ENGG*2660
Biological Engineering Systems - Winter 2009

Professor and TA Information

Professor: Manju Misra, Associate Professor, School of Engineering and the Department of Plant Agriculture, 215 Thornbrough Building, University of Guelph, Guelph, Ontario, N1G 2W1.

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Office Hours: Every Thursday from 10:00 till 10:45 a.m, or by appointment (if you've got a quick question/concern please feel free to send me an email or talk to me before or after class; if you have a question(s)/concern(s) that requires more time, we can set a time to meet that will work for both of our schedules).

Teaching Assistant:

Max Gong: mgong@uoguelph.ca, 305 Thornbrough Building

Course and Schedule Information

Course Description:
Bioengineering is a broad discipline that integrates engineering principles with biological sciences. Applications include biochemical and food engineering, biomedical engineering and bioresource engineering. Systems identification and analysis are common to all of these areas and form the foundation for engineering design.

This course uses techniques and tools developed in ENGG*2400 to analyse mass, energy and momentum components of biological systems. We will focus on systems containing biological catalysts (e.g. cells, enzymes) and/or other reacting species, or mechanical systems from the human body. A range of bio-system examples will be studied including those pertaining to the biomedical, food and bioprocessing industries.

Prerequisites: MATH*2270, MICRO*1020, ENGG*2400, *Co-requisite(s)*: BIOC*2580

Class Time: Tues./Thurs. – 8:30-9:50 a.m. Room 234, MacKinnon (MACK) Building.

Tutorial: Mon. - 12:30 p.m.-01:20 p.m. Room 107, Rozanski (ROZH) Hall/Building.

Reading Week No Classes: Feb. 16 - Feb. 20, 2009

Final Examination: Fri 08:30 a.m. - 10:30 a.m. (April 17, 2009) Room TBA

Recommended Texts:
Bioprocess Engineering Principles, P. M. Doran Academic Press, Toronto 1995.
Introduction to Biomedical Engineering, M.M. Domach, Pearson Education Inc., 2004.
Recommended References:
Molecular Cell Biology 5th Edition, Lodish, Harvey et al. W. H. Freeman and Company, NY, 2003
Introductory Biomechanics: From Cells to Organisms, C. Ross Ethier and Craig A. Simmons 2007

Course Website: login to blackboard/CourseLink (formerly WebCT)

Learning Objectives

Upon successful completion of this course, students will be able to:

- Identify and analyse mass and energy transformations in biological systems.
- Develop mathematical models for biological systems and analyse their dynamic behaviour.
- Integrate fundamental principles of microbiology and biochemistry with quantitative analysis to solve engineering problems.

Topics

Review:

-Cell characteristics, physiology and growth requirements

Bioprocess Engineering:

-Mass balances - conservation of mass; process flow diagrams; mass balances with and without reaction; total mass vs. composition; steady state and dynamic systems

-Energy balances- conservation of energy; enthalpy; heats of reaction; energy of phase changes

-Reaction kinetics - kinetics of cell growth and product formation; enzyme kinetics; first-order kinetics; temperature effects

Biomedical Engineering:

-Musculoskeletal System - Muscle anatomy, structure and function, active and sliding filament models, energy considerations, Hill's Model

-Circulatory System - Overview of anatomy, function, blood properties, flow and resistance

-Biomaterials and tissue engineering

Marking

Activity	Percentage of Final Grade
Quizzes and Assignments	35%
Term Project	20%
Final Examination Fri 08:30 a.m. - 10:30 a.m. (2009/04/17)	45%

Weekly assignments will be handed out through Courselink. Students are encouraged to complete all of these assignments. The teaching assistant will announce the due date for each assignment during the tutorial sessions. Late assignments will receive a grade of 0. The questions will be marked rigorously – i.e. solutions should be thoroughly and professionally presented. **Quizzes** will be held biweekly during tutorial sessions. The teaching assistant will provide a review and help with questions before the quiz during tutorial sessions.

Stipulations for passing the course

In order to pass the course, students must complete and pass all assigned term work (quizzes, assignments, and project) and the final examination. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the quizzes and assignments, and the term project portions of the course to count towards the final grade. Similarly, students must also obtain a grade of 50% or higher on the quizzes and assignments, and term project portions of the course in order for the examination portion of the course to count towards the final grade.

University Policy on Academic Misconduct:

Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2008-2009 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Communications

Communications is through announcements in class. Some information will be posted on the course website and some will be out through e-mails. Because of the large class enrolment, we usually go through student's messages twice a week. Therefore please do not expect immediate reply to your emails.

Disclaimer

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to the University of Guelph Academic Regulations.