Western University
Department of Mechanical & Materials Engineering

MME 4452b — Robotics and Manufacturing Automation

COURSE OUTLINE – Spring 2026

CALENDAR DESCRIPTION:

An overview of robotics and manufacturing automation technology and principles. Topics include: automatic production and assembly, sensors, actuators and drives, mechanization of part handling, industrial robots, and vision systems. Emphasis will be on the planning, design and implementation of automation systems. PLCs will be used in the lab sessions.

COURSE INFORMATION:

Instructor: HaoTian Harvey Shi, Ph.D., P.Eng.
Office: SEB 3089
Email: Harvey.shi@uwo.ca

Lectures: See Draft My Schedule

Labs: See Draft My Schedule

PREREQUISITES:

ECE 3374a/b and MME 3380a/b or ECE 3330a/b and ECE 3375a/b or registration in year four of the Integrated Engineering Program.

ACCREDITATION UNITS:

Engineering Science = 75%, Engineering Design = 25%

TOPICS:

- Introduction to industrial automation
- Components of manufacturing automation
- Assembly process and part handling
- Actuators for automated systems
- Industrial control
- Industrial robotics and robot motion analysis
- Industrial sensors and quality control
- Machine vision systems

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 the course, each student should be able to:

- Demonstrate understanding of manufacturing automation technologies and principles **(KB4)**
- Categorize different types of automated production processes **(KB4)**
- Apply electrical, mechanical and pneumatic actuators in the context of an automated system **(ET1)**
- Understand the operation and use of common industrial controllers (PLCs) **(ET2)**
- Understand the performance and dynamic characteristics of industrial robots **(PA2)**
- Perform motion analysis of serial link industrial robots **(PA2)**
- Design elementary mechanisms for automated machinery **(D2 & D3)**
- Apply the principles of Design for Assembly (DFA) **(D3)**
- Understand the principles and use of industrial sensors **(ET2)**
- Describe the basic operation of industrial machine vision systems **(ET2)**
- Integrate these manufacturing technologies into the design of an automated workcell **(D4)**
- During the term each student will design an automated production system as part of a team-based project. **(ITW2, EPM2)**

CONTACT HOURS:

2 lecture hours and 3 laboratory hours per week, half course.

TEXT:

James A. Rehg, Introduction to Robotics in CIM Systems, 5th edition, Upper Saddle River, NJ: Prentice Hall, 2003. ISBN 0130602434 (Optional)

REFERENCES: Beno Benhabib, *Manufacturing: Design, Production, Automation and Integration*, New York: Marcel-Dekker, 2003. (Optional)

Mikell P. Groover, *Automation, Production Systems, and Computer-Integrated Manufacturing*, 2nd Edition, Upper Saddle River, NJ: Prentice Hall, 2001. (optional)

UNITS: SI

EVALUATION: The final course grade will be determined as follows:

Lab Work	Weekly lab sessions starting week of **Jan. 12th**	10%
Individual Assignments (4)	Approx. biweekly, starting week of **Jan. 26th**	10%
Individual Design Notebook	**Mar. 27th, Apr. 1st, Apr. 2nd** in lab	10%
Group Project	**Mar. 27th, Apr. 1st, Apr. 2nd** in lab (Demo)	30%
Final Examination	April Exam Period TBD	40%

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness.

COURSE POLICIES: All work submitted must be of professional quality. Material that is handed in dirty, illegible, or disorganized will be returned to the student for resubmission and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence or lack of flow in the written reports.

Laboratory sessions:

- Attendance at scheduled lab sessions is mandatory.
- Students who arrive 20 min after the scheduled lab time without academic consideration or leave the lab early without permission from the TA or miss the lab without academic consideration will receive a 0 in the lab.

Assignments:

- There will be a total of 4 assignments over the term.
- Each assignment is worth 2.5% of the final grade.
- Assignments will be on OWL as specified. There is a 3-day grace period: no penalty will be applied if submitted within 3 days of the deadline.
- Homework assignments are expected to be completed individually. Plagiarism checks will be in place to ensure that each student submits original material. Work that is found to be unoriginal will result in a grade of 0 for the assignment, in the first instance. Subsequent submissions of unoriginal material will result in more severe academic penalties.
- Assignments will be penalized by 20% of the available marks per day for late submission.
- Assignments submitted more than 5 days late will not be accepted.
- Since there is flexibility incorporated into the submission deadlines for assignments, requests for academic consideration will be denied.

Term project:

- Project teams will be formed by the third week of the term.
- Students must form a team with others in the same lab section.
- The ideal team size will be 4 students.
- Students who do not choose a team will be assigned to one.
- The default assumption is that everyone contributes equally to the team effort, and hence all students will receive the same grade for the project components.
- If necessary, each student will be asked to specify the contribution made by each member of the team, including themself.
- Team grades may be adjusted by up to 30% for each student based on self and peer evaluation.
- If academic consideration was requested by one or more of the team members, then only the parts that they are responsible for can be submitted later.
- Term project is considered the designated assignment and a minimum of 60% must be obtained on the project in order to pass the course.

Design Notebook:

- Each student must maintain a hardbound design notebook throughout the term.
- Design notebook entries should be checked by a TA weekly during lab sessions.
- Failure to submit a notebook will result in a grade of zero.

Final examination:

- The exam will take place during the April examination period, with the timing of the exam to be announced in advance.
- Standard calculators will be allowed.
- The exam will be closed book.
- The length of the final exam will be three hours.
- To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination. A final examination mark < 50% will lead to final course grade < 48%.
- 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.

Tips for success:

- Paying close attention to the material presented each week will ensure your understanding of the topics and will allow you to gain the most from the course. In particular, the biweekly assignments are intended to provide preparation for the final exam.
- While every student works at a different level, it is the effort placed in each requirement that ultimately leads to success. Your interest in the course, participation in class by asking relevant questions, and communicating with the instructor will all contribute to your successful completion of the assignments, exams, and the project. Such behavior is highly encouraged.
- It is your responsibility to determine what is required of you. Read through the online materials to determine the instructions regarding assignments, unit tests, project deliverables, and exams.

OFFICE HOURS: By appointment

UNITS: Metric and US customary

USE OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI)

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

August 20, 2025

General Faculty / University Policies

In the event of contradictions between course-specific policies above and general Faculty / University policies described below, please contact your course instructor for clarification.

REQUISITE COURSES

Unless you have either the requisites for a course or written special permission from your Dean to enroll in it, you will be removed from the course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

ATTENDANCE

A student is entitled to be examined in courses in which registration is maintained, subject to the following limitations:

1) A student may be debarred from writing the final examination for failure to maintain satisfactory academic standing throughout the year.
2) 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 (or delegate) of the Faculty offering the course (after due warning has been given). On the recommendation of the department concerned, and with the permission of the Dean (or delegate) of that Faculty, the student will be debarred from taking the regular examination in the course. The Dean (or delegate) of the Faculty offering the course will communicate that decision to the Dean, Undergraduate of the Faculty of Registration.

POLICY ON MISSED DELIVERABLES

To avoid penalties, students missing the deadline of a deliverable designated as "mandatory" will have to report the absence by submitting an Academic Consideration Request through Student Absence Portal. In this case, both the academic consideration request and supporting documentation should be submitted as soon as possible and no later than 48 hours after the deadline of the missed deliverable. Students should seek the guidance of their Academic Advisor if the request for academic consideration was not submitted timely.

For undocumented absences for deliverables that are not designated as mandatory, the Academic Consideration Request must be submitted within 48 hours from the deadline of the missed deliverable.

Requests for academic consideration must include the following components:

a) Self-attestation signed by the student
b) Indication of the course(s) and assessment(s) affected by the request
c) Supporting documentation as relevant.

Requests for academic consideration without supporting documentation ("undocumented absences") are limited to one per term and per course.

Undocumented absences cannot be used for examinations scheduled by the Office of the Registrar during official examination periods (including take-home final exams and December mid-year exams for full courses) and practical laboratory and performance tests typically scheduled in the last week of the term. Undocumented absences also cannot be used for the "designated assessment" in each course. When flexibility in assessment exists and is clearly stated in the course outline, both undocumented absences and academic consideration requests with documentation may be denied.

Undocumented absences cannot be used for submitted for attempted or completed work, whether online or in-person. This includes (but is not limited to) term tests, performances, presentations, and laboratory/tutorial sessions to which the student has reported. Requests for retroactive relief are addressed in the Undergraduate Student Academic Appeals policy.

Documentation for medical illness, when required, must include the completion of a Western Student Medical Certificate (SMC) or, where that is not possible, equivalent documentation, by a health care practitioner.

Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline.

Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete (INC), or granting late withdrawals without academic penalty (WDN), may only be granted by the Academic Advising office of the Faculty of Registration.

An instructor may deny academic consideration for any assessment that is not required in the calculation of the final grade (e.g., "8 of 10 quizzes"). This assessment flexibility must be indicated on the course outline.

An instructor may deny academic consideration relating to the timeframe submission of work where there is already flexibility in the submission timeframe (e.g., 72-hour submission window). This assessment flexibility must be indicated on the course outline.

Additional terms on academic considerations are available in Senate Academic Policies: Rights and Responsibilities - Academic Consideration – Undergraduate Students in First Entry Programs as well as on the Office of the Registrar and Engineering Undergraduate Services webpages.

Submitting fraudulent supporting documentation constitutes a scholastic offense that will be penalized with severity.

POLICY ON LATE SUBMISSIONS

To avoid penalties for late submissions, students are required to advise - **prior to due date of the deliverable** - the instructor that they will be unable to submit the deliverable on time.

If requested by the instructor, students should submit an Academic Consideration Request Form and provide documentation supporting their absence.

If an extension is granted, an individual deadline should be set by the instructor and communicated to the affected student. The approval of the Associate Chair, Undergraduate and Associate Dean, Undergraduate ("Undergraduate Program Leaders") are required if the revised deadline was set within the examination period.

The approval of the Undergraduate Program Leaders is not required if the revised deadline was set prior to the last day of classes.

Some courses have built-in flexibility for assignment deadlines or the total number of assignments that will be graded. In these cases, the instructor might choose to deny any late submissions. Please review the course outline for details on course-specific policies and approach the instructor for additional clarifications on this matter.

POLICY ON MISSED FINAL EXAMINATIONS

Students who are unable to write the final exam are required to report their absence by submitting an Academic Consideration Request through Student Absence Portal. The request for academic consideration should be submitted as soon as possible and no later than 48 hours after the missed final examination.

In case of missed final examinations, students should be prepared to provide Engineering Undergraduate Services with supporting documentation within 48 hours of the missed final examination. The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading/misinterpreting final examination timetable and travel arrangements.

In order to receive permission to write a Special Examination, you must obtain the approval of the Associate Dean, Undergraduate that is issued in response to the submitted Academic Consideration Request. **It is student's responsibility to find out the date, time, and location of the Special Examination** for which they were approved.

Additional terms on considerations for final exams are available on Engineering webpages.

RELIGIOUS ACCOMMODATIONS

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair (or delegate) and, if necessary, the student's Dean (or delegate)

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

Additional terms on religious accommodations are available in the Academic Handbook, Rights and Responsibilities, Accommodation for Religious Holidays.

ACADEMIC INTEGRITY

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit Academic Integrity Western Engineering for additional information on this topic.

ACADEMIC OFFENSE

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the

course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. 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.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

POLICY ON THE USE OF GENERATIVE AI

The use of Generative Artificial Intelligence (GenAI) tools is generally permitted in the Faculty of Engineering unless otherwise stated in the course outline. Students must disclose when GenAI was used while preparing the response to a course deliverable.

Additional terms on the use of GenAI tools for coursework purposes is available on the AI at Western website.

ACCESSIBILITY

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement -Academic Accommodation.

INCLUSIVITY, DIVERSITY AND RESPECT

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender

expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

HEALTH AND WELLBEING

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.
- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.

Gender-Based Violence and Survivor Support - Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, here. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Links

Western Academic Calendar
Academic Rights and Responsibilities
Engineering Progression Requirements and Academic Regulations
University Students' Council (USC) - Services
Important Dates and Deadlines
Academic Consideration for Medical Illness – Undergraduate Students
Accommodations for Religious Holidays
Scheduling of Assignments, Tests and Examinations
Forms for Engineering Students
Office of the Registrar
Retention of Electronic Version of Course Outlines (Syllabi)
Academic Appeals
Student Absence Portal

Note: These regulations apply to all students registered in the Faculty of Engineering irrespective if the course taken is offered by the home faculty or a different faculty on campus.

Add Deadlines:

First term half course (i.e. "A" or "F")	September 13, 2024
Full courses and full-year half course (i.e. "E", "Y" or no suffix)	September 13, 2024
Second term half course (i.e. "B" or "G")	January 14, 2025

***Drop Deadlines*:**

First term half course without penalty (i.e. “A” or “F”)	November 12, 2024
Full courses and full-year half courses without penalty (i.e. “E”,“Y” or no suffix)	December 2, 2024
Second term half or second term full course without penalty (i.e. “B” or “G”)	March 7, 2025

Contact Information:

Engineering Undergraduate Services:	SEB 2097
Phone: 519-661-2130	E-mail: engugrad@uwo.ca
Mechanical Engineering:	SEB 3002
Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca
Chemical & Green Process Engineering:	TEB 477
Phone: 519-661-2131	E-mail: cbeugrad@uwo.ca
Civil Engineering:	SEB 3005
Phone: 519-661-2139	E-mail: civil@uwo.ca
Electrical, Mechatronics & Software Eng:	TEB 279
Phone: 519-661-3758	E-mail: eceugrad@uwo.ca
Integrated Engineering	ACEB 2410
Phone: 519-661-6725	E-mail: engceli@uwo.ca
Office of the Registrar/Student Central	WSSB 1120
Phone: 519-661-2100	