COURSE TITLE: **Crop preservation and handling**

Department: BIOSYSTEMS ENGINEERING  
Course Number **Bioe 4520**

Academic Session: Winter term 2011-2012  
Credit Hours: 3 credit hours

Prerequisites and how they apply to this course: None. Students are encouraged to contact with the instructor

Classroom Location: Agricultural Engineering BLDG A205

Meeting Days and Class Hours: MWF 1:30 - 2:20 (From Jan 4 to April 6, 2012)

Lab/Seminar Location: Not Applicable  
Lab/Seminar/ Hours: Not Applicable

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

Course Web Page (if applicable)

Instructor Information

Name & Title: Fuji Jian, Ph. D, P. Eng. Grain storage specialist, research Engineer.

Office Location: A208  
Office Phone Number: 474-7965

Office Hours: By appointment

Email Address: jianf@cc.umanitoba.ca

Teaching Assistant(s) (if applicable): Not Applicable

**Course Philosophy**

Students’ Learning Responsibilities

I expect you to be in attendance, and on time, for all scheduled lectures. 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 an 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 it was not stored at proper environments; and 2) have a storage life span even though it is properly stored. The principles and theories delivered in this course can be used to design qualified storage facilities and make a sound storage decision. This course also focuses on practice. Therefore, the lectures, texts, and course materials can be directly used in industrial applications.
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 engineer design; and 2) biology such as stored product insects, mites, moulds and their monitoring and control; ecosystems; and physical property of biomaterials.

**Who should take this course?**
Students in Biosystems Engineering and Agriculture, or the person dealing with 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 certain experiences and knowledge on biology, 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.

Students will get trained on: the practice of grain and biomass storage and handling.
Course Description/Objectives

Undergraduate Calendar Description: Interaction of biological and physical factors related to methods of preserving, storing, and handling cereals, oilseeds, and other agricultural crops.

Instructional Methods
Learning is most effective when both the teacher and the student are engaged in the subject material. The role of the teacher, therefore, is to create an environment that facilitates student 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.

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.

Learning outcomes
Learning outcomes assist: i) students to identify the knowledge, skills, attitudes and personal attributes expected of them to successfully complete their program of studies; ii) faculty to develop learning goals and objectives in their courses and programs, in prioritizing and focusing the learning experiences, and in the selection of appropriate assessment tools and; iii) potential students and outside agencies to assess the quality of our academic programs. These learning outcomes areas include:

Scholar, Content and technical expertise, Social accountability, Communicator, and Professional

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 products 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.

Additional Comments:

Description of Examinations
The mid-term exam will be scheduled at one of the lecture times (two weeks before the voluntary withdrawal deadline). 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 Faculty of Agricultural and Food Sciences.

The test and exam will be closed book. Test and exam questions will be similar to those assigned during the course plus descriptive questions on theory and course contents. Material presented in class and in the textbook will be covered.

Description of Assignments
Questions will be assigned weekly (on Monday) and will be evaluated for content. The reports should be presented in a neat and easy to read format (handwriting is acceptable).
The questions include the understanding of theories, principles, and design works. Each student will work on an individual basis.

**Assignment Due Dates**
Two weeks after the assignment date.

**Grade Evaluation**
The final grade is determined as follows:
- 40% on final examination
- 35% on mid-term test
- 25% on term work and assignments

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.

**Important Dates (e.g., voluntary withdrawal date)**

**Texts, Readings, Materials**

**Textbook(s) – Authors, Titles, Edition**

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

**Additional Materials**
Supplied by instructors.

**Course Policies**

**Late Assignments**
Assignments are to be handed in at the beginning of the lecture on the due date. Penalties deducted for late assignments will be as follows:
- up to 1 week late: −50%; and
- over 1 weeks late: −100%.

**Missed Assignments**
Will receive a zero grade.

**Missed Exams**
If the midterm 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 (see Section 7, p. 29 in the University of Manitoba Undergraduate Calendar 09/10).

**Additional Comments:**
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 are encouraged to discuss with your classmates about the assignments. However, you should finish your assignments by yourself.

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**Course Content**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Lecture Date or Number of Lectures</th>
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<tbody>
<tr>
<td>Introduction and overview of the postharvest grain industry in Canada. Grain storage in the world. Why storage is needed?</td>
<td>2</td>
</tr>
<tr>
<td>Ecosystem components: respiration of biological materials, pre and post harvest fungi, insects, mites, rodents. Characteristics of grain storage ecosystems. Example of hot spot, and storage life.</td>
<td>3</td>
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<tr>
<td>Grain physical properties: moisture contents, specific heat, thermal conductivity, thermal diffusivity, densities, angles of repose, distribution of dockage, mass and funnel flow. Grain depth and air flow resistance, vertical vs horizontal air flow resistance. Psychrometric chart.</td>
<td>5</td>
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<tr>
<td>Grain temperature: Initial temperatures, temperatures in stored grain bins. Effect of bin diameter and height, initial grain temperature, bin wall material, solar radiation, and geological location.</td>
<td>3</td>
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<tr>
<td>Grain moisture contents: change in moisture content, relative humidity, ERH-EMC curves.</td>
<td>3</td>
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<tr>
<td>Monitoring the quality and condition of stored grain. Grading mistake due to visual grading and poor sampling.</td>
<td>3</td>
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<tr>
<td>Grain drying: principles of drying. Fan selection.</td>
<td>2</td>
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<tr>
<td>Non-ventilated storages.</td>
<td>2</td>
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<tr>
<td>Near-ambient drying systems.</td>
<td>2</td>
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<tr>
<td>Heated-air drying systems.</td>
<td>2</td>
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<td>Other physical, chemical, and biological systems to preserve grains and oilseeds.</td>
<td>1</td>
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<tr>
<td>Advanced grain storage practice. Safety and health hazards.</td>
<td>1</td>
</tr>
<tr>
<td>Biomass and vegetable storage.</td>
<td>3</td>
</tr>
</tbody>
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