

Western University
Department of Mechanical & Materials Engineering

MME 4452B - Robotics and Manufacturing Automation

COURSE OUTLINE – 2023-2024

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 section.
COURSE INFORMATION:	Instructor: Dr. Burak Yenigun Room: SEB 3076 Email: byenigun@uwo.ca Office hours: by appointment Timetable information is available at https://draftbmyschedule.uwo.ca/
PREREQUISITES:	MME 3374A/B (or the former ECE 3374A/B), MME 3380A/B, or ECE 3330A/B, ECE 3375A/B, or registration in fourth year of the Integrated Engineering program. Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this 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
ACCREDITATION UNITS:	Engineering Science = 75%, Engineering Design = 25%
TOPICS:	<ul style="list-style-type: none">• 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:	Upon successful completion of the course, each student should be able to: <ul style="list-style-type: none">• Demonstrate understanding of manufacturing automation technologies and principles• Categorize different types of automated production processes• Apply electrical, mechanical and pneumatic actuators in the context of an automated system• Understand the operation and use of common industrial controllers (PLCs)• Understand the performance and dynamic characteristics of industrial robots• Perform motion analysis of serial link industrial robots• Design elementary mechanisms for automated machinery• Apply the principles of Design for Assembly (DFA)• Understand the principles and use of industrial sensors• Describe the basic operation of industrial machine vision systems• Integrate these manufacturing technologies into the design of an automated workcell. During the term each student will design an automated production system as part of a team-based project.
CONTACT HOURS:	2 lecture hours and 3 laboratory hours per week, half course.
RECOMMENDED TEXTBOOKS:	James A. Rehg, Introduction to Robotics in CIM Systems, 5 th 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.

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

EXAMINATIONS AND QUIZZES:

The final grade is computed as follows:

Lab Work	Weekly lab sessions starting Jan. 8th	10%
Individual Assignments (4)	Approx. biweekly, starting Jan. 22th	10%
Individual Design Notebook	Week of Apr. 1st in lab	10%
Group Project	Week of Apr. 1st (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.

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:

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 a legitimate reason, leave the lab early without permission from the TA, or miss the lab without a legitimate reason will not receive credit for 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. Due dates are non-negotiable.
- 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 be submitted to the Associate Chair Undergrad for investigation and assignment of a penalty.
- 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.
- Failure to submit an assignment without academic consideration will result in a grade of zero for the assignment.
- If an assignment is not submitted due to circumstances with academic consideration, the weight of the missed assignment will be redistributed to the other assignments.

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 his/herself.
- Team grades may be adjusted by up to 30% for each student based on self and peer evaluation.
- 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

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.

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:

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. Scholastic offences are taken seriously and students are directed to the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

SSD:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

NOTE:

The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie. <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.

STATEMENT ON GENDER-BASED AND SEXUAL VIOLENCE

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.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

A. GENERAL REGULATIONS & PROCEDURES

1. All first-year students will report to the Undergraduate Services Office by submitting the [Academic Consideration Request Form](#), for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination you will report the absence by submitting [Academic Consideration Request Form](#). Absences worth LESS THAN 10% of your mark, will be processed by your department office. If your course work is worth 10% OR MORE of your final grade, your request will be processed by the Undergraduate Services Office.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination, you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test and request relief through the [Academic Consideration Request Form](#). If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, your request for relief will be processed by your department office. If the test is worth MORE THAN 10% of your final grade your request for relief will be processed by the Undergraduate Services Office.
3. Be prepared to attach supporting documentation to the Department Chair and/or the Undergraduate Services Office through the online form (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. FINAL EXAMINATIONS

1. If you are unable to write a final examination, contact the Undergraduate Services Office PRIOR TO THE SCHEDULED EXAMINATION TIME to report your absence using the [Academic Consideration Request Form](#) and request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.

2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must submit an "[Application for a Special Exam](#)" form. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to submit the [Academic Consideration Request Form](#) and provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
 - i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).

2. You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2023 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness:

https://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_135

Academic Accommodations for Students with Disabilities:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_10

Academic Accommodations for Religious or Holy Days:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_16

Course Withdrawals:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page_75

Examinations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#Page_75

Scheduling of Term Assignments:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading_78

Scholastic Offences:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_20

Student Medical Certificate:

<https://www.eng.uwo.ca/files/undergraduate/student-medical-certificate.pdf>

Engineering Academic Regulations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page_86

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Add Deadlines:

September 15, 2023	First term half course (i.e. “A” or “F”)
September 15, 2023	Full courses and full-year half course (i.e. “E”, “Y” or no suffix)
January 16, 2024	Second term half course (i.e. “B” or “G”)

Drop Deadlines:

November 13, 2023	First term half course without penalty (i.e. “A” or “F”)
November 30, 2023	Full courses and full-year half courses without penalty (i.e. “E”, “Y” or no suffix)
March 7, 2024	Second term half or second term full course without penalty (i.e. “B” or “G”)

Contact Information:

Undergraduate Services Office	SEB 2097	Phone: 519-661-2130	E-mail: engugrad@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
Integrated Engineering	ACEB 2410	Phone: 519-661-6725	E-mail: engceli@uwo.ca
Mechanical Engineering:	SEB 3002	Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca
Computer, Electrical, Mechatronic Systems & Software Engineering	TEB 279	Phone: 519-661-3758	E-mail: eceugrad@uwo.ca