NJIT | DEPARTMENT OF BIOMEDICAL ENGINEERING

BME 303: Biological and Chemical Foundations of Biomedical Engineering
3 Credits, 3 Contact hours

Instructor: Alexander Buffone, PhD.,

Textbook(s)/Materials Required:
The course materials are posted in the Moodle portal to this course as PowerPoint lecturehandouts. Each lecture materials are accessed to students in http://moodle.njit.edu/ at least 48 hours prior to lecture. Students are required to read two books for more information.
(1) Essential Cell Biology. Alberts et. al., 3rd edition [Garland Science], ISBN Number (ISBN-10:0815341296).
(2) Principles of Biochemistry - 5th edition, by Robert Horton (2011, Pearson Publisher), (ISBN13: 978-0321707338).

Description:
This course introduces the biomedical students to the basic concept of cellular biochemistry and molecular biology in a well-organized intracellular compartment. Lecture series are designed in an orderly manner so that students can easily understand the complexity of human biochemistry within a self-organized cellular structure. The course objective is to enrich students with adequate knowledge of biochemistry, molecular and cellular biologyfor a meaningful interpretation of engineering principles to designing appropriate biomedical devices and application. The course adequately integrates the replication and translation of simple nucleic acid base in transforming into functional protein for regulation of biological signals in an energy dependent manner.

As an interactive learning to scientific research communications, students are given a challenging peer-reviewed article to critique the soundness of the title, hypothesis, experimental approach, statistical data analysis, data interpretation, and conclusion of the novel findings. A human disease related article is chosen within the course topics, which is presented by students in the form of journal club discussion. Thus, the course not only introduces critical thinking to design and conduct experiments, analyze and interpret data, use engineering judgment to draw conclusions, but imparts an ability to communicate effectively in public health care topics.

Prerequisites:
Grade of C or higher in Chem 126, Phys 111. This is a required course for all BME undergraduate students.

Course Learning Outcomes (CLO):
1. Understand the fundamental principles of biochemistry, cell biology, molecular biology, and intracellular signaling mechanisms for effective designing of biomedical devices.
2. Enrich critical scientific thinking, comprehensive analysis of experimental findings, and toimpart effective communication of scientific topics in human disease.
3. Introduce hands-on lab works to gain surgical techniques, cell isolation, and cell culture.

Student Learning Outcomes:

Student outcome B – An ability to design and conduct experiments, as well as to analyze
Related CLO – 6 and interpret data

Student outcome C – Apply engineering design to meet specified needs with consideration of
Related CLO – 2 public health

Student outcome G – Present oral and written communication of tech info/data
Related CLO – 3

Student outcome I – Ability to acquire and apply new knowledge learned to gain surgical
Related CLO – 7 techniques, cell isolation, and cell culture.

Student outcome J – A knowledge of contemporary issues from peer-reviewed article
Related CLO – 2

Student outcome L - Grasp bio- & physiological principles
Related CLO – 1

Program Specific Criteria:

A - an understanding of biology and physiology
Related CLO – 1

Course Syllabus:

Week & date	Lecture Topic	Reading Material	Assignments
Week 1	Overview of the course and introduction to living cell diversity	PPT lecture	
Week 2	Cell division cycles	PPT lecture	Quiz
Week 3	Cell structure, organelles and functions	PPT lecture	Quiz
Week 4	Membrane transport mechanisms	PPT lecture	Quiz
Week 5	Cytoskeleton proteins & functions	PPT lecture	Quiz
Week 6	Nucleic Acid-DNA	PPT lecture	Quiz
Week 7	Nucleic Acid-RNA	PPT lecture	Quiz
Week 8	Chromatin and Epigenetic	PPT lecture	Quiz
Week 9	Protein structure and enzymes	PPT lecture	Quiz
Week 10	Intracellular Signaling	PPT lecture	Quiz
Week 11	CNS Cell Signaling	PPT lecture	Quiz
Week 12	PNS Cell Signaling	PPT lecture	Quiz
Week 13	Metabolism and Energetic cell communication	PPT lecture	Quiz & journal assignment
Week 14	Lab work	Lab work	
Week 15	**Final exam** & Journal discussion		