



## Course Outline

### Instruction Team

- Dr. Jason Morrison, P.Eng.  
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### Student Hours

- Individual assistance is available by appointment.

### Teaching Assistant

- TBA

### Location

- Agric. 134  
M/W/F 9:30-10:20am

### Contact Hours

- 3 credit hours
- Lectures:  
3 hours x 12 weeks = 36 hours

### Prerequisites:

- Graduate Student and Instructor permission

### Course Website:

<http://umanitoba.ca/umlearn>

The Department of Biosystems Engineering has devised a plan so that there is minimal impact on the delivery and content of the course, should the instructor fall sick and be unable to continue lectures in-person. Please be assured that the alternative plan outlining any deviation from the normal mode of instruction will be communicated to you as quickly as possible if/when the need arises.

## BIOE 7260 Research Methods in Biosystems Engineering

### Course Description

Introduction to various research methods, including data acquisition and transmission, control systems, dimensional analysis, random signal analysis, experimental design, error analysis, stochastic modelling, fuzzy mathematics, and expert systems. Prerequisite: consent of instructor.

### Topics

1. Research: Objectives, Questions and Methods
2. Fundamental Analysis: Random Signals, Errors, Hypotheses
3. Data: Instruments, Measurements, Acquisition and Wrangling
4. Experimentation: Inference, Design of Experiments, Effects and Power
5. Statistical Estimation: Fits, Prediction and Quality
6. Classification: Supervised and Unsupervised Learning

### Textbook

H Wickham et al... *R for Data Science (2e)* 2022 (online:  
<https://r4ds.hadley.nz/>)

Çetinkaya-Rundel and Hardin. *Introduction to Modern Statistics* (online:  
<https://www.openintro.org/book/ims/>)

Lecture notes will be posted on the UM Learn portal.

### Deliverables

Deliverable	Date (Tentative)
Assignments	Jan 17, 24, 31, Feb 7, and 14 (25%)
R Library Review	Submission Mar 1,(10%) Present Mar 4, 6, and 8 (7.5%)
Term Assignment	Part 1 March 18 (5%) Part II April 10 (25%)
Takehome Exam	72 hours after release (TBD) (27.5%)

## Important Dates

- **Early Withdrawal Deadline**  
Jan 19, 2024
- **Winter Term Break**  
Feb 17-- Feb 25, 2024  
No classes or examinations
- **Voluntary Withdrawal Deadline**  
March 20, 2024
- **Last Day of Classes**  
April 10, 2024

## Grading Scale

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

## Assignment Feedback

Students can expect to receive graded assignments within two weeks of their submission.

## Late Submission Policy

Assignments submitted after the due date will be docked 10% per day.

## Evaluation

Assignment	Allocation	Description (Dates are tentative)
Short Assignments	25%	Jan. 17, 24, 31, Feb 7, 14
R Library Review	17.5%	Script due Mar 1 presentations Mar 4, 6, and 8.. Students will review an R library of their choice. The library must be available for download through CRAN, not focused on in class, and have been published or updated in the last year. Students will write an RMarkdown script demonstrating the utility of two or more of the key functions within the library. The script must utilize different datasets than the examples provided by the library authors. Each student will make a 10-minute presentation on why everyone should use that particular R library in their research. This assignment is broken down into: Submission (10%), presentation (7.5%),
Term Assignment	30%	Each student will select a dataset (ideally from their own research or from their supervisor, though I can provide datasets if necessary). Each student must discuss their choice of dataset with me and get my approval prior to beginning the assignment. The assignment is to perform a thorough analysis of the data including testing assumptions, selecting and performing appropriate tests, and evaluating and interpreting the results.
Takehome Exam	27.5%	

## Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

## Requirements/Regulations

- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication, or data storage devices) are allowed in examinations unless approved by the course instructor.
- All email communication must conform to the Communicating with Students university policy.

 [Communicating with Students](#)

- Attending lectures and laboratories is essential for the successful completion of this course.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences ( $\leq 72$  hours) for extenuating circumstances. Students don't need to share personal information about their situation beyond declaring the nature of the extenuating circumstance on the self-declaration form.

 [Self-Declaration Form for Brief or Temporary Absence](#)

- This form cannot be used for planned absences like vacations. It is also not to be used for longer-term absences, or ongoing circumstances (e.g., Authorized Withdrawals, Leaves of Absence, or other accommodations), which will still require additional documentation.

 [Self-Declaration Policy for Brief or Temporary Absences](#)

- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should familiarize themselves with the University's *General Academic Regulations*.

 [General Academic Regulations](#)

- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility

Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

 *Supplemental Resources*

### Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

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 *Copyright Office*