Western University
Department of Mechanical and Materials Engineering

MME 2285B – Engineering Experimentation

COURSE OUTLINE – 2022-2023

CALENDAR DESCRIPTION:

Measurement of physical quantities; experiment planning and design; characteristics of measurement systems; calibration, linearity, accuracy, bias and sensitivity; data acquisition systems; sampling theorem; signal conditioning; sources of errors; uncertainty analysis; data analysis techniques; systems for the measurement of displacement, velocity, acceleration, force, strain, pressure, temperature, flow rate, etc.

COURSE INFORMATION:

Instructor:	Dr. J.E. Makaran, P.Eng. Room: SEB 3095 Email: jmakaran@uwo.ca
Lectures:	M: 12:30 – 1:30 pm, SEB 1059 Tu: 12:30 – 1:30 pm, SEB 1200 F: 9:30 – 10:30 am, SEB 1200
Tutorials	Th: 4:30 – 6:30, SEB 2200, also held in ACEB 1400, and TEB 454
Labs:	M: Section 003, 3:30 – 6:30 pm, SEB 3100 Section 004, 6:30 – 9:30 pm, SEB 3100 Tu: Section 005, 3:30 – 6:30 pm, SEB 3100 W: Section 006, 3:30 – 6:30 pm, SEB 3100 Section 007, 6:30 – 9:30 pm, SEB 3100 Th: Section 008, 3:30 – 6:30 pm, SEB 3100

Students must use their Western (@uwo.ca) email addresses when contacting the instructor and use appropriate / agreed upon forms of address as well as e-mail etiquette.

CO-REQUISITE:

Statistical Sciences 2143A/B or 2141 A/B

CONSULTATION HOURS:

Meetings are by appointment and may either be in-person, or via Zoom. Appointments are to be requested via email in advance of the meeting.

ACCREDITATION UNITS:

Science = 25%, Engineering Science = 75%

TOPICS:

- Introduction
- General Characteristics of Measurement Systems
- Measurement Systems with Electrical Signals
- Computerized Data Acquisition Systems
- Discrete Sampling and Analysis of Time-Varying Signals
- Experimental Uncertainty Analysis
- Description of Various Measurement Systems
- Introduction to Arduino Hardware, Software and associate peripherals for interfacing to sensors and data acquisition

Topics may change during the course at the discretion of the course instructor.

LEARNING OUTCOMES:

Upon successful completion of this course, student will be able to:

- recall and describe the general characteristics of measurements systems used for engineering measurements
- describe functions and characteristics of common types of measurement systems/instruments used for engineering measurements
- setup an experiment
- perform measurements
- process, analyze and report conclusions based on measured data both orally and in writing
- estimate the error/uncertainty in measurements
- setup, perform, and analyze measured data from an experiment

CONTACT HOURS: 3 lecture hours, 2 tutorial hours and 3 lab hours (5 labs per semester), half course. The lab and tutorial schedule will be made available during the first week of classes.

TEXTBOOK AND RESOURCES: Introduction to Engineering Experimentation, A.J. Wheeler and A.R. Ganji, Third Edition, Prentice Hall, 2010

Elegoo Arduino Super Starter Kit UNO R3 Project, Arduino Bluetooth JDY-31 Module, Arduino SD Card Module, NTC Temperature Sensor (Fajoeda Thermistor Temperature Sensor NTC 10K B3950 1% with 1m Cable Digital Thermal for Arduino).

Some resources may change pursuant to availability

REFERENCES: Other references may be used in this course at the discretion of the professor

TECHNICAL REQUIREMENTS: Students will be expected to have a computer that is capable of running the entire MS Office set of software, including but not limited to; Excel, and Word as well as MATLAB.

UNITS Metric and US customary. ISO symbols will be used as well.

EVALUATION:

The examinations will be based on the material covered in lectures, assignments and tutorials. All exams will be closed book. Only non-programmable, single-line-screen calculators will be permitted during the examinations. The final course grade will be determined according to the following weighting scheme:

Evaluation	Date	Value
Test #1 (2 Hours)	Thursday, February 16th (Tentative)	25%
Test #2 (2 Hours)	Thursday, March 16th (Tentative)	25%
Final (3 Hours)	During Final Examination Period	25%

Labs	5 Labs Throughout the term according to schedule	20%
Participation, Attendance, and Professional Behaviour	Ongoing	5%

NOTE:

- If you miss one evaluation, there will be no supplemental available to you. The weight of the missed test will be transferred to the final exam.
- There will be material overlap between successive evaluations.
- Participation marks shall be awarded based upon class attendance as well as in-class engagement (including, but not limited to: timely arrival to class, the presence of a nametag, in-class questions / discussion), and e-mail etiquette

COURSE POLICIES The following course-specific policies will be enforced throughout the course:

Computer Requirements

All students are to ensure that they have a laptop computer that will be used during class sessions or when working on labs and in-tutorial exercises.

Tests and examinations in this course will be conducted in person.

Laboratory sessions

- All students are to attend their assigned lab or tutorial sessions **with no exceptions**. Failure to do so may result in your not obtaining credit for the lab.
- Lab sessions will be held in-person.
- Lab reports will be due at the end of the assigned lab session. No late submissions will be accepted.
- Failure to pass the laboratory component of the course will attract an automatic course failure.
- Passing of the laboratory component is equivalent with obtaining more than 50% on the laboratory component of the course.
- A maximum of **one** make-up session will be offered to students who have missed a laboratory session **with** academic consideration.
- A mark of 0% will be assigned to students who have missed a laboratory session **without** academic consideration.
- All approved make-up laboratory sessions will be offered in the final week of the term.
- When academic consideration has been obtained for a particular laboratory session, it is the student's responsibility to contact the instructor of the course in a *timely* fashion in order to seek alternate arrangements for the missed laboratory session (*i.e.*, within 24 hours after consideration has been obtained from the Engineering Undergraduate Services Office).

- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Term Tests and Final Examination

- Failing to achieve a grade of 50% in tests and the final examination components of the course will result in an automatic course failure.
- Term tests and the final examination will be delivered in-person. All tests and examinations will be closed-book.
- Only non-programmable calculators will be allowed during term tests
- Term tests will be 2 hours long and will be submitted at the end of the allotted time.
- The final exam will take place during the April examination period and delivered in person. Its timing will be announced in advance.
- The final exam will be 2 hours long and will be submitted at the end of the allotted time.
- Only non-programmable calculators and a double-sided formula sheets will be allowed to refer to during the final exam.

Missed Tests and Examinations

- A mark of 0% will be assigned to students who have missed a term test or the final examination **without** academic consideration.
- **No make-up test** will be offered to those who miss a term test with academic consideration. The weight of missed tests with academic consideration will be automatically transferred to the weight of the final test.
- When academic consideration has been obtained for a particular missed term test or final exam, it is the student's responsibility to contact the instructor of the course in a *timely* fashion (*i.e.*, within 24 hours after consideration has been obtained from the Engineering Undergraduate Services Office).
- Students are required to contact the instructor of the course for any other circumstances.
- Not attending in-person course requirements due to potential COVID-19 symptoms is **not** sufficient on its own.

Students who have failed an Engineering course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

ENGLISH: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is

permitted, it may be graded with marks deducted for poor English and/or late submission.

CLASSROOM DEMEANOR:

The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion.

Components of this course will involve live interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- Please arrive to class on time
- Please use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- Please maintain focus on the class material during lectures.
- Use of the Internet for other than course related activities is discouraged.

You will be required to display your name at all times in every lecture on a single, folded, sheet of plain, white, 8.5" x 11" sheet of paper with your name written on it in block letters, so as to be clearly visible from a distance of 15 m. Attendance will be taken during lectures, and will factor into the participation mark.

Note that disruptive behaviour of any type during classes or laboratories, is unacceptable. Depending on the severity, the actions may be subject to disciplinary measures under the Code of Student Conduct. Examples of disruptive behaviour, depending upon the circumstances includes, but is not limited to:

- Late class arrival
- Disrespectful communication with Teaching Assistants, Colleagues, and Professor
- Side conversations during the lecture not related to course material
- Cell-phone usage / texting during lectures.

USE OF RECORDINGS:

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

ATTENDANCE:

Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

CHEATING:

Cheating is stealing. Engineering is a profession with a code of ethics. Students are expected to behave in a manner consistent with the PEO Code of Ethics. University policy states that cheating, including plagiarism, is a

scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning (see Scholastic Offence Policy in the Western Calendar). If cheating during any course evaluation is suspected (including lab assignments), the student will receive a mark of zero for that particular evaluation.

KEY SESSIONAL DATES

Fall Term
Classes begin: January 10th, 2023;
Spring Reading Week: February 20th – February 25th, 2023;
Classes end: April 10th, 2023;
Exam period: April 13th – April 30th

ACCOMMODATIONS:

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities.

Students that are in emotional/mental distress should refer to Mental Health@Western, **http://www.uwo.ca/uwocom/mentalhealth/**, for a complete list of options about how to obtain help.

ACADEMIC CONSIDERATION FOR STUDENT ABSENCE:

For Western University policy on Consideration for Student Absence, see http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_12

and for the Student Medical Certificate (SMC), see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

NOTICES:

Students are responsible for checking their Western email and notices posted on OWL (http://owl.uwo.ca) for news and updates. This is the primary method by which information will be disseminated to all students in the class.
If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

RELIGIOUS ACCOMMODATION:

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.