

Biochemical engineering ENCH 482/682 Schedule, Fall 18

Class Meets	Date	Day	Topic	Remark
1	30-Aug-18	Thursday	Introduction, overview of chemical engineering principles applied to biotechnology, History of modern Biotech, opportunity in the future and syllabus and schedule	
2	4-Sep-18	Tuesday	2.1 Basic Biology & Biochemistry of Cells (sugars/lipids/amino acids) Literature review (James Liao, Nature 2008)	
3	6-Sep-18	Thursday	2.1 Basic Biology & Biochemistry of Cells (Double helix DNA structure /protein structure and function) Literature review (Stamatakis, Biophysical journal 2009)	HW1
4	11-Sep-18	Tuesday	3.1 Enzymes General Principles, Pseudo steady state, M-M equation	HW1 Due
5	13-Sep-18	Thursday	3.2 Enzyme Inhibition kinetics (Ch 3), Competitive, Incompetitive and Uncompetitive	HW2
6	18-Sep-18	Tuesday	3.3 Enzyme Immobilization (Ch 3) and Kinetics Project review and matlab modeling session	HW2 Due
7	20-Sep-18	Thursday	4.1 DNA Replication, Transcription, promoter and terminator 4.2 Translation, genetic codon, ribosome bindign site Literature review (Collins, PNAS 2010)	HW3
8	25-Sep-18	Tuesday	4 Genetic Regulation, repressor and activator, lac operon and trp operon; Literature review (Collins, Nature 2000 and Elowitz, Nature 2000)	HW3 Due
	27-Sep-18	Thursday	Gates Foundation meeting, No class, Group project discussion	
10	2-Oct-18	Tuesday	5.1 Metabolic Pathway (EMP, TCA, PP, ED, fatty acid degradation and biosynthesis) Literature review (Ratledge, Biotech Lett, 2014)	
11	4-Oct-18	Thursday	5 Fermentation (ethanol, lactate and glycerol) and cell energetics Literature review (Stephanopoulos, Nat Biotechnol, 2011 & 2017)	HW4
12	9-Oct-18	Tuesday	8.1 rDNA Technology; 8.2 PCR, Sequencing, Vector, plasmid, reporter gene Literature review (Stephanopoulos, Science, 2010)	HW4 Due

13	11-Oct-18	Thursday	Basic molecular biology: Blue-white screening, PCR-based mutation and genome editing with recombinase and CRISPR-Cas9 Literature review (Datsenko & Wanner, PNAS 2000)	
14	16-Oct-18	Tuesday	Mid-term exam (1 pm to 2:30 pm, Fine Arts 215)	EXAM 1
15	18-Oct-18	Thursday	6.1 Modeling How Cells Grow, cell growth phase, exponential growth, specific growth rate	HW5
16	23-Oct-18	Tuesday	Temperature effect, Arrhenius equation and sterilization Literature review (Reuss, Biotech & Bioeng 2002)	HW5 Due
17	25-Oct-18	Thursday	Monod equation and Logistic equation, derive growth parameter (K_s and μ_{max}), integration of Logistic equation	HW6
18	30-Oct-18	Tuesday	Yield, Substrate consumption rate, product formation rate, Maintenance coefficient Literature review (Fredrickson, J Bacteriology 1972)	HW6 Due
	1-Nov-18	Thursday	AIChE meeting, No class, Group project discussion	
19	6-Nov-18	Tuesday	General category of microbial fermentation, Operation mode, fed-batch, continuous, dilution rate	
20	8-Nov-18	Thursday	Mass balance for CSTR, Optimal biomass productivity in CSTR	HW7
21	13-Nov-18	Tuesday	Semhar Yohannes, Biochemical engineering literature search and how to effectively use Endnote. Class will meet at library instruction room 259.	Guest lecture from UMBC library
	15-Nov-18	Thursday	Conference, No class, Group project discussion	
22	20-Nov-18	Tuesday	CSTR with effluent recycle	HW7 Due
	22-Nov-18	Thursday	No Class, Thanksgiving Day.	
23	27-Nov-18	Tuesday	Plug-flow bioreactor, airlift reactor and perfusion reactor and its application	HW8
24	29-Nov-18	Thursday	Oxygen uptake rate, K_{La} , fermenter configuration Literature discussion (You, Molecular Systems Biology 2008)	
25	4-Dec-18	Tuesday	Mixing effect, Fermenter broth rheology and bioreactor scale-up	HW8 Due
26	6-Dec-18	Thursday	Bioprocess modeling and optimal bioreaction control (DO-stat, pH-stat, Glucose starvation, exponential feeding)	
27	11-Dec-18	Tuesday	Final project presentation	Project report Due
	18-Dec-18	Tuesday	Final exam (1pm to 3pm, Fine Arts 215)	EXAM 2