



Course Syllabus: Foundations of Synthetic Biology - BioE 202

Division	Biological and Environmental Sciences & Engineering Division
Course Number	BioE 202
Course Title	Foundations of Synthetic Biology
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	04:00 PM - 05:30 PM Sun Wed

Instructor(s)				
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Teaching Assistant(s)	
Name	Email

Course Information	
Comprehensive Course Description	The course focuses on introducing bioengineers to the types of concepts, cellular hosts, devices, and engineering principles they need to apply to solve real-world problems. Key concepts are covered including the cell as a basic unit of life, central dogma, gene regulation, genetic modification, growth, development and evolution. The course covers the basic principles of cell structure and function of different prokaryotic and eukaryotic species used as hosts for bioengineering applications (bacteria, yeast, algae, plant, human). Students will learn the chemical structure of DNA, RNA, and protein, enzymatic catalysis, metabolism, and manipulations. How this structure information is used to evolve new functions in these molecules will be discussed. The course then highlights the use of these key concepts, devices, molecules, and engineering principles to solve real world problems by providing examples and grand challenges.

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Goals and Objectives	To introduce students to the field of synthetic biology and bioengineering in a biology-based context involving key concepts, molecules, cellular hosts, devices, and engineering principles. This course will prepare students to think as a bioengineer about problems and solutions to address key challenges.
Required Knowledge	Basic science knowledge
Reference Texts	1- Gene Cloning and DNA Analysis: An Introduction, 7th Edition T.A. Brown 2- Molecular Biology of the Cell (Sixth Edition) Bruce Alberts 3- Lehninger Principles of Biochemistry (Sixth Edition) David Nelson and Michael Cox
Method of evaluation	15.00% - Written report 15.00% - Presentation 25.00% - Midterm exam 20.00% - Homework /Assignments 25.00% - Final exam
Nature of the assignments	Concept presentation and paper summary
Course Policies	Attendance is required
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019 Wed 08/28/2019	Introduction: A course overview highlighting the overarching themes, modules, and course objectives including key concepts, cellular hosts, engineering biomolecules, synthetic biology applications and grand challenges.
2	Sun 09/01/2019 Wed 09/04/2019	Key Concepts: The cell as the basic unit of life. General overview of cell structure, function and organization in different prokaryotes and eukaryotes.
3	Sun 09/08/2019 Wed 09/11/2019	Key Concepts: Central dogma and transcriptional regulation in prokaryotes and eukaryotes.
4	Sun 09/15/2019 Wed 09/18/2019	Key Concepts: Genetic modification and precise genome editing
5	Sun 09/22/2019 Wed 09/25/2019	University holiday Key concepts homework/ assignment
6	Sun 09/29/2019 Wed 10/02/2019	Key Concepts: Cell growth, development and evolution
7	Sun 10/06/2019 Wed 10/09/2019	Cell structure and function of different chassis: Bacteria
8	Sun 10/13/2019 Wed 10/16/2019	Cell structure and function of different chassis: Yeast
9	Sun 10/20/2019 Wed 10/23/2019	Cell structure and function of different chassis: plants/ Algae
10	Sun 10/27/2019 Wed 10/30/2019	Mid-semester break
11	Sun 11/03/2019 Wed 11/06/2019	Engineering molecules: Chemical structure of DNA, RNA, and proteins
12	Sun 11/10/2019 Wed 11/13/2019	Engineering molecules: Enzymatic catalysis and metabolism
13	Sun 11/17/2019 Wed 11/20/2019	Engineering molecules: Protein engineering and directed evolution
14	Sun 11/24/2019 Wed 11/27/2019	Engineering molecules: DNA synthesis and assembly
15	Sun 12/01/2019 Wed 12/04/2019	Engineering molecules: Synthetic genes, networks, and genomes Applications: How these key concepts, chassis and engineering principles are used to build devices to solve real world problems?
16	Sun 12/08/2019	Exams

Note

The instructor reserves the right to make changes to this syllabus as necessary.