

MME 4452b — Robotics and Manufacturing Automation

COURSE OUTLINE – 2011-2012

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.

PREREQUISITES:

ECE 3374a/b and MME 3380a/b and MME 3381a/b, or ECE 3330a/b and ECE 3375a/b or registration in year four of the Integrated Engineering Program.

ACCREDITATION UNITS:

Engineering Science = 80%, Engineering Design = 20%

TOPICS:

- Introduction to industrial automation
- Components of automation
- Industrial robotics
- Industrial sensors and switches
- Assembly machines (continuous transfer, intermittent transfer)
- Transportation devices (linear, rotational, vibrational)
- Feeding and orientation devices (in-bowl tooling, feed tracks, escapements)
- Industrial control
- Machine vision systems
- Intelligent manufacturing

SPECIFIC OBJECTIVES:

During the term each student will design and implement an automated production system as part of a team-based project.

At the end of the course each student should be able to:

- Identify the basic components of manufacturing automation;
- Categorize different types of automated production processes;
- Understand the performance and dynamic characteristics of industrial robots;
- Understand the principles of industrial sensors;
- Apply electrical, mechanical and pneumatic actuators;
- Design elementary mechanisms for automated machinery;
- Understand the operation of common industrial controllers (PLCs);
- Describe the basic operation of industrial machine vision systems;
- Apply the principles of Design for Assembly (DFA);

GENERAL LEARNING OBJECTIVES:

Knowledge Base	✓	Individual Work	✓	Ethics and Equity	
Problem Analysis	✓	Team Work	✓	Life-Long Learning	✓
Investigation	✓	Communication	✓	Economics and	✓
Design	✓	Professionalism	✓	Project Management	
Engineering Tools	✓	Impact on Society	✓		

CONTACT HOURS:

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

Lecture Schedule:

Mondays 2:30-3:30 PM, room SEB 3109

Wednesdays 9:30-11:30 PM, room SEB 1200

Laboratory Schedule:

Section 003: Mondays 3:30-5:30 PM, room SEB 1068

Section 004: Wednesdays 1:30-3:30 PM, room SEB 1068

Section 005: Fridays 2:30-4:30 PM, room SEB 1068

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.

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

UNITS: SI

EXAMINATIONS AND QUIZZES: Closed Book
Only simple, non-programmable calculators will be allowed in the final exam.

EVALUATION: The course grade will be determined as follows:

Individual Assignments (Total = 5)	15%
Assignment 1) Out Jan. 30 Due Feb. 6	
Assignment 2) Out Feb. 6 Due Feb. 13	
Assignment 3) Out Feb. 13 Due Feb. 27	
Assignment 4) Out Feb. 27 Due Mar. 5	
Assignment 5) Out Mar. 5 Due Mar. 12	
Assignment 6) Out Mar. 12 Not Due (study only)	
Lab Reports (Total = 3)	5%
Lab 0) Jan. 9 No Report Due	
Lab 1) Jan. 16 Report Due Jan. 23	
Lab 2) Jan. 23 Report Due Jan. 30	
Lab 3) Jan. 30 Report Due Feb. 13	
Design Notebook	5%
Group Project	35%
Final Examination (Closed Book)	40%

METHOD OF EVALUATION: A series of assignments, labs and a team-based project will be associated with this course. For the group project each student will be asked to specify his/her own contribution.

Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness. Questions that are **descriptive** and **interpretative** in nature require the student to demonstrate his/her knowledge about the topic. These questions are graded using the following marking strategy. A grade of 70% is assigned for an answer that is simply a reiteration or brief interpretation of the information presented during the lectures. A proportionately higher grade is assigned for a thorough presentation or an answer that demonstrates deeper insight into the topic. Answers failing to meet a minimum standard are assigned a proportionately lower grade.

If a minimum of 50% is not obtained on the final examination, the student cannot receive a mark greater than 48%. **Only simple, non-programmable calculators will be allowed in the final exam.**

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 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.

INSTRUCTOR: Louis M. Ferreira, Ph.D., P.Eng.
 Department of Mechanical and Materials Engineering
 Room SEB 3024; Tel: 611-2111 ext. 86124; lferreir@uwo.ca

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 offense is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

NOTE:

The above topics and outline are subject to adjustments and changes as needed.

December 6, 2011/mdn



**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 ACCOMMODATION WILL NOT BE GRANTED AUTOMATICALLY ON REQUEST. YOU MUST DEMONSTRATE TO YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE IF YOU ARE IN FIRST YEAR) THAT THERE ARE COMPELLING MEDICAL OR COMPASSIONATE GROUNDS THAT CAN BE DOCUMENTED BEFORE ACADEMIC ACCOMMODATION WILL BE CONSIDERED. DIFFERENT REGULATIONS APPLY TO TERM TESTS, FINAL EXAMINATIONS AND LATE ASSIGNMENTS. READ THE INSTRUCTIONS CAREFULLY. (SEE THE 2010 UWO ACADEMIC CALENDAR).

A. GENERAL REGULATIONS & PROCEDURES

1. CHECK THE COURSE OUTLINE TO SEE IF THE INSTRUCTOR HAS A POLICY FOR MISSED TESTS, EXAMINATIONS, LATE ASSIGNMENTS OR ATTENDANCE.
2. BRING YOUR REQUEST FOR ACADEMIC ACCOMMODATION TO THE ATTENTION OF THE CHAIR OF YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE IF YOU ARE IN FIRST YEAR) PRIOR TO THE SCHEDULED TIME OF THE TEST OR FINAL EXAMINATION OR DUE DATE OF THE ASSIGNMENT. IF YOU ARE UNABLE TO CONTACT THE RELEVANT PERSON, LEAVE A MESSAGE WITH THE APPROPRIATE DEPARTMENT (OR WITH THE UNDERGRADUATE SERVICES OFFICE, IF YOU ARE IN FIRST YEAR). THE ADDRESSES, TELEPHONE AND FAX NUMBERS ARE GIVEN AT THE END OF THESE INSTRUCTIONS. DOCUMENTATION MUST BE PROVIDED AS SOON AS POSSIBLE.
3. 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 TESTS

1. If you are unable to write a term test, inform your instructor and the Chair of your Department (or the Undergraduate Services Office if you are in first year) prior to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office and inform the Chair of the Department (or the Undergraduate Services Office if you are in first year).
2. Be prepared to provide supporting documentation to the Chair and the Undergraduate Services Office (see next page for information on documentation).
3. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair (or the Undergraduate Services Office if you are in first year) is required when rescheduling 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 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 (please spell your full name).
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, 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 sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

N.B. 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 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 Associate Dean 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. 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.

SHORT ABSENCES

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

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 may want to seek advice from the academic counsellor in your Department or the counsellors in the Undergraduate Services Office if you are in first year.

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 if you are in first year). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence.**

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).

ACADEMIC CONCERNS

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).

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.

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 2011 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness - page 18
Academic Accommodations for Students with Disabilities - page 16
Academic Accommodations for Religious or Holy Days - page 18
Course Withdrawals - pages 58
Incomplete Standing - page 14
Scheduling of Term Assignments – page 15
Scholastic Offences - page 19
Special Examinations - page 34

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.

<u>Drop Deadlines:</u>	First term half course (i.e. "A" or "F"):	October 15, 2011
	Full courses and full-year half courses (i.e. "E", "Y" or no suffix):	November 30, 2011
	Second term half or second term full course (i.e. "B" or "G"):	February 15, 2012

Undergraduate Services Office:	SEB 2097	telephone: (519) 661-2130	fax: (519) 661-3757
Dept. of Chemical and Biochemical Engineering:	TEB 477	telephone: (519) 661-2131	fax: (519) 661-3498
Dept. of Civil and Environmental Engineering:	SEB 3005	telephone: (519) 661-2139	fax: (519) 661-3779
Dept. of Electrical and Computer Engineering:	TEB 279	telephone: (519) 661-3758	fax: (519) 850-2436
Dept. of Mechanical and Materials Engineering:	SEB 3002	telephone: (519) 661-4122	fax: (519) 661-3020