Modification. Forces that determine protein structure. Overview of Protein Folding.	**Reading Assignment:** Anfinsen, C.B., et.al., The Kinetics of formation of Native Ribonuclease during oxidation of the reduced polypeptide chain.,PNAS 47(9), 1309.
9/19	Protein Expresion, Purification, and Characterization. Protein Engineering.	**Reading Assignment:** Stefan, A., et.al., Overexpression and Purification of the Recombinant Diphtheria Toxin Variant CRM197 in Escherichia Coli."doi:10.1016/j.jbiotec.2011.08.024.
9/26	Techniques in determining protein structure and function: • Protein Fluorescence Spectroscopy • Protein Circular Dichroism Spectroscopy • Protein EPR spectroscopy • Protein NMR Spectroscopy • Protein X-ray crystallography	**Reading Assignment:** Sudo, Y., et. al., Spectral Tuning In Sensory Rhodopsin 1 from Salinibacter ruber., JBC, 286(12)11328-11336.
10/03	**In-Class Mid Term Examination**	

10/10	Introduction to the Protein Data Bank (PDB). Introduction to Visual Molecular Dynamics (VMD) and the visualization of protein structure. Protein Bioinformatics and Computational tools in determining protein structure and function: • Protein databases • Sequence analysis • Protein sequence alignments • Secondary structure prediction • 3D structure prediction Homology modeling	No Slides. In-class Handouts. **Reading Assignment:** Chakraborteea, S., et.al., Catalytic and chaperone-like functions in an intrinsically disordered protein associated with desiccation tolerance., PNAS, 107(37), 16084.
10/17	Introduction to Python programing and application to protein sequence analysis.	No Slides. In-class Handouts.
10/24	The nature of protein-ligand interactions and Control of Protein Function. Case Study in Protein Structure and Function: Catalysts	**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.
10/31	Case Study in Protein Structure and Function : Transport Review of Lipid membranes. Case Study in Protein Structure and Function : Membrane Transport	**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. **Reading Assignment:** Doyle, A., et. al., The structure of the Potassoium Channel: Molecular Basis of K+ Conduction and Selectivity. 1998. Science, 280, 69-77.

11/07	Case Study in Protein Stucture and Function: Cellular Signaling Case Study in Protein Structure and Function: Defense	**Reading Assignment:** Rasmussen, S.G.F., et.al., Crystal Structure of the B2Adrenergic Receptor-Gs Protein Complex. Nature, 2011. 477, 549-555. **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.
11/14	**In-Class Mid Term Examination**	
11/21	Student Presentations	
11/28	Student Presentations	
12/05	Student Presentations	

Instructional Modes:

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

Reading Assignments:

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 before we discuss it in class.

You will also be responsible for writing a summary/critique for four of your choosing. Your submission should summarize 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.**

Each summary/critique should be 1-2 pages in length.

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 exams will be approximately 1-2 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.

Research Proposal: If you are a graduate student and are taking this course for graduate credit you are required to submit a research proposal **tackling a problem in protein structure/function.** Details of how to properly format your proposal can be found on cougar courses. It is not necessary that your proposal be doable, *but I do expect you to identify a problem related to the structure and/or function of a protein, describe the broad significance of the proposed research, and to outline a reasonable course of action to test your hypothesis. The structure of the target protein, or a related protein, should be known (and exist in the PDB) so that a structure/function based hypothesis can be formulated.*

The body of the proposal is not to exceed three pages. One additional page **each** may be used for references (required) and figures (optional). A well written proposal will contain all relevant sections described in detail on cougar courses, will be researched well, must contain appropriate references, and will be formatted as described on cougar courses.

The proposal **must be submitted as a PDF file via cougar courses**. Please DO NOT submit hard copies of your work. Submission of Microsoft word files is discouraged as it can lead to changes in document formatting.

Grading (points):

Mid-term Examinations	100	33.3%
Final Examination	70	23.3%
Problem Sets (20 points each)	60	20.0%
Presentation	15	5.0%
Reading Summary/Critique	40	13.3%
Research Proposal	15	5.0%
Total	300	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.