

Syllabus for BE 4332: Molecular Methods in Biological Engineering

Catalog Description of Course: (3 credit hours) Prereq: BIOL 2083, BE 2350 and credit or registration in BE4303. Fundamentals of the theory and applications of quantitative molecular techniques used in biological engineering research and design. Topics include absorbance, fluorescence, biophotonics, Enzyme-Linked Immunosorbent Assay (ELISA), chromatography, electrophoresis, recombinant DNA, polymerase chain reaction (PCR), microarrays, genetic therapies, lab-on-a-chip assays, and molecular computing.

Prerequisites: BIOL 2083 Biochemistry, BE 2350 Experimental Methods for Engineers, and credit or registration in BE 4303 Engineering Properties of Biological Materials.

Objectives:

1. To identify the fundamental aspects of molecular bioengineering techniques relevant for design in diagnosing, understanding and regulating biological systems.
2. To apply the principles of molecular methods in a design to sense, study or control a biological system
3. To analyze a peer-reviewed current research article in one of the course topic areas.
4. To report on a thorough analysis of a design involving a quantitative molecular application used in a research, biotechnology or healthcare setting.

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Office hours: TBA. Appointments can also be scheduled to students' preference via phone or email.

Text: No required text. Notes and electronic documents will be provided in class and on the course website. Students are encouraged to consult texts placed on hold in the library during the semester, browse highlighted e-books online (e.g. the PubMed Bookshelf), and perform their own searches for other relevant online material.

Material will be adapted from several texts, including:

- Alberts, B., et al. (2002). Molecular Biology of the Cell, 4th edition. Garland Division of Taylor & Francis Publishing, Oxford, UK.
- Aydin Tozeren, S. W. B. (2003). New Biology for Engineers and Computer Scientists. Upper Saddle River, NJ, Pearson - Prentice Hall.
- Ballou, A. J. N. D. P. (1998). Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Bethesda, MD, Fitzgerald Science Press.
- Fung, Y. C. (2001). Introduction to Bioengineering. River Edge, NJ, World Scientific Publishing Co.
- Prasad, P. N. (2003). Introduction to Biophotonics. Hoboken, NJ, Wiley-Interscience.

Criteria for determining grade:

Homework and Quizzes	25%
Exams	60%
Term Project	15%

Final course grade will be determined from the following scale:

A = (100 - 90)%, B = (89 - 80)%, C = (79 - 70)%, D = (69 - 60)%, F = (59 - 0)%.

Grading Criteria for Graduate Credit:

Graduate students wishing to receive graduate credit for this course will be required to perform an in-depth study of a particular molecular technique and present their findings to the class in the form of a graduate seminar oral presentation. This project will be graded and will serve as an additional grade in the "Exams" category of the overall course grade.

Academic Misconduct:

Academic Misconduct, as defined in the Code of Student Conduct, will not be tolerated in this course. It is my responsibility as the instructor to report such incidents to the Department of Judicial Affairs. It is your responsibility to understand the Code of Student Conduct and make sure your actions and perceived actions are not considered as misconduct. Ignorance of these rules will not be an adequate defense in such cases. Go to <http://appl003.lsu.edu/slas/judicialaffairs.nsf/index> for a copy of the current Code of Student Conduct.

Outline of Subject Matter for BE 4332:

Interaction of Light with Matter

Geometrical Optics

Absorbance

Fluorescence

Brief Review of Molecular Biology

Molecular Considerations of Recombinant Protein Production: Factor VIII Case Study

Chromatography

Column Design and Chromatogram Analysis

Electrophoresis and Blotting

Enzymatic Methods and Kinetics

Enzyme-Linked Immunosorbent Assay (ELISA) applications in Biosensing

DNA synthesis and PCR

Recombinant DNA Techniques for Biotechnology

Microarrays and Lab-on-a-chip Assays

Mammalian Cell Culture and Flow Cytometry Instrumentation

Gene and Antisense Therapies

Nucleic Acid-based Molecular Computing