Course Number  BIOE 4420  Course Title  Crop Preservation

Academic Session  Winter 2017  Credit Hours  4

Prerequisites and how they apply to this course
BIOE 2110 Transport Phenomena provides students with: 1) an introduction to the heat and mass transfer inside the biomass materials, 2) basic knowledge on temperature gradients; and 3) experience on Psychometric chart which will be used to explain grain drying and aeration. 3 hr/week BIOE 4420 will build upon this knowledge.

Classroom Location  Room: EITC E2 351
Meeting Days and Class Hours  TuTh  8:30 am to 9:45 am
Lab Location  EITC E2 164 or Grain Storage Lab. 220
Lab Hours  Monday 2:30 to 5:15 pm (Students can choose time after the third weeks)

Department Office location  E2-376 EITC
Department Phone Number  474-6033

Student Contact Time (Hrs)
Lectures:  2 hrs and 30 min lecture/week × 13 weeks/term = 32.5 hrs
Laboratories:  3 hr/week × 12 weeks = 36 hrs
Tutorials:  laboratorial time or TBA

Instructor Information
Name & Title  Dr. Fuji Jian, P. Eng. Assistant Professor
Office Location  E1-532 EITC
Office Phone Number  474-7965
Email Address  fuji.jian@umanitoba.ca
Office Hours  TBA

Teaching Assistant(s)  Md Abdullah Al Mamun
TA Office Hours and Location  TBA

Important Dates
Assignment due date  One or two weeks (will be specified)
Voluntary withdrawal date  Mar 31, 2017
Midterm examination  March 20 (Monday) afternoon, 2017
Laboratory report due date  April 17, 2017
Final examination  Arranged by the Department
Course Philosophy

Students’ Learning Responsibilities
Attendance for lectures and laboratories is strongly expected. If you must be absent, please show me the courtesy of sending an e-mail notifying me of your absence. To benefit the most from this class, you must be willing to participate in class discussions. You are expected to read the texts and course materials, do assignments independently (even though you are encouraged to discuss with your classmates and instructor), and understand principles and theories. Deadlines are a reality in the world of engineering; I expect assignments to be completed on time. Finally, please respect both me as instructor and your classmates by turning off your cell phone during class time. Laptops may be used during lectures only if you are taking notes on the laptop.

Why this course is useful?
Any biomaterials will: 1) spoil if not stored under proper conditions; and 2) have a finite storage life even though it is properly stored. The principles and theories delivered in this course can be used to design qualified storage facilities and make sound storage decisions. This course also focuses on practice. Therefore, the lectures, texts, and course materials can be directly used in industrial applications. Laboratory activities are intended to expose students to grain storage practices.

Students’ knowledge will be enriched in the following areas: 1) Engineering such as heat and mass transfer, drying, aeration, ventilation, fan selection, air conditioning, material handling, and engineering design; and 2) biology such as stored product insects, mites, moulds and their monitoring and control; ecosystems; and physical properties of biomaterials.

Who should take this course?
Students in Biosystems Engineering and Agriculture with an interest in the storage life of biomaterials.

How this course fits into the curriculum?
It is intended that students take this course during the third or fourth year after they have gained experiences and knowledge on biology, engineering design, heat and mass transfer, and environmental control. This course introduces the students to several fundamental engineering competencies and “solid skills” for grain and biomass storage and handling.

Course Description/Objectives

Undergraduate Calendar Description
Biological and physical deterioration during storage. Methods of preserving and storing cereals, oilseeds, and other agricultural crops.

Instructional Methods
Learning is most effective when both the instructor and the students are engaged in the subject material. The role of the instructor, therefore, is to create an environment that facilitates students’ engagement (and therefore learning). In this course, some dissemination of information will occur using the traditional lecture format (PowerPoint presentations). However, a substantial portion of the content will be distributed as reading materials which will be covered using classroom discussion. Therefore, you will be expected to prepare for class by reading the assigned materials. Also you will design and conduct experiments inside lab.

Course Content:
Course Objectives

Students are expected to gain an understanding of the physical (grain physical properties, temperature, moisture, and gas), chemical (chemical materials and chemical reaction such as grain respiration), biological (insects, mites, and microorganisms), and economic variables affecting the preservation and storage of cereal grains, oilseeds, and other agricultural products such as biomass and vegetables. The principles are applied to the design and operating criteria of storage systems. After the completion of the lectures, students should have the knowledge of industrial grain storage practice to maintain quality of grain and their products.

The laboratory work will also provide students with an opportunity to collaborate equitably with group members in a team setting to manage an engineering testing project and write a technical report.

Learning outcomes

At the conclusion of the course, the student should be able to:

- Understand fundamental concepts of the grain and biomass storage and handling
  1. Explain the physical, chemical, biological, and economic variables affecting the preservation and storage of cereal grains, oilseeds, and other agricultural products such as biomass and vegetables.
  2. Explain how to control stored-product insects, mites, and mould.
  3. Identify safety concerns during grain and biomass storage and handling.

- Use the principles and theories delivered in this course to solve problems
  1. Evaluate existing storage scenarios to identify condition likely to cause storage losses.
  2. Design storage systems to preserve the quality of grain, oilseeds, and other agricultural products such as biomass and vegetables.
  3. Design suitable drying and aeration systems to store biomaterials under safe storage conditions.

Grade Evaluation

The grade will be based on the assignments, lab performance and reports, and midterm and final examination.

The final grade is the combination of the following grades:

1. 40% on final examination
2. 30% on mid-term test
3. 30% on term work, assignments, design project, and laboratory report.

Final letter grades will be assigned on the basis of the overall performance of the class, the spread of the numerical marks, and in comparison with previous classes.

**Description of Assignments**
Questions will be assigned weekly or biweekly and will be evaluated for content (Total eight assignments). The reports should be presented in a neat and easy to read format (handwriting is acceptable but prefer printing).
The questions include the understanding of theories, principles, and design works. The design works will be assigned in two assignments (two projects). The mark of the two design projects will be counted as four assignments.
Students are expected to complete their assignments on an individual basis even though discussion with the instructor and class mates are encouraged.

**Description of Laboratories**
One laboratory period (3 hr) per week throughout the semester. Laboratory work includes demonstrations and experiments with written reports.

**List of the laboratories**
1. Tour to grain storage facility, identification of insects, mites, and molds.
2. Demonstration of angle of repose and friction of biomass materials.
3. Design project: design a detail protocol to evaluate grain quality during storage and when the stored grain is delivered to elevators.
4. Experimental project: deterioration of wheat and canola during storage.
5. Writing of complete proposal and experimental reports.

**Description of Examinations**
The mid-term exam is scheduled on March 20, 2017. The results of the mid-term exam will be returned to students before the voluntary withdrawal deadline.
Date of the final exam will be scheduled by the University of Manitoba.
The examinations will be close-book exams. The questions will be similar to those assignments plus descriptive questions on theory and design works. Design works will weigh 50% of the total mark of the final exam. Material presented in class, in laboratories, and in the textbook will be covered.

**Texts, Readings, Materials**

**Textbook(s) – Authors, Titles, Edition**
Dr. W. E. Muir. 1999. Grain Preservation Biosystems. Students are required to purchase this text book.

**Supplementary Reading**
Canadian Grain Storage CD-Rom.

**Additional Materials**
Supplied by instructor.

**Course Policies**

**Late Assignments**
Will not be accepted and will receive a zero grade.

**Missed Assignments**
Will receive a zero grade unless student has a valid medical certificate or compassionate reason (see Missed Exams).
Missed Exams
If the midterm or/and final examination is missed and the student has a valid medical certificate or compassionate reason (i.e., death of an immediate family member), a make-up examination will be scheduled by the course instructor. Students who miss the examination without a valid reason will receive a grade of zero for the examination.

Academic Integrity
Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University’s policy on plagiarism, cheating, exam impersonation and duplicate submission.

Use of Third Party Detection and Submission Tools
Electronic detection tools may be used to screen assignments in cases of suspected plagiarism.

Group Work Policies:
You will be required to share your laboratorial results with your classmates. If you could not provide your results on time, penalties deducted for late sharing will be 10% per day.
All courses in the Biosystems Engineering program are expected to contribute, in some way, to the development of one or more of the 12 graduate attributes that have been identified by the Canadian Engineering Accreditation Board. The graduate attributes which will be emphasized and evaluated in this course have been defined below for your information:

- **A Knowledge Base for Engineering**
  Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

- **Problem Analysis**
  An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

- **Investigation**
  An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

- **Design**
  An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

- **Use of Engineering Tools**
  An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

- **Individual and Team Work**
  An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

- **Communication Skills**
  An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

To maintain the accreditation of our Biosystems Engineering program, it is a requirement that student competency with respect to the 12 graduate attributes be assessed. To enable such assessment to occur in a meaningful manner, the Faculty of Engineering and representatives from industry developed a comprehensive list of indicators for each of the 12 graduate attributes. The indicators being formally assessed in BIOE 4420 are shown in the table below.

The ultimate goal of mapping the course evaluation to graduate attributes and indicators is the identification of potential deficiencies in the Biosystems Engineering program so that continuous improvement can occur. Data generated from this course will be compiled with data collected from other sources (i.e., other courses, SEEQ surveys, exit surveys, co-op surveys) to facilitate on-going review and improvement of the Biosystems Engineering curriculum.
## Mapping of Course Evaluation to Graduate Attributes & Indicators

<table>
<thead>
<tr>
<th>Grade Component</th>
<th>Specific Evaluation Point</th>
<th>Graduate Attribute (^{[b]})</th>
<th>Indicators Being Assessed (^{[b]})</th>
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</thead>
<tbody>
<tr>
<td>Assignments (15%)</td>
<td>Assignment 1</td>
<td>1. Knowledge base 2. Problem analysis</td>
<td>1.15 Specialized Discipline-specific Engineering Concepts 2.2 Contextualize problem</td>
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<tr>
<td></td>
<td>Assignment 2</td>
<td>1. Knowledge base 2. Problem analysis</td>
<td>1.15 Specialized Discipline-specific Engineering Concepts 2.2 Contextualize problem</td>
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<td>Assignment 3</td>
<td>1. Knowledge base 2. Problem analysis</td>
<td>2.2 Contextualize problem 2.8 Evaluate solution</td>
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<td></td>
<td>Assignment 4</td>
<td>1. Knowledge base 2. Problem analysis</td>
<td>2.2 Contextualize problem 2.8 Evaluate solution</td>
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<td></td>
<td>Assignment 5</td>
<td>1. Knowledge base 2. Problem analysis</td>
<td>2.2 Contextualize problem 2.8 Evaluate solution</td>
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<td></td>
<td>Assignment 6 (marks as two assignments)</td>
<td>4. Design 5. Use of engineering tools</td>
<td>4.3 Implementing design strategy 4.4 Evaluating final design 5.2 Identify and use tools</td>
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<td></td>
<td>Assignment 7 (marks as two assignments)</td>
<td>4. Design 5. Use of engineering tools</td>
<td>4.3 Implementing design strategy 4.4 Evaluating final design 5.2 Identify and use tools</td>
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<tr>
<td>Laboratory (15%)</td>
<td>Design testing procedure</td>
<td>3. Investigation 4. Design</td>
<td>3.9 Procedure 4.2 Problem solving</td>
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<td>Conduct testing</td>
<td>5. Use of engineering tools 6. Individual and teamwork 3. Investigation</td>
<td>5.2 Identify and use tools 6.2 Time management 6.7 Working with others 3.10 Data/evidence collection</td>
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<td>Lab report</td>
<td>3. Investigation 7. Communication skills</td>
<td>3.11 Data presentation and error analysis 3.12 Evaluation of experiment 7.10 Formatting/layout/design of communication</td>
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<td>Midterm Examination (30%)</td>
<td>Part A and B</td>
<td>1. Knowledge base 2. Problem analysis 5. Use of engineering tools</td>
<td>1.15 Specialized Discipline-specific Engineering Concepts 2.2 Contextualize problem 2.8 Evaluate solution 5.2 Identify and use tools</td>
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<td>Part C</td>
<td>4. Design</td>
<td>4.2 Problem solving 4.3 Implementing design strategy</td>
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<td>Final Examination: (40%)</td>
<td>Part A and B</td>
<td>1. Knowledge base 2. Problem analysis 5. Use of engineering tools</td>
<td>1.15 Specialized Discipline-specific Engineering Concepts 2.2 Contextualize problem 2.8 Evaluate solution 5.2 Identify and use tools</td>
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<td></td>
<td>Part C</td>
<td>4. Design</td>
<td>4.2 Problem solving 4.3 Implementing design strategy</td>
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