

UNIVERSITY OF GUELPH, SCHOOL OF ENGINEERING

ENGG*3830 Bio-process Engineering, F'2007, 3+1 (0.5)

Instructor: Dr. Gauri S. Mittal, Professor of Food Engineering, Room 2344, ext. 52431, fax: 836-0227, email: gmittal@uoguelph.ca

Calendar Description (2007-08):

Application of engineering principles to the processing of biological products in the biological and food industry. Analysis and design of unit processes such as sedimentation, centrifugation, filtration, milling and mixing involving rheology and non-newtonian fluid dynamics of biological materials. Analysis of heat and mass balances for drying, evaporation, distillation and extraction.

Pre-requisites: ENGG*2230; ENGG*2660, Corequisite: ENGG*3260

Course Objectives:

After successfully completing the course, students will be able to:

1. Analyse unit operations for biological processes using the techniques of engineering and system analysis.
2. Analyse and quantify separation processes used for the recovery of biological materials in unit operations.
3. Analyse and design some unit operations involving simultaneous heat and mass transfer.

Text Materials:

McCabe, W.L., Smith, J.C. and Harriott, P. 2005. Bioprocess Engineering ENGG*3830. McGraw-Hill, Inc., Toronto. (Condensed version of "Unit Operations of Chemical Engineering", 7th edition).

References:

1. Mittal, G.S. 1992. Food Biotechnology--Techniques and Applications. Technomic Pub. Co., Lancaster, PA.
2. Rizvi, S.S.H. and Mittal, G.S. 1992. Experimental Methods in Food Engineering. Van Nostrand and Reinhold, New York, NY.
3. Geankoplis, C. 2003. Transport Processes and Unit Operations. Prentice Hall, Inc., New York.
4. Mittal, G.S. (Ed.) 1996. Computerized Control Systems in the Food Industry. Marcel Dekker, Inc., New York. A number of unit operations for food industry are discussed along with their controls. Part III. on Unit Operations containing chapters 8 to 14 is related.

Class Schedule:

Lectures: T,TH 8:30 to 9:50, MACK 306; Tutorials: W 2:30 to 3:20, MACK 235

Teaching Schedule:

1. Properties, handling, and mixing of particulate solids--chapter 28, pages 967-974, 977-983.

2. Mechanical separations including screening, filtration, membranes, micro- and ultra-filtration, sedimentation, centrifugation, cyclones and hydroclones--chapter 29, pages 1001-1033, 1037-1056, 1059-1076, ref. 1 and 3.
3. Membrane separation processes -- dialysis, pervaporation, reverse osmosis: chapter 26, pages 904-922.
4. Basics of heat and mass transfer
5. Evaporation--chapter 16, pages 486-515, ref. 3.
6. Drying of solids, slurries and pastes--chapter 24, pages 796-831, ref. 2, 3.
7. Leaching and extraction, supercritical extraction, chapter 23, pages 764-776, 779-786, ref. 3.
8. Distillation--chapter 21, pages 663-686, ref. 3.
9. Other topics based on time available. Some of the topics (not covered in class) will be assigned as projects and their reports will be presented in the class to provide background information.

Evaluation:

Short tests (quiz type)	20% (in the tutorials based on assignments, and class and tutorial work, best 4 out of 6)
Project	20% (report due date: any time up to Nov. 23, 2007)
Exam. (1, Final only)	60% Final Exam

Assignments will be given on various topics, however students are not required to hand over the solutions to the instructor for grading. Solutions of all the assignments will be placed on the WebCT for comparing your solutions. Please try to solve all the assignments before going through the solutions placed on the WebCT. For further practice, a number of solved examples will be assigned. Projects will be assigned soon. Last class week will be used to present project reports. All short tests will be held during tutorial hour based on assignments, and class and tutorial work conducted during the weeks after the last quiz. **All tests and examinations will be open book.**

Holy Days: Students must contact the instructors within first two weeks of class if academic consideration is to be requested due to religious reasons.

Instructor will be available during office hour only. Additional time for individual consultation will be provided by appointment. E-mail can also be used for consultation.