BIOT 6336 **Biophysical Chemistry** **Credit Hours: 3**

Semester: Summer - Long **Year:** 2024
Class Day/Time: Friday 9-5 Lecture/Lab **Class Location:** B13 and Lab D12

Instructor of Record: Dr. Mitsuo Ikebe Professor
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Office Hours: TBA

Course Description: Instrumental analysis of proteins, nucleic acids, carbohydrates and lipids. Methods may include liquid chromatography; UV/Visible spectroscopy; mass spectrometry; Biacore-SPR; CD spectroscopy; X-ray diffraction of proteins and nucleic acids; Fluorescence cell sorter; CT scanning.

Prerequisite: As per program admission **Co-requisite:** None

Goals of Course & Course Objectives:
The information presented in this course will provide the student with valuable insight into the characterization and separation of biological macromolecules. During this semester several characterization and separation techniques will be described theoretically and used in the laboratory. By the end of this course, the student should be able to choose the correct method or combination of methods to characterize and separate biological macromolecules based on the physical and chemical properties of the molecules.

Course Objectives:

1. To be able to communicate and discuss fundamental instrumental methods.
2. To be able to communicate and discuss the various methods available to purify and characterize biological molecules based on their physical and chemical properties.
3. To be able to choose from the various methods available for purifying and characterizing biological molecules based on their physical and chemical properties.
4. To be able to organize the lab results and write a report on a standard paper format.

Student Learning Outcomes (Course Competencies):

1. The student will be able to communicate and discuss, both verbally and in writing, fundamental instrumental methods.
2. The student will be able to communicate and discuss, both verbally and in writing, the various methods available to purify and characterize biological molecules based on their physical and chemical properties.
3. The student will be able to organize the results, discuss the obtained results on the basis of their knowledge, and write a formal lab report.

Subject-specific Skills:
In the lab portion of the course, students will become experts in and demonstrate mastery of use of the equipment required in the labs.

Course Assessment/Methods of Evaluation:
Student understanding will be evaluated with a combination of comprehensive examinations of the subjects covered, as well as in formal written laboratory reports. Students who successfully complete the course will demonstrate a thorough understanding of fundamental biophysical and instrumental methods used in biotechnology, including basic background information, theory and application.
Total possible course point accumulation = 1,360 pts

- **Lecture Examinations (200 pts):** There will be two comprehensive exams (100pts each). CT-Scanning and X-ray crystallography. **Due Date is notified by the instructor.**
- **Full Laboratory Report (200 pts):** There will be **one full lab reports** (200 pts), The report must

include the following sections: Title, Abstract, Introduction, Materials and Methods, Results, Discussion, References. **Due Date is one weeks after the Data Analysis Session at 5:00pm.** The report will be returned to the students with instructor's comments and suggestions at one week after the submission of the report. **All reports must be type written.**

- **Short Laboratory Reports (400 pts)** There will be **four short lab reports** (100 pts each), These reports must include the following sections: Title, Materials and Methods, Combined Results and Discussion. **Due Date is ONE week after the Data Analysis Session at 5:00pm.** The report will be returned to the students with instructor's comments and suggestions at one week after the submission of the report.
- **Laboratory/Class participation (160 pts):** Participation and presence in the laboratory will be evaluated (20 pts each lab). Non punctual attendance, missing lecture and lab lose points.
- **Final EXAM** (**400 pts):** There will be a comprehensive final EXAM.

A = 90% to 100% D = 60% to 70%

B = 80% to 90% F = <60%

C = 70% to 80%

- A grade of less than a B may result in loss of Graduate Assistantships.
- No grades will be withheld for completion of work except in extreme circumstances.
- Every attempt will be made to hand out reading assignments and descriptions of lab procedures one week prior to their performance. Therefore, students will be expected to be prepared at the beginning of each lab.
- Lab reports will be expected to be formal write-ups with an emphasis on computer manipulation and presentation of data as is expected in industry and research laboratories. Most of these reports should have a Title, Summary, Background, Materials, Methods, Results, Discussion, References and Answers to and questions posed.

Work turned in late will lose 5% (1 day late), 10% (2-3 day late), 15% (4-7) and 25% (7-14) of the points possible. Reports turned in more than two weeks late will not be accepted (0 point).

Linked Program Learning Outcomes:
The student learning outcomes listed above address the following Biotechnology Program PLOs:

- PLO-1. The student will demonstrate English communication skills in both oral and written forms.
- PLO-2. The student will demonstrate mastery of basic and advanced biotechnology methods
- PLO-3. The student will demonstrate the ability to safely operate basic and advanced laboratory equipment, analytic devices and computers.
- PLO-4. The student will demonstrate independent and critical thinking skills integrated with the ability to utilize multiple informational resources.

Textbook:
Physical Biochemistry: Principles and Applications by David Sheehan, Wiley Press.

Course Content and schedule:

May 16 Spectroscopy *(Short Report 1)* (Neuenschwander/Sato)
Laboratory 1: Absorption (amino acid spectra compared to BSA absorption), pH effects on absorption.
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May 23 Chromatography (Ikebe/Sato)
Laboratory 2: Ion Exchange Chromatography and SDS PAGE

May 30 Chromatography *Cont. (Full Report)* (Ikebe/Sato)

Laboratory 3: Gel filtration Chromatography and SDSPAGE

June 06 Mass Spectroscopy/Biacore-SPR *(Short Report 2)* (Neuenschwander)
Laboratory 4: MALDI TOF MS- Peptide analysis; Surface Plasmon Resonance (SPR) Biacore-SPR

June 13 Data analysis (Question and answer session)

June 20. CD Spectroscopy *(Short Report 3)* (Sato)
Laboratory 5: Circular dichroism spectroscopy.

June 26 Fluorescence techniques *(Short Report 4)* (Tvinnereim)
Laboratory 6: Fluorescence, FACS and Cell Imaging

July 04 Holiday (Independence Day)

July 11 CT Scanning *(EXAM 1)* (Tvinnereim)
Laboratory 7: CT Scanning

July 18 Data Analysis ((Question and answer session)

July 25 Three-Dimensional Structure Determination *(EXAM 2)* (Neuenschwander)
X-ray Crystallography and Imaging

August 01 Final EXAM (Take home exam)

August 08 No Class (Final EXAM Due)

Attendance:

- **Punctual attendance is critical, and active participation in lab experiment is very important. It is critical to sign (legibly) the sign-up sheet for each class to record your attendance. Students are expected to be in attendance for the majority of the class time. If not, students will not get full-credit for attendance. Tardiness of more than 30 min may not get full credit.**

- If a student misses a class or lab, the student is responsible for obtaining any information distributed during those times. Make-ups are possible only under certain instances (labs cannot be made up). Arrangements for any make-ups and/or missed labs should be discussed directly with the instructor for that day's class.

Academic Honesty:
Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

Cheating
Dishonesty of any kind involving examinations, assignments, alteration of records, wrongful possession of examinations, and unpermitted submission of duplicate papers for multiple classes or unauthorized use of keys to examinations is considered cheating. Cheating includes but is not limited to:

- Using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class.
- Falsifying or inventing any information, including citations, on an assigned exercise.
- Helping or attempting to help another in an act of cheating or plagiarism.

Plagiarism

Plagiarism is presenting the words or ideas of another person as if they were your own. Materials, even ideas, borrowed from others necessitate full and complete acknowledgment of the original authors. Offering the work of another as one's own is plagiarism and is unacceptable in the academic community. A lack of adequate recognition constitutes plagiarism, whether it utilizes a few sentences, whole paragraphs, articles, books, audio-visual materials, or even the writing of a fellow student. In addition, the presentation of material gathered, assembled or formatted by others as one's own is also plagiarism. Because the university takes such misconduct very seriously, the student is urged to carefully read university policies on Misconduct in Research and Other Scholarly Activity 05.00. Examples of plagiarism are:

- Submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another.
- Submitting a work that has been purchased or otherwise obtained from an Internet source or another source.
- Incorporating the words or ideas of an author into one's paper without giving the author due credit.

Adding/Dropping:
The official deadline for adding and dropping courses is as published in the academic calendar and Graduate Bulletin (typically the day before Census Day). However, students are strongly encouraged to meet with their graduate advisor or the Program Coordinator prior to adding/dropping courses. Movement into and out of classes after the 4th class day requires approval of the Program Director. Students can drop until mid-semester without a WP or WF. Drops after mid-semester require approval of the Dean. Each student is responsible for their own enrollment status with the university.

Disability Accommodations:
UTHSCT abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act, which mandate reasonable accommodations be provided for students with documented disabilities. If you have a disability and may require some type of instructional and/or examination accommodations, please contact me early in the semester so that I can provide or facilitate provision of accommodations you may need. If you have not already done so, you will need to register with the Student Services Office (located on the UT Tyler Campus). You may call 903-566-7079 for more information.

Program:	Master of Science in Biotechnology
Degree:	MS
Department:	Cellular and Molecular Biology
School:	Medical Biological Sciences
Course:	**BIOT5222/522L – Advanced Metabolism** (and associated lab)

Area	Marketable Skill*
TASKS	Maintain accurate laboratory records and data.
	Design molecular or cellular laboratory experiments, oversee their execution, and interpret results.
	Perform laboratory procedures following protocols.
TECHNOLOGY SKILLS	Analytical or scientific software; Graphics or photo imaging software - GraphPad, ImageJ, Adobe; Office suite software - Microsoft Office
SKILLS	**Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
	Writing — Communicating effectively in writing as appropriate for the needs of the audience.
ABILITIES	**Written Comprehension** — The ability to read and understand information and ideas presented in writing.
	Written Expression — The ability to communicate information and ideas in writing so others will understand.
WORK ACTIVITIES	**Documenting/Recording Information** — Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.
	Getting Information — Observing, receiving, and otherwise obtaining information from all relevant sources.
	Processing Information — Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.
	Updating and Using Relevant Knowledge — Keeping up-to-date technically and applying new knowledge to your job.
WORK CONTEXT	Wear Common Protective or Safety Equipment such as Safety Shoes, Glasses, Gloves, Hearing Protection, or PPE.
	Importance of Being Exact or Accurate

*All marketable skills listed for this course and program were drawn from the Knowledge, Skills, and Abilities identified by the US Department of Labor and Statistics for “Biological Technicians” and “Molecular and Cellular Biologists” as published on O*Net Online (www.onetonline.org)