EML 6805
ADVANCED DESIGN OF ROBOTS
Spring 2016

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Florida International University
Department of Mechanical Engineering
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www.eng.fiu.edu/mme/robotics

Course Description:
Robotic arm and mobile platform design including a review of major design components such as actuators, sensors, and controllers. Robot programming. Kinematic and structural robot design. Computer-based design, analysis and hands-on project assignment.

Prerequisite:
EML 4806 or permission of the instructor.

Lectures:
Lectures: TR 11:00 am – 12:15 pm, EC 1112.

Office Hours:
R 2:00 – 3:00 pm. For other times, by appointment via email.

Text Book:
No formal textbook will be required. Handouts will be provided at the course website as necessary.

Course Outline:
1. Introduction to robotic systems
2. Review of industrial robots and mobile platform architectures
3. Swarm robots
4. Humanoid robots
5. Kinematic robot design
6. Microcontroller programming
7. Components in robot design
8. Actuators
9. Sensors
10. Controllers
11. System interface
12. Structural design
13. Control software

Course Objectives:
1. Introduction to the design of multi degree-of-freedom robots and mobile platforms.
2. Review of the latest technology available to design robotic systems.
3. Use of professional engineering tools to design robots.
4. Programming of microcontrollers to control a robotic system.
5. Hands-on experience to design a robotic system.

Learning Outcomes:
Students will be able to design a robot starting with the conceptual design, develop the concept into a model, analyze the model on computer using engineering software packages, complete the structural design, and be able to build a prototype, present results in terms of a PowerPoint presentation, develop an engineering report, technical paper and demonstrate the robot’s performance.

ABET ME Student Outcomes (and Academic Learning Compact – ALC) Supported by the Course:
ME departmental student outcomes (and the corresponding Academic Learning Compact – ALC – items) that are supported by this course are as follows:

(a) an ability to apply knowledge of mathematics, science, and engineering (ALC 1).
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (ALC 3).
(d) an ability to function on multi-disciplinary teams (ALC 5).
(e) an ability to identify, formulate and solve engineering problems (ALC Critical Thinking 1).
(g) an ability to communicate effectively (ALC Oral & Written Communication 1).
(j) a knowledge of contemporary issues (ALC 9).
(k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice (ALC 4).

Note Regarding ABET ME Student Outcomes and ALC Items:
ABET program objectives, student outcomes and Academic Learning Compact (ALC) items are defined for the ME program that must be achieved by graduating students. Each course supports several of the objectives, outcomes and ALC components incrementally but must not necessarily achieve them fully.
Grading:

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<th>Activity</th>
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<td>Assignments</td>
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Project 0: Identification of individual robotics research project with the instructor. Literature survey and definition of the project in detail. Each student will develop a technical paper to be submitted to FCRAR 2016.

Project 1: Team project on kinematic/structural design or control of a multi-DOF robot, mobile platform, or swarm robots.

Project 2: Team-based robot programming, report and in-class team presentation.

Project 3: Team-based robot design, construction, programming, testing, and in-class demonstration. Project 3 will require each team to make several presentations on the progress of work as well as written progress reports. Teams will prepare a 10-minute formal presentation video to describe their experience. The final report will be written professionally in the form of a complete formal report and then condensed as a technical paper for possible submission to a technical conference. Format of the technical paper that must be followed will be made available to students.

Note on team projects: Each presentation, progress report and final report is required to clearly demonstrate the contribution of each team member. This requires division of responsibilities clearly ahead of time. Team members should be flexible to take on additional responsibilities and help another member when necessary.

Correspondence via Email:
Each student is required to provide a reliable email address for correspondence. Announcements and reminders will be sent via email throughout the semester. Students are expected to check their email regularly and make sure their inboxes are not full as the bounced mail messages will not be sent again.

Late Projects:
Project due dates will be strictly enforced. Late project submissions will not receive full credit, and the following policy will apply: Submissions after the class hour on due date or the following day will lose 10 points out of 100. Submissions on the second or third day after the due date will lose 10 additional points each day.
Assignments:
Assignments based on material covered will be occasionally given throughout the semester.

Ethics:
All work prepared and submitted in this course in the form of projects, presentations, problem solutions in quizzes and exams are expected to be original and produced by the submitting student. Any portion that may have been borrowed from a previous work must be clearly identified and referenced to indicate the original author along with the title of the work, and where and when it appeared. The origin of each figure, photograph, table as well as text used from other sources must be clearly identified.

It is extremely important to realize that not doing so may result in an accusation of plagiarism.

Projects must contain the following statement and include student signatures:

Ethics Statement:
The work submitted in this project is solely prepared by TEAM MEMBER 1, TEAM MEMBER 2, TEAM MEMBER 3, and it is original. Excerpts from others’ work have been clearly identified and listed in the list of references. All of the engineering drawings, computer programs, formulations and related files submitted on the accompanying CD and documented on paper are also original and prepared by the team.

Signature1   Signature2   Signature3
Team Member 1  Team Member 2  Team Member 3

Policy on Incomplete Grades:
A grade of “incomplete” will not be assigned to replace an unwanted grade. In order to be eligible to receive “incomplete,” only a single component of the entire coursework needs to be missing, and the reason for the missing component must be verified in writing – such as a letter from a medical doctor.

The University requires that a student must fill out an “Incomplete Grade Form” before the incomplete grade is assigned. The form must be signed by both the student and the professor, and copies provided to the Chair as well as the Dean’s office. Otherwise, an incomplete grade will not be assigned.
**Academic Misconduct:**
Academic dishonesty is a serious offense and will be treated according to the University policy as outlined below.

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.