Course Number:	ChE 161
Course Title:	Engineering Biology
Calendar Term(s):	W, S
Credit Weight:	0.5
Hours per week:	3 LEC, 2 TUT
Calendar Description:	Introduction to basic concepts of biochemistry and cell biology. Overview of the chemistry of amino acids, carbohydrates, lipids and nucleic acids. Properties and functions of biopolymers. Elements of cell structure and diversity, and relationship of biochemistry with cell metabolism. A focus on biotechnologically relevant examples such as biomimetic engineering design, proteomics, system biology and high throughput biology.
Prerequisite:	*1B Engineering or Software Engineering*
CEAB Math:	
CEAB Basic Sc.:	
CEAB Eng. Sc.:	
CEAB Eng. Dgn.:	
CEAB CSE:	
Instructor(s):	R.L. Legge
Textbook:	Bioprocess Engineering: Basic Concepts (Shuler & Kargi)
Software:	
Resources needs:	Ideally one A and one B task is required for this course! Currently only one A task is being assigned. • Tutorials: 12 wks * (2 prep + 2 tutorial + 7 marking)/wk = 132 hrs (marking includes quizzes, memos, assignments & group projects) • Office hours: 12 wks * 1/wk = 12 hrs • Proctoring exams: 2 hrs (midterm) + 3 hrs (final) = 5 hrs • Assistance with marking midterm & final exams = 8 hrs Total = 157 hrs!
Weekly Description of Topics Covered	
Week 1	Course contract; cell composition (elemental analysis); material balance on cell composition; monosaccharides to polysaccharides.
Week 2	Chemistry and functionality of starch and cellulose (detailed); lipid chemistry and functionality; biological membranes; structure and function of biological membranes (transport & role in information processing & cellular organization).
Week 3	Nucleic acids to nucleotides; DNA/RNA structure, base pairing; amino acids & proteins; formation of the peptide bond and protein structure from 1°-4° structure.
Week 4	Cell structure – prokaryotes & eukaryotes; eukaryote structure and growth; biological diversity; cultural characteristics of bacteria.
Week 5	Genetic code and protein synthesis; information processing including transcription and translation; post translational modification. Diversity of life.

Week 6	Eukaryotes in detail relating cell structures to biochemistry; technologies using eukaryotes including animal cell culture, stem cells & tissue engineering, plant cell culture, virus production.
Week 7	Metabolic pathways; carbon catabolism & energy production; electron transport; yield co-efficients for biomass and product formation; energy balances and examples of their application (aerobic vs. anaerobic).
Week 8	Cell transport phenomena in detail; modification of membrane transport; genetic engineering tool box (introduction to genetic engineering).
Week 9	Restriction enzymes; restriction maps; DNA cloning & PCR technology; cDNA; nucleic acid hybridization and Southern/Northern blots.
Week 10	Comprehensive example of genetic engineering to pull all elements together; enzymes (introduction).
Week 11	Enzyme nomenclature; measurement of enzyme kinetics; kinetics of single substrate enzyme catalyzed reaction and development Michaelis-Menten equation; discussion of enzyme inhibition and kinetic analysis.
Week 12	Growth kinetics and growth curves; Monod growth model developed from fundamentals; review lecture.
Examination type:	
Midterm:	Closed book
Final:	Closed (35%) and open (65%) book
Marking Scheme:	
Assignments:	3 Assignments – 0% (2/3 satisfactory assignments required otherwise marks deducted from final grade.) 2 Group Projects – 15%
Quizzes:	Quizzes – 3 (10%) (On assignment material given at the start of the tutorial session.)
Labs:	none
Midterm exam:	25%
Final exam:	50%
Special marking rule:	For the projects, if there is evidence that all group members have not contributed equally, mark assignments to individual group member are adjusted accordingly. The projects involve groups of 4 and include research, brain-storming and debate. One project involves a discussion on the societal and ethical impacts of biotechnology from a list of topics provided at the start of the project; the second project is a technological evaluation of a new product from a biotechnology company from a list of topics provided at the start of the project.

Comments:

Course Number:	ChE161
Course Title:	Engineering Biology
Calendar Term(s):	Spring
Credit Weight:	
Hours per week:	3 h Lecture + 2 h Tutorial
Calendar Description:	
Prerequisite:	
CEAB Math:	
CEAB Basic Sc.:	
CEAB Eng. Sc.:	
CEAB Eng. Dgn.:	
CEAB CSE:	
Instructor(s):	C. P. Chou
Textbook:	Biochemistry by Voet and Voet (optional)
Software:	
Resources needs:	
Weekly Description of Topics Covered	
Week 1	Introduction to biotechnology, biochemistry, biology, molecular biology, microbiology. Review of chemistry concepts and backgrounds relevant to this course.
Week 2	Biomolecule: biopolymers, carbohydrate, sugar, oil, lipid, amino acids
Week 3	Biomolecule: amino acid chemistry, isoelectric point, protein, peptide, protein chemistry, protein structure, protein folding
Week 4	Biomolecule: nucleotides, nucleic acids, gene, genome
Week 5	Cell: cell structure, prokaryote vs. eukaryote
Week 6	Cell: cell propagation, classic genetics, virus
Week 7	Gene expression: gene structure and elements, DNA replication, transcription, posttranscriptional processing, rRNA and tRNA processing
Week 8	Gene expression: translation, posttranslational processing
Week 9	Metabolism: metabolic pathway, catabolism, anabolism, metabolite, enzyme, fermentation pathway, aerobic and anaerobic pathways
Week 10	Metabolism: EMP pathway for glycolysis, citric acid cycle, oxidative phosphorylation for electron transport
Week 11	Engineering applications: genetic engineering, metabolic engineering, molecular genetics, protein engineering, recombinant DNA technology
Week 12	Engineering applications: -omics, systems biology, high-throughput biology,
Examination type:	
Midterm:	
Final:	
Marking Scheme:	

Assignments:	
Quizzes:	2 × 15%
Labs:	
Midterm exam:	30%
Final exam:	40%
Special marking rule:	

Comments:

The course description in UW Calendar book needs a major revamping.

1. Add “gene expression” section (a very important topic leading to the understanding of modern biotechnology) into the course content.
2. Replace itemized “relevant examples” (e.g. biomimetic engineering design, proteomics, etc.) with a broad item of “engineering applications”.