

MECHENG 2BA3
Mechanical Engineering Measurements
Undergraduate Studies
Winter 2025
Course Outline

CALENDAR/COURSE DESCRIPTION

Static and dynamic characteristics of instruments, statistical analysis of measurement errors, variable conversion elements and signal amplification. Metrology, measurement of strain and force, pressure, flow, temperature and power.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in Level II of any Mechatronics Engineering program
Antirequisite(s): MECHENG 2BO3

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Shakirudeen Salaudeen
ABB C304
salaudes@mcmaster.ca

Office Hours:
Mondays: 11:30 AM – 12:30 PM or by appointment.

TEACHING ASSISTANTS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn (hereafter: Avenue) is used to administer the course. This platform is intended to enhance course management and delivery and serves as the primary means of communication with students via announcements. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, usernames 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor. Avenue can be accessed via the following link:

<http://avenue.mcmaster.ca/>

The course will be delivered in-person; all the lectures, labs, and quizzes will be in-person. In the event that the course is required to be delivered online, the instructor may modify the course structure and assessment details to more appropriately support an online format. In the event of a poor weather day, the class may be flipped to an online delivery format in relatively short notice. All course information will be communicated through Avenue. It is your responsibility to regularly check the course webpage to stay apprised of course news, announcements, and any changes in our delivery format.

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- 1- Perform measurements of fundamental mechanical properties such as linear and angular dimensions of machine parts, force, torque, stress, strain, flow, etc.
- 2- Use common mechanical shop measurement tools.
- 3- Understand ISO 286 based GD&T specifications.
- 4- Use a DC bridge circuit-based sensor with a signal conditioner/amplifier
- 5- Analyze and calculate the uncertainty of measurement and error propagation
- 6- Conduct measurements and collect data as a member of a team
- 7- Construct a written measurement report with appropriate graphs and charts
- 8- Calculate parameters used by Statistical Process Control (SPC)
- 9- Recommend the type and capability of a measurement system based on the time domain characteristics of the measured quantity.

MATERIALS AND FEES

Required Texts:

None

Recommended Additional Texts:

“Theory and Design for Mechanical Measurements, 6th Ed.”, by R.S. Figliola and D.S. Beasley, John Wiley and Sons, Inc., 2015.

Calculator:

Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:

An aid sheet with useful equations and information will be provided for quiz assessments and will be posted on Avenue to Learn one day before each quiz.

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 1 classroom-based lecture per week: Wednesdays 2:30 – 4:20 PM in PGCLL 124
- 1 lab per week: ABB C202
- 4 in-class quizzes (2 in-class quizzes for A-series and 2 in-class quizzes for B-series): PGCLL 124

COURSE SCHEDULE

Lecture Schedule and Study Materials:

This course consists of two parts: (1) A-series lectures in the first half of the semester which will start in the week of January 6th; (2) B-series lectures in the second half of the semester which will start in the week of February 24th. The details of instructional methods for each part of the course will be announced at the beginning of each series. Announcements will be made in class and will also be posted on the course website (Avenue). All lectures, quizzes and labs are in-person.

This course builds up steadily and rapidly. Do not fall behind. The instructional course materials will be available on Avenue in the form of course notes and videos.

Labs Schedule and Training:

Laboratories:

A-series labs: The first lab starts in the week of January 13th.

B-series labs: The first lab starts in the week of February 24th.

Location of all labs: ABB C202

ME 2BA3 Labs:

L01 Wednesday 8:30 - 11:20 AM

L02 Monday 8:30 - 11:20 AM

L03 Monday 2:30 - 5:20 PM

L04 Thursday 2:30 – 5:20 PM

Lab Experiments and Report Due date

Lab	Experiment #	Title	Report due date
A-series Labs	Experiment A1	Dimensional Measurements	A-series lab reports must be submitted on Avenue to Learn by the end of the day on which the experiment is conducted (the same day as the lab).
	Experiment A2	Statistical Analysis of Measurements	
	Experiment A3	Electrical Measurements and Calibration	
B-series Labs	Experiment B1	Measurement of Force and Strain	B-series lab reports must be submitted on Avenue to Learn no later than one week after the day the experiment is conducted.
	Experiment B2	Fluid Flow Measurements	
	Experiment B3	Characterization of a Motor and Gear Box	

ASSESSMENT DETAILS

Component	Due Date	Weight
A-series Labs	3 throughout the first part of the course	15%
B-series Labs	2 throughout the second part of the course	25%
2 Quizzes (A-series Lectures)	In-class, Date: TBD	30%
2 Quizzes (B-series Lectures)	In-class, Date: TBD	30%
Total		100%

Lab reports:

All the A-series labs, i.e., A1, A2, and A3, are mandatory and each lab report is worth 5% of the course grade.

Labs B1 and B2 are mandatory, and each lab report is worth 12.5% of the course grade.

Lab B3 is not mandatory, and it carries a bonus grade of 5%.

Quizzes:

Quizzes will be taken during lecture hours. The exact timing of each quiz will be announced on Avenue to Learn.

Grading Concerns:

Your lab reports will be marked by the TAs. Any concerns about grading or requests for re-marking of the lab reports must be communicated to the TA who marked your work with a written explanation of the reason for re-marking within two weeks after the marks are released and before the end of the term.

Practice Problems:

Practice problems will be uploaded to the course platform throughout the semester to help students reinforce their understanding of the course material. Solutions to the practice problems will be posted a few days after the problems are made available. These problems are optional, and students are not required to submit them, as there is no grade associated with the practice problems.

LABORATORY EXPERIMENTS AND REPORTS

Students registered in MECHENG 2BA3 will complete six laboratories in total, three in cycle A and three in cycle B. Each student should attend the lab session they registered for. Laboratory Teams will consist of teams of 2 to 6 students, assigned by the instructor. Students should note that their team numbers and team members will likely be different between the A (small groups) and B (large groups) cycle labs. It is the student's responsibility to determine their team number and the laboratory they are performing prior to the start of the laboratory session. The list of teams and the laboratory schedules will be posted under "Group Schedules" on the course home page. Please note that separate schedules are posted for each laboratory section.

Participation in the laboratory during the assigned laboratory section is compulsory, and attendance will be taken. Failure to attend the assigned laboratory session without legitimate and documented reasons will result in a mark of zero being assigned for the laboratory. It is the student's responsibility to direct all matters concerning laboratory attendance to the instructor at the earliest possible opportunity. Instructions for each experiment are provided on the course website under "Content" in the "Labs" section. It is the student's responsibility to download the instructions, review them carefully, and be prepared for the lab. It is strongly recommended for students to watch the lab videos on Avenue prior to the labs to be prepared.

Students are required to submit an individual, independently written report for each experiment. Full details of the required elements of the lab report and marking scheme can be found in the document Lab Report Writing Guidelines on the course website in the "Labs" section.

Cycle A laboratories are relatively straightforward experiments involving small-scale metrology instruments and apparatus. Reports for the A cycle experiments will be written during the laboratory period and submitted on Avenue to Learn by the end of the day on which the experiment is conducted (the same day as the lab). A deduction of 10% per working day will be assessed for late reports. All late laboratory reports must be submitted to Avenue within two days past the due date. It is expected that students will be prepared to analyze the experimental data and write up the laboratory, including possessing a calculator, a straight edge to construct any required plots, graph paper, and writing instruments.

Cycle B labs are more complex, involving measurements associated with the mechanical properties of materials, fluid flow, etc. Students should note that they will likely be assigned to different lab groups for rotations A and B. Reports for the B cycle experiments will be written outside of regular laboratory hours and submitted to Avenue within one week following the performance of the laboratory. A deduction of 10% per working day will be assessed for late laboratory reports. All late laboratory reports must be submitted to Avenue within two days past the due date.

COMMUNICATION POLICY

The best way to communicate with the instructor is through email (salaudes@mcmaster.ca). I will ensure to respond to emails within 24 hours. Emails must be sent from your McMaster email address, including a subject prefix of "MECHENG 2BA3".

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course. MECHENG 2BA3 course provides the student the opportunity to develop competence in the following CEAB graduate attributes:

Graduate Attributes	Learning Outcome Measurement Point
Knowledge base for engineering: (1.03, 1.04)	1,3,8,9
Problem analysis: (2.0x)	5
Use of engineering tools: (5.01, 5.02)	1, 2,4
Individual and team work: (6.0x) - team work on Conceive-Design-Implement-Operate (CDIO) mechanical design project	1
Communication skills: (7.03) – writing design project report and presenting the design to a large audience	7

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If any modifications become necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Mechanical Engineering is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the [Equity and Inclusion Office](#).

MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the [Student Wellness Centre](#). [Talkspot](#) is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

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:

1. plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. improper collaboration in group work.
3. 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

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

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.

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.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage (Avenue to Learn) for updates and announcements related to this course.
2. All submissions are due at midnight (specifically, 11:59 PM on the due date).
3. If an MSAF is submitted for one of the labs in either the A-series or B-series, its weight will be redistributed among all the remaining labs in both A-series and B-series.
4. An MSAF for any of the 4 quizzes will result in redistributing its weight among the remaining 3 quizzes.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**
 - Use the [McMaster Student Absence Form](#) (MSAF) on-line self-reporting tool. No further documentation is required.
 - Students may submit requests for relief using the MSAF once per term.
 - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
 - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
 - The MSAF cannot be used for academic work that has already been completed attempted.
 - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
 - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.
2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**
 - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
 - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

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.