

MECHENG 4K03/6K03
Robotics
Undergraduate Studies
Fall 2026/27
Course Outline

CALENDAR/COURSE DESCRIPTION

Introduces the fundamentals of robot manipulators: kinematics, velocities and Jacobians, inverse kinematics, dynamics, statics, trajectory planning, machine vision, mobile robots, sensors and actuators, and an introduction to robot programming.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in any Mechanical Engineering program, or ENGINEER 2Q04 or MECH ENG 2Q04
Antirequisite(s): None

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Fengjun Yan
ITB-161
yanfeng@mcmaster.ca
ext. 21525

Office Hours:
Wednesday – 1:00pm–1:30pm
(immediately before the Wed. lecture)
Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Pourhajiaghashafti, Amir pourhaja@mcmaster.ca	Carter, Zoe Zuyi cartez1@mcmaster.ca	Razmjooei, Hamid Sr. razmjoooh@mcmaster.ca	Gentile, Stavros gentis3@mcmaster.ca
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For any issues related to assignments, please contact Hamid (Assignment 1-4) or Zoe (Assignment 5)
For any issues related to Midterm Exam, please contact Stavros (Midterm 1&2) or Zoe (Midterm 3)
For any other issues, please contact either of them or Dr. Yan.

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

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

Avenue to Learn (A2L) is used for all formal communication, lecture notes, assignments, and announcements.
Lecture Notes, Assignments, Formula Sheets and solutions are posted on Avenue.

COURSE INTENDED LEARNING OUTCOMES

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

- Determine the forward and inverse kinematics of a serial robot manipulator using homogeneous transformations and the D-H convention.

- Compute manipulator Jacobians, identify singular configurations, and relate joint to end-effector velocities.
- Apply Lagrangian dynamics and static force/torque analysis to simple robot manipulators.
- Plan joint-space and Cartesian trajectories for a robot end-effector.
- Describe the principles of machine vision, mobile robots, sensors and actuators used in robotic systems.

MATERIALS AND FEES

Required Texts:

Course notes by Dr. Gary Bone and Dr. Fengjun Yan (posted on Avenue).

Recommended Additional Texts:

None.

Calculator:

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

Other Materials:

None

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- Monday, Wednesday, Thursday, 1:30pm–2:20pm
- No separate tutorial section
- 5 assignments (average counts 10% of overall grade)
- 3 in-class midterm tests (10% each)
- Final exam (2.5 hrs, 60%). For 6K03: Final Exam 30% + individual project 30%.

COURSE SCHEDULE

Date/Week	Topic	Readings
Lecture 01	Introduction	Ch. 1
Lecture 02	Introduction	Ch. 1
Lecture 03	Introduction	Ch. 1
Lecture 04	Forward Kinematics	Ch. 2
Lecture 05	Forward Kinematics	Ch. 2
Lecture 06	Forward Kinematics	Ch. 2
Lecture 07	Forward Kinematics	Ch. 2
Lecture 08	Forward Kinematics	Ch. 2
Lecture 09	Forward Kinematics	Ch. 2
Lecture 10	Forward Kinematics	Ch. 2
Lecture 11	Forward Kinematics	Ch. 2
Oct 7 (Wed)	MID-TERM 1 (Ch. 1–2), 10%	—
Lecture 12	Velocities, Jacobians and Singularities	Ch. 3
Oct 12–18	Mid-term recess — no classes	—
Lecture 13	Velocities, Jacobians and Singularities	Ch. 3
Lecture 14	Velocities, Jacobians and Singularities	Ch. 3

Lecture 15	Velocities, Jacobians and Singularities	Ch. 3
Lecture 16	Inverse Kinematics	Ch. 4
Lecture 17	Inverse Kinematics	Ch. 4
Lecture 18	Inverse Kinematics	Ch. 4
Nov 2 (Mon)	MID-TERM 2 (Ch. 3–4), 10%	—
Lecture 19	Dynamics	Ch. 5
Lecture 20	Dynamics	Ch. 5
Lecture 21	Dynamics	Ch. 5
Lecture 22	Statics	Ch. 6
Lecture 23	Statics	Ch. 6
Lecture 24	Statics	Ch. 6
Nov 18 (Wed)	MID-TERM 3 (Ch. 5–6), 10%	—
Lecture 25	Trajectory Planning	Ch. 7
Lecture 26	Trajectory Planning	Ch. 7
Lecture 27	Trajectory Planning	Ch. 7
Lecture 28	Machine Vision	Ch. 8
Lecture 29	Machine Vision	Ch. 8
Lecture 30	Machine Vision	Ch. 8
Lecture 31	Mobile Robots	Ch. 9
Lecture 32	Mobile Robots	Ch. 9
Lecture 33	Mobile Robots	Ch. 9
Lecture 34	Sensors, Actuators & Other Topics	Ch. 10–11

ASSESSMENT

Component	Due Date	Weight
Assignments (average of 5)	see Avenue for due dates	10%
Mid-Term 1 (Ch.1–2)	Oct 7, 2026	10%
Mid-Term 2 (Ch.3–4)	Nov 2, 2026	10%
Mid-Term 3 (Ch.5–6)	Nov 18, 2026	10%
Final Exam	TBD (Dec 11–23 exam period)	60%
Total		100%

If this is a 400/600 Level course, indicate the additional work (e.g., additional paper, project, or more in-depth analysis of course material) required of graduate students and the assessment for those components.

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.

Outcomes	Indicators
Knowledge Base for Engineering — 1.3 Competence in Engineering Fundamentals	Introduced
Knowledge Base for Engineering — 1.4 Competence in Specialized Engineering Knowledge	Introduced

Analysis — 2.2 Ability to identify suitable engineering fundamentals for analyzing a technical problem

Developed

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

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.

McMaster University 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 Chair (Undergraduate), Academic Advisor or 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 sustaining 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 (ex. Avenue to Learn) for updates and announcements.

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.