Advanced Enzyme Kinetics and Mechanisms

CHEM 385/465
Spring 2021
Dr. Miguel A. Ballicora (Instructor)

Lectures: Tuesday & Thursdays 5:30 pm – 6:45 pm (Online course).

Description

This course will be about topics related to advanced methods in steady state enzyme kinetics. Student will learn how to go from a modelled reaction scheme to a conceptual and mathematical analysis of how the rate of the reaction is influenced by different ligands. The structure of the course will involve lectures by Dr. Ballicora for each of them, intermixed with class discussion. Since this is an advanced course, the instructor may slightly adjust the topics presented to better accommodate class interest and the most suitable pace.

Environment

This is an online course. The instructor will provide proper links to access the class synchronously. The instructor may provide some asynchronous material if needed.

Pre-requisites

A previous course in biochemistry such as CHEM370 is required.

Reading assignments

There is no official textbook in this course. We will use material from current papers, reviews, and excerpts from different books. The instructor will provide handouts or references when needed. Considering it is an advanced course, the material covered in class will not be easily found anywhere else, so it is critical to have perfect or near perfect attendance.

Tentative schedule

In a separate sheet, there is the intended schedule for the lectures. The schedule is tentative as it may slightly change to accommodate the most appropriate lecturing pace. The academic schedule for the University is here http://www.luc.edu/academics/schedules/

Website and professor-student communication

We will use *Sakai* (http://sakai.luc.edu) for announcements, grades, and other information. Students are responsible to check *Sakai* as well as the Loyola e-mail account at least once a day. To contact the instructor, the students could send e-mails from their Loyola e-mail account. They should include in the subject line "CHEM385 or CHEM465". Otherwise, the instructor can overlook the message. The student could also e-mail the instructor directly from *Sakai* (**RECOMMENDED!** Since it will automatically add a proper subject line).

Participation

The instructor strongly encourages the students to participate in class and interact with other classmates after class. To facilitate the communication, a discussion forum will be set up in *Sakai*. Students can post questions, answers, and/or anything related to the course.

Grading

These five items will constitute the final score for the course:

A. Quizzes/Assignments/Discussion work   10%
B. Mid-term examination 1   20%
C. Mid-term examination 2   20%
D. Mid-term examination 3   20%
E. Final *cumulative* examination   30%

Even though the midterms are not strictly cumulative, some concepts from previous units may be integrated into questions from the new unit.

There will be three different options to compute the final score of the course. All options will be calculated and the student will get the highest of the three.

Option 1: Standard calculation based on the weights given above. For instance, if each grading item listed above (A to E) has an individual score of 100 points, the calculation will be *Course Score = 0.1 A + 0.2 (B + C + D) + 0.3 E*

Option 2: Worst midterm is dropped. If MT_{top} is the score of the best midterm and MT_{sec} is the second best score of the midterms then,
Course Score = 0.1 A + 0.26 (MT_{top} + MT_{sec}) + 0.38 E

Option 3: The worst score midterm is replaced by a number based on the final exam performance. If X is the score of the student in the final, X_m is the median score of the whole class in the final, and MT_m is the median score of the whole class in the midterm to be replaced (MT_{rep}), then $MT_{rep} = MT_m$ $X/$ X_m. Of course, this replacement cannot be higher than 100. Once MT_{rep} is calculated, then *Course Score = 0.1 A + 0.2 (MT_{top} + MT_{sec} + MT_{rep}) + 0.3 E*

The final score of will be rounded, and the letter assigned according to the following table.

Letter	Range
A	92-100
A-	86-91
B+	81-85
B	76-80
B-	71-75
C+	66-70
C	61-65
C-	57-60

D+	55-56
D	47-54
F	46 and below

There will be no make-up examinations under any circumstance for mid-term exams. By design, options 2 and 3 contemplate any type of possible problem that will prevent the student to attend one of the midterm exams.

There will be no make-up examination for the final unless there is a **documented** family or medical emergency (or any other compelling reason such as jury duty).

Assignments

These activities will worth some points that will accumulate throughout the course. There will be at least 10 points worth of accumulated activities, but no more than 20. Those will equal to 10% of the final score of the course (see above). There will be no make-up for any missed quiz or assignment.

Final Exam

The University sets the schedule for all final exams. The final will be held on:

Tuesday May 4th 5:30 PM - 7:30 PM, Online

You will have exactly 2 hours to complete the exam. Additional time will not be granted, even if you arrive late. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either. Instructors may not reschedule final exams for a class for another day and/or time during the final exam period. There can be no divergence from the posted schedule of dates for final exams. Individual students who have four (4) final examinations scheduled for the same date may request to have one of those exams rescheduled. If a student reports having four final examinations scheduled for the same date, students should be directed to e-mail a petition to Adam Patricoski, Assistant Dean for Student Academic Affairs, CAS Dean's Office (apatricoski@luc.edu).

Student Accommodations

If you have any special needs, please let me know in the first week of classes. The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Student Accessibility Center (SAC), Sullivan Center, (773) 508-3700. Further information is available at http://www.luc.edu/sac/.

Accommodations for Religious Reasons

If you have observances of religious holidays that will cause you to miss class or otherwise affect your performance, you must alert the instructor *within 10 calendar days of the first class meeting of the semester* to request special accommodations. They will be handled on a case-by-case basis.

Loyola University Absence Policy for Students in Co-Curricular Activities (including ROTC)

Students missing classes while representing Loyola University Chicago in an official capacity (e.g. intercollegiate athletics, debate team, model government organization) should discuss with the instructor the potential consequences of missing lectures/tests/assignments. Students must provide

their instructors with proper documentation describing the reason for and date of the absence. The student should provide this information as far in advance of the absence as possible (https://www.luc.edu/athleteadvising/attendance.shtml).

Academic Integrity

Any work from the student must come from his/her independent and honest efforts. All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences (http://www.luc.edu/cas/advising/academicintegritystatement/). A basic mission of a university is to search for and to communicate the truth as it is honestly perceived. A genuine learning community cannot exist unless this demanding standard is a fundamental tenet of the intellectual life of the community. Students of Loyola University Chicago are expected to know, to respect, and to practice this standard of personal honesty. Academic dishonesty can take several forms, including, but not limited to cheating, plagiarism, copying another student's work, and submitting false documents. Any instance of dishonesty (including those detailed on the website provided above or in this syllabus) will be reported to The Chair of The Department of Chemistry & Biochemistry who will decide what the next steps may be.

A student caught cheating will receive an automatic "0" or F at that particular examination (which cannot be dropped). Serious violations of academic integrity may even cause the students to get an F in the course.

Exams

Exams will be conducted in an online environment. It is expected that the student will have access to a scanner or a smart cell phone app to scan the exams. In addition, having a printer minutes before the exam will speed up the process of having the exam. If this is not available, please contact the instructor within the first two weeks of the course.

Amendments

The instructor reserves the right to correct or amend this syllabus at any time. However, if that occurs, the students will be informed.

Instructor's contact information:

Dr. Miguel A. Ballicora
Flanner Hall 125 • Phone: 508-3154 • e-mail: mballic@luc.edu

Please use email as described above in "Website and professor-student communication"

Office hours:

Special meeting hours could be arranged by appointment.

CHEM 385/465, Tentative Schedule

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Tue	1/19	Intro/Basic concepts in enzyme kinetics	1
Thu	1/21	Basic concepts in enzyme kinetics	2
Tue	1/26	Enzyme assays	3
Thu	1/28	Enzyme assays	4
Tue	2/2	Enzyme Assays	5
Thu	2/4	Steady state and equilibrium	6
Tue	2/9	Midterm Exam #1	7
Thu	2/11	Spring Break	-
Tue	2/16	Derivation of equations (Rapid Equilibrium)	8
Thu	2/18	Derivation of equations (Rapid Equilibrium)	9
Tue	2/23	Derivation of equations (Rapid Equilibrium)	10
Thu	2/25	Inhibition	11
Tue	3/2	Inhibition	12
Thu	3/4	Inhibition	13
Tue	3/9	Spring Break	-
Thu	3/11	Non hyperbolic behavior of enzymes	14
Tue	3/16	Midterm Exam #2	15
Thu	3/18	Allosterism	16
Tue	3/23	Allosterism	17
Thu	3/25	Allosterism	18
Tue	3/30	Allosterism	19
Thu	4/1	Easter Break	-
Tue	4/6	Allosterism	20
Thu	4/8	Midterm Exam #3	21
Tue	4/13	Derivation of equations (steady state)	22
Thu	4/15	Derivation of equations (steady state)	23
Tue	4/20	Hysteretic enzymes	24
Thu	4/22	Substrate specificity	25
Tue	4/27	Data processing	26
Thu	4/29	Special topic	27
Tue	5/4	FINAL EXAM (5:30 PM – 7:30 PM)	