MATLS 3J03 Statistical Methods for Materials and Chemical Engineers—Fall 2021

INSTRUCTOR
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CLASS TIME AND LOCATION
Lectures will be given **asynchronously**: lecture videos will be posted weekly.
Thursdays 7:00 pm – 10:00 pm will be used as **tutorial** time. Note that the total number of hours (video lecture + tutorials) will still be 3 hours per week so the tutorial time will be adjusted accordingly (e.g. if video lectures are 2 hours then tutorial session will be 1 hour). The tutorial will start with a brief recap of the lecture material for the week and then move onto assignment take up (if applicable) and an open Q&A session. No new material will be covered in the tutorials that has not been covered in the lectures.

DESCRIPTION
This course introduces probability and univariate data analysis. Topics will also include linear regression, design of experiments (including factorial and response surface designs), and statistical process control. Emphasis will be on the application to industrial and real-life problems.

COURSE TOPICS
1. *Data preprocessing and visualization*: data cleaning and how to create high-density, efficient graphics that highlight the data honestly.
2. *Univariate data analysis*: probability distributions and confidence intervals
3. *Least squares regression modelling*: correlation, covariance, ordinary and multiple least squares models. Enrichment topics may be covered, time permitting.
4. *Design and analysis of experimental data* and response surface methods for continuous process improvement and optimization.
5. *Process monitoring*, or statistical process control (SPC), for monitoring process behaviour.

COURSE OBJECTIVES
At the conclusion of this course, the student will be able to:
- Understand that all data has variability and that we want to separate that variability into information (knowledge) and error (unknown structure, noise, randomness).
- Interpret univariate data statistics (mean, median, standard deviation), testing for significant differences, and calculating and interpreting confidence intervals.
- Understand and use process monitoring charts (including Shewhart charts or control charts).
- Least-squares regression models: how to fit and especially how to interpret them; understand the confidence limits and model limitations.
- Be able to design an experiment using statistical concepts and then interpret experimental data.

PRIMARY TEXTBOOK

We will be using **the first 5 chapters** from the online book *Process Improvement Using Data* by Kevin Dunn. The pdf is available on the Avenue to Learn course page. This work is the copyright of Kevin Dunn and portions of MATLS 3J03 are also the copyright of Kevin Dunn. The copyright to the book and materials is held by Kevin Dunn, but it is licensed to you under the permissive Creative Commons Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0)3 license.

EVALUATION

Assignments:	30%	(6 assignments—in **groups of two or individual**)
Experimental report:	10%	(an experiment that you do in **groups of two**; due date TBD)
Midterm Test:	20%	(will occur during scheduled class hours - date TBD)
Final Exam:	40%	(date and time TBD)

LATE ASSIGNMENTS

Late assignments will not be accepted and will be assigned a grade of zero. Emergencies do arise, so each person has one "late day" credit for assignments. This means that you can hand in 1 assignment 1 day late (within 24 hours), without penalty. This applies on an individual basis, not to the assignment group.

SOFTWARE

Course software: use of a computer is required in the course. Python is the programming language of choice. The easiest way to install Python and the libraries necessary for this course is via Anaconda.

You are allowed to use other statistical tools for investigative purposes, but assignments *must be* completed in Python.

COURSE COMMUNICATION AND QUESTIONS

Avenue will be the official method (or official avenue) for course communications. Video lectures and other course materials will be uploaded to Avenue. Assignments will be released and submitted via Avenue.

Microsoft Teams will be used for the scheduled 'live' lectures/tutorial components. The link to the Teams meeting will be posted in Avenue before the lecture. If you have clarification questions about an assignment, or general questions about the course please post the question on the "Questions" channel in Teams and the instructor will try to answer within 24 hours. The instructor will also be available to chat with directly on Teams whenever possible. If you wish to have a virtual one-on-one meeting, please send the instructor an email to arrange a time.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY/PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/ software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning, and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas.mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the *RISO* policy. Students should submit their request to their Faculty Office *normally within 10 working days* of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical, and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.