Western University
Department of Mechanical & Materials Engineering

MME 2285B – Engineering Experimentation

COURSE OUTLINE – 2025-2026

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. Ryan Willing, PhD, PEng.

Email: rwilling@uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

CONSULTATION HOURS: TBD, or arranged by email.

PREREQUISITES: None.

ANTIREQUISITES: None.

ACCREDITATION UNITS: Science = 25%, Engineering Science = 75%

TOPICS:

- 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 LabVIEW Software for Data Acquisition and Processing

LEARNING OUTCOMES:

The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and Western Engineering's GA Indicators are identified below.

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

1. recall and describe the general characteristics of measurements systems used for engineering measurements. (KB2-3)
2. describe functions and characteristics of common types of measurement systems/instruments used for engineering measurements. (KB4)
3. set up an experiment. (I1, ET1)
4. perform measurements. (I2, ET2)
5. process, analyze and report conclusions based on measured data both orally and in writing. (I3, ET2, CS2-3)
6. estimate the error/uncertainty in measurements. (KB1, PA3)
7. work in a team to setup, perform and analyze measured data from an experiment. (ITW1-3)

CONTACT HOURS:

3 lecture hours, 2 tutorial hours/week and 3 lab hours/week (6 per term including supervised laboratory time for projects), half course.

TEXTBOOK:

A.J. Wheeler and A.R. Ganji, Introduction to Engineering Experimentation, Third Edition, Prentice Hall, 2009. Available from publisher: https://www.pearson.com/

Students are welcome to purchase second-hand or earlier editions of this textbook, though instructor only uses the 3rd edition. All midterms/exams are closed-book, and so using electronic versions or shared ownership of textbooks is possible.

UNITS:

SI will be used; however, English units may be introduced through examples as required.

EVALUATION:

Mid Term exam (tentatively Feb. 11, during tutorial timeslot) (1.5 hours, closed book, non-programmable calculator allowed)	15%
Laboratory work	20%
LabVIEW exam (tentatively Mar. 11 or 18, during tutorial timeslots)	15%
Project In-class/tutorial presentations from Mar. 30 – Apr. 1 Deadline for project completion & report submission: Apr. 9	20%
Final exam (during April final examination period) (3 hours, closed book)	30%

*Note: see course-specific policies below which outline circumstances when alternative grading weighting for the midterm and final may apply.

If a minimum mark of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

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

Laboratory sessions

- Labs will be completed in teams of two. Teams of three may be formed by the instructional team where required.
- Failure to pass the laboratory component of the course will result in automatic course failure.
- Passing 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.
- Missing of a laboratory session **without** academic consideration will translate into a zero mark for that laboratory session.
- Students arriving to a laboratory session later than 10 minutes after the scheduled start time will be considered absent and will receive a zero mark for that laboratory session.
- Missing two or more laboratory experiments **without** academic consideration may result in a grade of not more than 48% for the entire course.
- Lab reports, if required, are due one week from the date of lab (unless otherwise specified). Labs will be accepted up to 72 hours after these deadlines without penalty.
- When required, lab reports must be submitted electronically, and detailed instructions will be provided with the labs' outline.
- Lab reports will not be accepted if the student did not attend the laboratory experiment.
- As flexibility is incorporated into the lab report deadline, **any requests for academic consideration will be declined** (unless the corresponding lab was missed *with* academic consideration).

Tutorial sessions

- Tutorials are dedicated to training students to use LabVIEW software.
- Attendance and completion of weekly LabVIEW assignments is optional but encouraged. Historical data have shown that students who participate in the weekly tutorials and complete the tutorial assignments get better grades on the LabVIEW exam.
- LabVIEW tutorial assignment solutions are due by the end of day on the same day as the tutorial but will be accepted up to 72 hours after that without penalty.
- This year we will attempt to implement a peer-review process for LabVIEW assignments. Students who successfully complete and submit at least 5 of the 6 LabVIEW tutorial assignment solutions and participate fully in the peer review process for those assignments will be eligible for a **10% bonus** applied to their LabVIEW exam grade.
- As flexibility is incorporated into this component of the course (deadline flexibility and ability to miss one assignment without penalty), **any requests for academic consideration will be declined**.

LabVIEW exam

- Missing of the LabVIEW exam **without** academic consideration will translate into a zero mark for that exam.
- If a student misses the LabVIEW exam **with** academic consideration, **one** make-up session will be scheduled for the student to complete an alternative exam (during next available tutorial session, or sooner, at the instructor's discretion).

- Completion of the LabVIEW exam is a critical aspect of this course and has been deemed the **designated assessment**. This means that requests for academic consideration without supporting documentation will be denied.
- Students with approved accommodations from Accessible Education will complete this test with the rest of the class on Engineering Lab PCs. Approved accommodations will be provided to the extent possible.
- If cheating during the examination is suspected, the Associate Chair Undergrad will investigate and will determine an appropriate resolution. This may range from completing a one-on-one oral examination with the instructor, to receiving a grade of zero on the exam, to further academic penalties for scholastic offences applied by the Associate Dean Undergrad.
- The 10% bonus for sufficient LabVIEW tutorial assignment completion and peer review (described above) cannot be used to achieve an exam grade of more than 100%, nor can it be used to increase a failing exam grade (48% or less) to a passing grade.

Team deliverables - Projects

- While the default assumption is that everyone contributes equally to the team effort and hence everyone should receive the same mark for the team submission, individual adjustments of the marks are also permitted, at the discretion of the instructional team (*i.e.*, course instructor and teaching assistants).
- The maximum team size will be five students, while the minimum team size will be three students.
- Students who do not choose a team will be assigned to one.

Midterm examination

- The exam will be administered in-person and closed-book.
- Only non-programmable calculators will be allowed during the midterm examination.
- A student who misses the midterm **without** academic consideration will receive a zero mark for the midterm.
- Should a student miss the midterm **with** academic consideration, there will be no make-up midterm, however the value of the midterm will be shifted to the final exam.
- If cheating during the examination is suspected, the Associate Chair Undergrad will investigate and will determine an appropriate resolution. This may range from completing a one-on-one oral examination with the instructor, to receiving a grade of zero on the exam, to further academic penalties for scholastic offences applied by the Associate Dean Undergrad.
- 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.

Final examination

- The exam will take place during the Spring examination period. Its timing will be announced in advance.
- The exam will be closed book.
- The length of the final exam will be three hours.
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.
- If cheating during the examination is suspected, the Associate Chair Undergrad will investigate and will determine an appropriate resolution. This may range from completing a one-on-one oral examination with the instructor, to receiving a grade of zero on the exam, to further academic penalties for scholastic offences applied by the Associate Dean Undergrad.

- 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.

Final course grade – alternative weighting scheme

- For eligible students, the contributions of the midterm and final exam to the final course grade will be automatically selected from the two options below, based on whichever is most beneficial for the student's final course grade:
    - Option 1: Midterm and final exam grades contribute to final course grade according to the distributions described in the "Evaluation" section.
    - Option 2: Midterm grade is ignored, and weight is shifted to the final exam.
- To be eligible for Option 2, students must have attempted and received a grade of at least 50% on the midterm, earned the LabVIEW tutorial bonus, received a grade of at least 50% on the LabVIEW exam, and received a cumulative grade of at least 50% for the labs as well as the project.
- Students with academic consideration for the midterm will automatically be graded according to Option 2, regardless of lab and project grades.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.