Biophysical Chemistry – CH 4404 / Fall 2013
Course Syllabus

Nicholas Fitzkee [nfitzkee (@) chemistry (.) msstate (.) edu]
Office: Hand Lab 3310

Course Description

As our understanding of life has grown, it has become increasingly important to quantify the behavior of biological systems. Such characterization not only allows us to explain in increasing detail how these systems function, but it also allows us to intervene when something goes awry. The fundamental principles that govern life are the same as those that govern all of chemistry: thermodynamics, kinetics, and quantum mechanics. In this class, we will examine how these physical principles apply to the chemistry of life. When you have completed the course, you will understand how scientists are using physical chemistry to study the myriad of reactions inside the living cell.

Meeting Times / Attendance

The course will meet Tuesdays and Thursdays from 12:30 to 1:45 PM in Hand Lab 3324. Although the primary format for the class will be lecture, opportunities will be given for students to present their problem set solutions and work examples in class. Other forms of group participation will also be encouraged. A specific schedule of meeting times is given below. Because of the interactive nature of the lectures, attendance is mandatory for the course. Please contact the instructor if you must miss a class meeting. The instructor reserves the right to deduct up to 5% from your final grade if you have more than two unexcused absences.

Reading / Textbook

The textbook for the class is *Physical Chemistry: Principles and Applications in the Biological Sciences* (4^{th} ed.) by Tinoco, Sauer, Wang, and Puglisi (2003 Prentice-Hall, Inc., ISBN 0-13-095943-X). The book is available in the bookstore, but it may be cheaper for you to purchase it online (try www.addall.com). *Note that while a 5^{th} edition has been published, we will use the 4^{th} edition this semester*. This should be cheaper for you in the long run. In addition, there will be supplemental readings throughout the semester of papers and additional handouts. It is expected that you come to class having read the material.

Homework

Throughout the course, you will have ten weekly problem sets to test you on the material taught. These assignments are collected and constitute 30% of your final course grade. This significant percentage reflects two facts: (1) The problem sets will take a significant amount of time to complete. (2) Solving problems in a relaxed environment on your own is probably the best way for you to learn the course material. It is therefore essential for you to be able to

complete each problem set and understand the correct answers. To help with this, detailed solutions will be provided when you turn in the problem sets.

Homework assignments are due at the beginning of class on Thursday (unless otherwise specified). Late assignments will not be accepted unless prior arrangements with the instructor are made. In these cases, there must be extenuating circumstances (not simply an exam in another course scheduled for the same day).

A solutions manual is available for the book problems. No one can stop you from purchasing this for yourself, but be warned! Several problems, particularly in the later chapters, have typos or are totally incorrect. Some problems have the correct answer but the wrong approach. From a learning perspective, this can be very confusing and may hinder your understanding. Additionally, you will not master the material if you simply copy answers from the solutions manual. *If you must use this book, please attempt the problem first and then critically compare your solution to what the solutions manual presents.*

Grade Distribution

The grades for the course will be calculated according to the table below. Although attendance is not explicitly included, the instructor may deduct up to 5 percentage points from your final course grade if you have more than three unexcused absences.

Course Component	Percentage
In-Class Exams (3)	50%
Homework (10)	30%
Final Exam	20%

If the distribution of grades necessitates it, the final grades will be curved. However, if all students do well, they should not expect to receive poor grades simply because of a forced bell curve on the final distribution. Students are encouraged to concentrate on learning, which has lifelong benefits, rather than grades, which are useful to your mid-twenties at best. No student who has shown discipline in pursing educational excellence will fail this course.

Final Exam

The final exam is a cumulative assessment of your understanding of the course. Although it would be far preferable for you demonstrate your mastery of the material in some other way, a final exam is the time-tested means of assessing your performance in the course. The exam will cover all the course material, starting from day one, and it will emphasize “higher levels” of understanding: analysis, application, and synthesis of ideas. While there will be multiple choice portions of the exam, because the class is so small, you should not expect the exam to be entirely multiple choice.

Office Hours

I will be available for course help in my office on most Monday mornings from 10:00 am to 11:00 am. If you are unavailable then and wish to schedule an alternative time to meet, please send me an email. Drop-in appointments are welcome, but may need to be rescheduled depending on my schedule.

Course Web Page

The web page for this course is located at http://fitzkee.chemistry.msstate.edu/ch4404/. Please check this site frequently for course updates. You will be able to find PDF copies of this syllabus and other important course materials at this site. You can also subscribe to the course RSS feed to receive updates; however most course news will be disseminated by email.

Academic Integrity

Collaboration is encouraged in this course, but all students are expected to complete their own assignments and submit their own work. Failure to do so not only cheats the system, but also diminishes your own understanding of the material. An example of acceptable collaboration is meeting in a study group to discuss problem solving strategies, then actually solving the problems on your own. Instances of plagiarism and cheating will be addressed according to the Student Honor Code. In severe cases of academic dishonesty, students will be dropped from the class with an XF grade and will be required to take a class in academic integrity to have the "X" sanction removed. You are encouraged to read the Student Honor Code, available on the Honor Code Office website, http://www.honorcode.msstate.edu/.

Honors Credit and Graduate Course (CH 6404 01)

It is possible to take this class for graduate credit (CH 6404), and undergraduates can take CH 4404 to receive honors credit as well. The requirements for both students are the same and are outlined in the supplemental syllabus handout for CH 6404. Note that the decision to take a class for honors credit must be made within the first two weeks of class.

Course Schedule and Topics Covered

Week 1			
Date	**Description**	**Reading**	**Assignment**
August 20	Syllabus, Protein structure #1	Chapter 1; *Molecules of Life*, Chapter 1*	PS #1 out
August 22	Protein structure #2, DNA structure		
Week 2			
Date	**Description**	**Reading**	**Assignment**
August 27	Thermodynamics: Introduction and the first law	Chapter 2	
August 29	Internal energy, enthalpy and chemical reactions		PS #2 out, PS #1 due
Week 3			
Date	**Description**	**Reading**	**Assignment**
September 3	Temperature, pressure, and phase changes; the heat capacity		
September 5	The second law and entropy; Calculus review	Chapter 3	PS #3 out, PS #2 due
Week 4			
Date	**Description**	**Reading**	**Assignment**
September 10	The third law and Gibbs free energy		
September 12	Gibbs free energy and chemical reactions; forces in protein folding		PS #4 out, PS #3 due
Week 5			
Date	**Description**	**Reading**	**Assignment**
September 17	Exam #1: Chapters 1-3		
September 19	The chemical potential	Chapter 4	
Week 6			
Date	**Description**	**Reading**	**Assignment**
September 24	Standard states and chemical equilibrium		
September 26	Electrochemistry and applications		PS #5 out, PS #4 due

Week 7			
Date	**Description**	**Reading**	**Assignment**
October 1	Equilibrium: DNA hybridization, protein folding, protein binding	Chapter 11	
October 3	Statistical approaches to molecular binding		PS #6 out, PS #5 due
Week 8			
Date	**Description**	**Reading**	**Assignment**
October 8	No Class – Gibbs Conference		
October 10	Statistical approaches to protein folding		
Week 9			
Date	**Description**	**Reading**	**Assignment**
October 15	Introduction to statistical thermodynamics		
October 17	Chemical kinetics #1	Chapter 7	PS#7 out, PS #6 due
Week 10			
Date	**Description**	**Reading**	**Assignment**
October 22	Exam #2: Chapters 4, 11		
October 24	No Class – Fall Break		
Week 11			
Date	**Description**	**Reading**	**Assignment**
October 29	Chemical kinetics #2		
October 31	Chemical kinetics #3		PS #8 out, PS #7 due
Week 12			
Date	**Description**	**Reading**	**Assignment**
November 5	Transition state theory		
November 7	Perturbation kinetics		PS #9 out, PS #8 due

Week 13			
Date	**Description**	**Reading**	**Assignment**
November 12	Marcus theory, diffusion controlled reactions, and chemical kinetics problems		
November 14	Application: Protein folding kinetics		PS #9a due
Week 14			
Date	**Description**	**Reading**	**Assignment**
November 19	Exam #3: Chemical kinetics		
November 21	Enzyme kinetics #1	Chapter 8	PS #10 out
Week 15			
Date	**Description**	**Reading**	**Assignment**
November 26	Enzyme kinetics #2		PS #9b due
November 28	No Class – Thanksgiving Break		
Week 16			
Date	**Description**	**Reading**	**Assignment**
December 3	Enzyme kinetics #3		PS #10 due

Unless otherwise noted, readings are from *Physical Chemistry: Principles and Applications in the Biological Sciences (4th ed.)*. Additional readings will be assigned throughout the course. The schedule is subject to change, but all scheduling updates will be posted to the course web page and sent out via email.

* The *Molecules of Life* reading is assigned from a textbook by John Kuriyan, Boyana Konforti, and David Wemmer. Chapter 1 is available for free at the link below, and it may serve as a useful refresher for you. Parts A and C of this chapter are assumed: your introductory chemistry and biology prerequisites covered basic chemical interactions and the central dogma. We will review Part B in class.

The link is: http://www.garlandscience.com/res/pdf/9780815341888_ch01.pdf .

MISSISSIPPI STATE UNIVERSITY
2013 FALL ACADEMIC CALENDAR

All deadlines are at 5:00 P.M. unless otherwise stated.
All dates and deadlines are subject to change.

August 1 .....Freshmen and transfer students should apply for admission by this date
August 15 .....Final registration and payment of tuition and fees
August 16 .....New student orientation
August 19 .....Classes begin
August 19 – October 15.....Apply online via myState for December 2013 graduation 12:00 midnight - $50 fee
.....applies
August 23 .....Last day to drop a course without a grade (5th class day)
August 26 .....Last day to register or add a course (6th class day)
.....Last day to request undergrad academic forgiveness via myState 12:00 midnight
September 2.....Holiday
September 23 - October 18.....Report progress grades on line
September 30.....Last day to drop a class with a "W" grade
October 7 .....Mid-point of semester
October 15.....Last Day to apply for December 2013 degree via MyState with $50 fee 12:00 midnight
.....Last day to apply for Advanced Standing Examination
October 16 – October 31 .....Late December 2013 Degree Application via myState –
.....$50 fee plus $50 late application fee
.....** Account balance must be paid before application is accepted
October 21 – November 1 .....Faculty advising for pre-registration
October 24 and 25 .....Fall Break – No Classes Scheduled
October 31.....Last Day to apply for December 2013 Degree Application via myState - $50 fee + $50 late fee 12:00 midnight
.....** Account balance must be paid before application is accepted
November 1 – December 3.....Very Late December 2013 online Degree Application via myState - $50 fee plus $200 late application fee
.....** Account balance must be paid before application is accepted
November 4 – 15.....Primary pre-registration period for spring semester
November 14.....Last day to withdraw from the University (ten class days remaining)
November 27-29.....Thanksgiving holidays (Wednesday through Sunday)
December 2 .....Classes resume
December 3 .....Classes end
December 3 .....Last day December 2013 Degree Application via myState - $50 fee + $200 late fee 12:00 midnight
.....** Account balance must be paid before application is accepted
December 4, 5 .....Reading Days (No mandatory class assignments, requirements, meetings)
December 6, 9-12 .....Final examinations
December 13 .....Final examinations - make-up day (only if needed)
December 14 .....Starkville Campus Commencement 10:00 A.M. – All Colleges
December 16 .....Final Grades Due 12:00 noon
December 23- January 2.....Winter Holidays

10/31/2012

Recent changes highlighted in yellow