

Course Outline
ChE 3BK3: Bio-Reaction Engineering
September - December, 2017

Instructor: Dr. Kim Jones (JHE-374; Ext. 26333; Email: kjones@mcmaster.ca)

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Schedule: 3 lecture-hours per week (Tuesday, Thursday and Friday: 2:30-3:20, JHE 326H)

Learning Objectives: Understand the basics of -

- 1) Kinetics of cellular processes, microbial processes and enzyme reactions including those of immobilized cells and enzymes.
- 2) Cell culture. bioreactor design, operation, scale-up and control.
- 3) Bioprocess development including downstream processing.
- 4) Expression systems.

Objective: To provide students with an understanding of the fundamentals of biological processes, including biological reaction kinetics, and bioprocess design, scale-up and operation.

Course Text: M.L. Shuler and F. Kargi
Bioprocess Engineering: Basic Concepts
Second Edition, Prentice Hall, 2002

Web Page for Course: Avenue to Learn

Assessment: Problem Sets (4 @ 1.25% each) – 5%
Mid-term I (open book) – 30%
Mid-term II (open book) – 25%
Summary of Research Paper – 15%
Final (open book) – 25%

Format for the Summary of Research Paper:

The objective of this activity is for you to get into the habit of reading, understanding, evaluating and simplifying cutting-edge research publications. A series of papers, from journals such as Science, Nature, Nature Biotechnology, will be made available to each student in the class. The student will then prepare a two page summary of the paper, where the main concepts of the work are explained and the significance of the work is highlighted. This is an individual project and not a group project. I feel that this is a very rich exercise in terms of being able to distill information from a high level publication and to communicate this efficiently to others, a critical set of skills in highly dynamic industries. Students may also choose their own papers from the field of biotechnology. These papers must have been cited at least 100 times and approved by me.

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Tentative Course Outline:

LECTURE PERIODS	ACTIVITIES	CHAPTERS IN SHULER AND F. KARGI
1	Introduction	
2-3	Applied microbiology (cell growth, nutrition, the "cell factory")	Ch. 2
4-7	Enzymes (structure/function, kinetics, industrial enzymes)	Ch. 3
8-9	Gene expression, metabolic regulation	Ch.4
10-12	Cell growth (metabolism)	Ch. 5
13-15	Growth kinetics (batch & continuous growth kinetics, structured and unstructured models)	Ch. 6
16	Stoichiometry (microbial growth and product formation)	Ch. 7
17-22	Bioreactor design and operation (suspended and immobilized cultures)	Ch. 9
23-27	Scale-up and control of bioreactors (transport phenomena, instrumentation, sterilization, examples of large-scale bioprocesses)	Ch. 10
28	Overview of downstream processes (recovery and purification)	Ch. 11
29	Choice of expression system (microbial, mammalian, transgenic)	Ch. 12
30-34	Genetic Stability	Ch. 14
35	Review	

PROPOSED MIDTERM DATES (2 HOURS):

- 1. Wednesday OCTOBER 18 FROM 5:30 TO 7:20**
- 2. Wednesday NOVEMBER 15 FROM 5:30 TO 7:20**

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Policy Reminders:

1. The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Departmental Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.
2. Students are reminded that they should read and comply with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available in the Senate Office.

Academic Dishonesty:

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

Turnitin.com

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism.

Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com.

All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., online search, etc.). To see the Turnitin.com Policy, please go to www.mcmaster.ca/academicintegrity

Use of Avenue to Learn

In this course we will be using Avenue. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure.

If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Students Requiring Academic Accommodation

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.