



**University of Manitoba  
Faculty of Agricultural and Food Sciences  
Department of Biosystem Engineering**

## **Course Syllabus**

### **BIOE 3530 Engineering Fundamentals**

**Academic Session: Fall 2022 (Sept. 7- Dec. 12, 2022)**

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## COURSE DETAILS

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<b>Course Title &amp; Number:</b>	BIOE 3530: Engineering Fundamentals
<b>Number of Credit Hours:</b>	3
<b>Class Times &amp; Days of Week:</b>	Class: M/W/F 10:30 - 11:20 am Lab: T 2:30 pm - 4:30 pm
<b>Location for classes/labs/tutorials:</b>	Class: EITC E2 360
<b>Pre-Requisites:</b>	MATH1680 (136.168M) or the former 013.129 or 013.128

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## Instructor Contact Information

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<b>Instructor(s) Name:</b>	Dr. Wen Zhong (Professor)
<b>Office Location:</b>	W579 Duff Roblin Bldg.
<b>Office Hours or Availability:</b>	By appointment (via email or phone)
<b>Office Phone No.</b>	(204)474-9913
<b>Email:</b>	<a href="mailto:Wen.Zhong@umanitoba.ca">Wen.Zhong@umanitoba.ca</a>
<b>Contact:</b>	Preferred contact method: email (24/7)
<b>Teaching Assistant(s):</b>	Shahin Torki, <a href="mailto:torkis@myumanitoba.ca">torkis@myumanitoba.ca</a>
<b>Department Office location:</b>	E2-376 EITC Phone Number 474-6033

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## Course Description

(Formerly 034.353) Principles of heat transfer, steam, psychometrics, fluid mechanics, material balances, electricity and refrigeration. Cannot be held for credit in the Faculty of Engineering. Not to be held with the former 034.329. Prerequisite: [MATH 1300 or equivalent] and [MATH 1500 or equivalent] or the former MATH 1680 (136.168).

## General Course Information

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### Students' Learning Responsibilities

It is expected that students will be in attendance, and on time, for all scheduled lectures and labs. If you must be absent, please show 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. Deadlines are a reality in the world of engineering; I expect assignments to be completed on time. Finally, please respect both us as instructors 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?

This course applies scientific concepts in practical applications and will help you to learn fundamentals in engineering.

### Who should take this course?

Students whose futures work will involve agriculture/food processing or production industry. This is a required course in the Department of Food Science and a core course in the program of Agroecology.

### How this course fits into the curriculum?

This course is a core course required by the accreditation in the Food Science program. Also, it gives the basis to the Food Engineering course.

### Undergraduate Calendar Description

Physical quantities, mechanical concepts, basic fluid mechanics, basic electricity, steady-state heat transfer, psychometrics.

### Description of Examinations

A one-hour quiz on basic math skills will be conducted at the beginning of the first lab on Sept. 13, 2022. Students are encouraged to brush-up their basic math skills. There will be two midterm tests (Oct. 11 and Nov. 15, 2022) conducted during the laboratory period. The midterm tests will be graded and returned to the students a week later. The final examination will cover the material for the entire term and it will be scheduled by the Registrar's Office.

## Course Goals

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1. to understand and explain basic engineering principles involved in plant and animal production and food preservation,
2. to identify physical quantities, vectors, scalars, impulse, momentum, work, electromagnetic quantities, heat energy,
3. to apply principles of physics and engineering in solving numerical problems on basic mechanics, energy, electricity, fluids, heat transfer, and psychrometry.

## Intended Learning Outcomes

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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*

Additional Comments:

Students will be able to classify and explain basic engineering principles, employ units in practical problems, calculate engineering quantities, generate results, apply theory to practice, conclude

## Using Copyrighted Material

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Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact [um\\_copyright@umanitoba.ca](mailto:um_copyright@umanitoba.ca).

## Recording Class Lectures

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Dr. Wen Zhong and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Dr. Wen Zhong. Course materials (both paper and digital) are for the participant's private study and research.

## Textbook, Readings, Materials

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### Textbook

Cutnell, J.D. and K.W. Johnson. 1998-2014. Physics. John Wiley and Sons, New York (or latter edition).

Supplementary readings – Any book on physics.

### Additional Materials

PowerPoint presentations are available on the JUMP (the University of Manitoba portal and course tools) website. The address is <https://universityofmanitoba.desire2learn.com/d2l/login>. When you enter this page, you will find files containing the slides in the pdf format. The slide files are numbered and can cover several lectures. New slide files will be added to the website as the course progresses. Because the slides are saved in the pdf format as handouts, you cannot change their configuration. Also, you will receive assignments and lab handouts via JUMP but they will be saved in separate folders named “Assignments” or “Labs”.

## Course Technology

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It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Student Accessibility Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline “gaming” during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (©S Kondrashov. Used with permission)

## Class Communication

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The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit:

[http://umanitoba.ca/admin/governance/media/Electronic Communication with Students Policy - 2014 06 05.pdf](http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf)

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy

([http://umanitoba.ca/admin/governance/governing\\_documents/community/electronic\\_communication\\_with\\_students\\_policy.html](http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html)). You are required to obtain and use your U of M email account for all communication between yourself and the university.

## **Expectations: I Expect You To**

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We expect you to be in attendance, and on time, for all scheduled lectures and labs. If you must be absent, please show us the courtesy of sending an e-mail notifying us of your absence.

To benefit the most from this class, you must be willing to participate in class discussions. Therefore, you will be expected to prepare for class by reading the assigned materials.

### **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 the University of Manitoba Undergraduate Calendar for 2016).

## **Students Accessibility Services**

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### **Student Accessibility Services**

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

*Student Accessibility Services* <http://umanitoba.ca/student/saa/accessibility/>

520 University Centre

204 474 7423

[Student\\_accessibility@umanitoba.ca](mailto:Student_accessibility@umanitoba.ca)

## **Expectations: You Can Expect Me To**

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### **Instructional Methods**

In this course, dissemination of information will occur using the traditional lecture format. Examples of problems will aid in understanding steps involved in a solution process. Students will take home weekly numerical problems as assignments that will be evaluated by a teaching assistant; will perform laboratory experiments, work with laboratory equipment, will prepare written lab reports that will be evaluated.

## Class Schedule

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students. Changes are subject to Section 2.8 of the – [ROASS](#)- Procedure).

Topic	Lectures Dates
1. The Role of Units in Problem Solving - SI base units, derived SI units, some conversion factors, rounding.	Sep 7/9
2. Physical Quantities - Scalars and vectors, addition and subtraction of vectors, resolving a vector into components, vector diagrams, importance of the slope, describing motion with velocity vs time graphs. Free fall and acceleration of gravity, kinematic equations.	Sep 12/14/16
3. Basic mechanical concepts - Mass and force, Newton's laws, work against gravity, against friction, against pressure, kinetic and potential energy, power and torque, impulse and momentum theorem, principles of conservation of linear momentum.	Sep 19/21/23 /26/28, Oct 3, 5
4. Basic Electricity - Basic units of electricity, direct and alternating current, basic electric circuits, power factor, generation of power, three-phase alternators, electrical transmission and distribution system, electric motors, single-phase electric motors, three-phase electric motors, electrical wires, fuses, electrical controls, receptacles.	Oct 7/12/14/ 17/19/21/24/26
5. Fluids: Fluid static - pressure in fluids, instruments, buoyancy forces, hydrometers, hoop forces; Fluid dynamics – viscosity, Newtonian and non-Newtonian fluids, laminar and turbulent flow; pipeline flow – conservation of mass, conservation of energy, Bernoulli's equation; fluid power – friction losses, loss coefficient, examples of pumping to a reservoir, maximum lift; flow measurements – Pitot, tube, Venturi meter, Orifice plate, open channel flow, main parameters, maximum velocity.	Oct 28/31, Nov 2/4/14/16/18/21
6. Steady-State Heat Transfer - temperature, specific heat, modes of heat transfer; Conduction - thermal resistance, example of vegetable storage wall; Convection - forced convection, free convection, heat exchangers; Radiation - solar radiation, absorptivity, reflectivity, emissivity, net radiation balance	Nov 23/25/ 28/30, Dec 2
7. Psychrometrics - Properties of moist air, perfect gas law, absolute humidity, relative humidity, psychrometric chart, enthalpy, air conditioning, drying, humidifying, mixing air streams.	Dec 5/7/9

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

Sept. 13, 2022	Basic Math Quiz
Oct. 11, 2022	Midterm I
Nov. 7 - Nov. 11, 2022	Fall Term Break
Nov. 15, 2022	Midterm II
Nov. 22, 2022	Last day for Voluntary Withdrawal from courses
Dec. 13-23, 2022	Final examination period

## **Lab/Tutorial Schedule**

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(Sept.13) Math quiz  
 (Sept. 20) Lab 1: Thermocouples  
 (Sept. 27) Lab 2: Friction  
 (Oct. 4) Lab 3: Momentum  
 (Oct. 11) Midterm-Exam I  
 (Oct. 18) Lab 4: Circuits  
 (Oct. 25) Tutorial  
 (Nov. 1) Lab 5: Hydraulic friction  
 (Nov. 8) Midterm break  
 (Nov. 15) Midterm- Exam II  
 (Nov. 22) Lab 6: Heat transfer  
 (Nov. 29) Lab 7: Psychrometry  
 (Dec. 6) Tutorial

## **Course Evaluation Methods**

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**Grade Evaluation**

The basis of the final grade will be as follows:

40% written final examination  
 40% two written term tests (Test I = 20%; Test II =20%)  
 15% problem assignments and lab reports  
 5% basic math quiz

### **Grading**

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Final marks will be assigned as follows: A+ =100 - 92%, A = 91.9– 85%, B+ = 84.9 – 78%, B = 77.9 – 70%, C+ = 69.9 – 62%, C = 61.9.9 – 55%, D = 54.9 – 50%, F = below 50%



## Referencing Style

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N/A- no referencing is required in assignments

## Assignment Descriptions

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During the lab period, numerical problems will be given as an assignment each week. These assignments will be posted on the D2L website. Assignments should be neat, easy to read, and show the intervening steps leading to the solutions of the problems. The laboratory periods are to support and enhance lectures. Labs are also good for consulting the instructor on assignments and labs, and discussing the experimental results with other students (but not to copy other students' work).

## Assignment Grading Times

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Problems will be assigned weekly and are to be handed in a week later at the beginning of the lab period on the due date.

## Assignment Extension and Late Submission Policy

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### Late Assignments

Penalties deducted for late assignments will be as follows: up to 1 week late -20%; 1 to 2 weeks late -40%; and over 2 weeks late -100%.

### Missed Assignments

Each missed assignment will be counted as 0%

### Missed Exams

If a student misses a midterm exam due to a justifiable or important reason, the percentage of the missed midterm-exam will be added towards the final exam. For example; with one missed mid-term, the final exam will be valued at 60%. With two mid-terms missed, the final exam will be valued at 80%. If a final exam is missed, a university policy for such cases is followed.