BME 303: Biological and Chemical Foundations of Biomedical Engineering

3 Credits, 3 Contact hours
Instructor: Drew D. Onat, PhD, MSc
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Office Location: Fenster Building, Room # 624
Course Location: CKB 217

Prerequisites:
Prerequisites: Grade of C or higher in CHEM 126 or CHEM 122.
This is a required course for all BME undergraduate students.

Week	Date	Lecture Topic	Reading Material	Assignments
Week 1	09/03/21	L1: Overview of the course and introduction to living cell diversity	PPT lecture	
Week 2	09/07/21 09/10/21	L2: Cell Structure and Organelles L3: Membrane Structure and Transport Across the Membrane	PPT lecture PPT lecture	Quiz
Week 3	09/14/21 09/17/21	L4: Voltage/Ligand-gated Channels L5: Cell Division Cycle	PPT lecture PPT lecture	Quiz
Week 4	09/21/21 09/24/21	L6: Cytoskeleton Proteins I L7: Cytoskeleton Proteins II	PPT lecture PPT lecture	Quiz
Week 5	09/28/21 10/01/21	L8: Protein Structure and Function L9: Enzymatic Activation	PPT lecture PPT lecture	Quiz
Week 6	10/05/21 10/08/21	L10: Intracellular Signaling I L11: Intracellular Signaling II	PPT lecture PPT lecture	Quiz
Week 7	10/12/21 10/15/21	L12: CNS and PNS signaling L13: Mitochondria and Chloroplasts	PPT lecture PPT lecture	Quiz
Week 8	10/19/21 **10/22/21**	L14: Metabolic Energetic Communication **MIDTERM EXAM**	PPT lecture **L1 to L14**	**MIDTERM**
Week 9	10/26/21 10/29/21	L15: Nucleic Acid – DNA I L16: Nucleic Acid – DNA II	PPT lecture PPT lecture	Quiz
Week 10	11/02/21 11/05/21	L17: Nucleic acid – RNA I L18: Nucleic Acid – RNA II	PPT lecture PPT lecture	Quiz
Week 11	11/09/21 11/12/21	L19: DNA Replication and Repair L20: Control of Gene Expression	PPT lecture PPT lecture	Quiz
Week 12	11/16/21 11/19/21	L21: Chromatin and epigenetics L22: Analyzing structure & function of genes	PPT lecture PPT lecture	Quiz
Week 13	11/23/21 **11/26/21**	L23: Sexual Reproduction and genetics **THANKSGIVING RECESS**	PPT lecture	Quiz
Week 14	11/30/21 12/03/21	L24: Cell Communities L25: Applications to Current Medical Field	PPT lecture	Journal Assignment
Week 15	12/07/21 12/10/21	L26: Peer-reviewed article L27: Recitation	Journal L1 to L24	Discussion Review
Finals Week	**12/15/21 – 12/21/21**	**FINAL EXAM**	**L1 to L24**	**FINAL EXAM**

Lecture duration: Each lecture is designed for 90 minutes class.

Course Grading:

Class Attendance:	5%
Quizzes:	30%
Midterm:	30%
Journal discussion:	5%
Final Exam:	30%

Course Description:
The course "Biological and Chemical Foundations of Biomedical Engineering" introduces the biomedical students a basic concept of cellular biochemistry and molecular biology in a well-organized systematic intracellular compartment. The lecture series are designed in an orderly manner that students will have an easy understanding of a human biochemistry complexity within a self-organized cellular structure. The lecture series will adequately explain how replication and translation of simple nucleic acid base can transform into a functional protein to successfully integrate biological signals in an energy dependent manner. The objective of the course is to enrich the students with adequate biochemistry and molecular biology knowledge for successful application of engineering principles to biomedical advancement.

Assignment:
As an interactive learning to scientific research communications, students will be given a challenge to critique the soundness of the title, hypothesis, experimental approach, data interpretation and conclusion, statistical evaluation, and novelty of the findings of selected peer-reviewed articles. This will be an open discussion like in journal club. Students will not submit any write-up material.

Quizzes: There will be 11 quizzes during the semester. Each quiz will carry 3 points. The total score of 10 quizzes will be 30 points. The lowest score out of the 11 quizzes will be dropped. There will be no make-up quizzes. If any student will miss a quiz, that will be the dropped quiz. All quizzes questions will be asked strictly from the course materials covered in the lecture.

Attendance: A perfect attendance, that is without missing a single class will carry a total of FIVE points. One point will be taken off for each miss class. If a student will miss fives classes out of the total of 28 classes, then that student will get a zero point in attendance.
NOTE: A student will not be allowed to sit in the class if he/she misses the first 15 min lecture.

Midterm Examination: MIDTERM EXAM will carry 30 points. All exam questions will be asked strictly from the course materials covered in lecture 1 to 14.There is no lecture on midterm exam day.

Final Examination: FINAL EXAM will carry 30 points. All exam questions will be asked strictly from the course materials covered in lecture 1 to 24.

Course Learning Outcomes (CLO):

1. Understand the basic principles of cell biology, molecular biology and biochemistry in sufficient depth to give biomedical engineering students a strong background to understand the introductory aspects of the discipline.

2. Enrich critical scientific thinking, comprehensive analysis of contemporary peer-reviewed article related to the course context, and to impart effective communication of the scientific knowledge during discussion.

Textbook(s)/Materials:
This course does not require textbook. The main course materials will be the power point lecture handouts, which will be provided via the Canvas portal to this course, and can be accessed in https://canvas.njit.edu Students are encouraged to read the following book for more challenging knowledge.

Essential Cell Biology. Alberts et. al., 5th edition [W. W. Norton and Company, Inc.], ISBN Number (ISBN- 9780393680379).