University of Florida  
Department of Mechanical and Aerospace Engineering  

**EML 6934, Section 5159, “Dynamics and Control of Robots” (3 credits)**  
**Spring 2006**  
TR 4:05pm-6:00pm (9th and 10th periods), Venue: MAE-A 327  

*Note: Class meets on average 3 hours per week, during above TR times adjusted to accommodate any Thursday seminars on DSC topics of interest, MAE faculty meetings and Dr. Wiens’ travel.*

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**INSTRUCTOR:** Doctor G. J. Wiens  
Office: MAE-A 322  
Telephone: 352-392-0806, FAX: 352-392-7303  
E-mail: gwiens@ufl.edu  
Web-page: www.mae.ufl.edu/samm/  
Office Hours: MW 3-4pm (8th period) or by appointment.

**TEXTBOOK:** None. Course notes, reference texts and technical papers.

**REFERENCE TEXTS:**  

**Will be put on reserve in Marston Science Library.**

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**PREREQUISITES:**  
Knowledge of vector and matrix algebra, kinematics and dynamics, and computer programming, and have had a first level controls course.

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**COURSE OBJECTIVES AND OUTCOMES:**  
By the end of the course, every student should:  
- have an understanding of the dynamics and control of serial and parallel robotic systems  
- be able to model the dynamics of robotic systems using Newton-Euler, Lagrangian and Kane Methods  
- be able to perform the inverse dynamics of robotic systems  
- be able to model robot interaction with its environment and/or other robots and robot base mobility  
- be able to analysis and evaluate the effects of dynamic system parameters on the robot’s performance  
- be able to design controllers for robotic systems
PROGRAM OBJECTIVES AND OUTCOMES:
The course most directly supports the following department program objectives in educating students:
• to communicate their ideas verbally, graphically, and in writing;
• to understand their professional, societal, and ethical responsibilities; and
• to acquire the knowledge base, confidence, and mental discipline for self-education and a lifetime of learning.

COURSE ASSESSMENT:

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<th>SCHEDULE</th>
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<tr>
<td>Exam I</td>
<td>30%   Tuesday, February 28 (In-Class, 2 hours)</td>
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<tr>
<td>Exam II</td>
<td>30%   Thursday, April 20 (In-Class, 2 hours)</td>
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<tr>
<td>Project</td>
<td>20%   Friday, April 27, 4:00 p.m. (Abstract Due: March 7)</td>
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<td>Homework</td>
<td>20%   Assigned on a regular basis, and is to be one's own work. Use of ADAMS and Matlab/Simulink software or other equivalent software packages will be a part of assignments.</td>
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EXAMINATIONS: Dates for the exams are indicated above. The exams will be 'take-home', in compliance with the University of Florida Honor Code. NO MAKEUP EXAMS will be given without prior permission from the instructor. The ONLY acceptable reasons for a makeup exam are an excuse accepted by the instructor BEFOREHAND and a CONFIRMED illness at the time of the exam. Failure to take or turn in an exam paper will result in a zero.

PROJECT:
Individual project may involve programming and application of technical papers, etc. Topic must have emphasis on the dynamics and control of robots/manipulators, and may not be your thesis/dissertation research however it can compliment the work. An abstract of your proposed project must be submitted for approval by March 7.

HONOR CODE:
We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.
For Examinations: On my honor, I have neither given nor received aid on this examination.

--- Suggested Course Outline ---

1. Introduction and Review.
2. Jacobians: Velocities and Static Forces.
3. Dynamics: Lagrangian, Newton-Euler, Kane.
4. Inverse Dynamics → Simulations.
5. Controller Designs.
7. Robot arm Design and Performance Metrics (e.g., manipulability).
8. Mobility and Robot Interaction with Its Environment and/or Other Robots.

OTHER COURSE INFORMATION:
• All students must have an email address that they check regularly.
• Class information will often be disseminated via email. Course information is also posted on the web page www.mae.ufl.edu/SAMM/ select ‘Courses’.
• Access to MSC/Adams software will be made available via special arrangements TBD.
• Late homework assignments will be penalized. No assignment accepted if more than one week late.

TRAVEL DATES/Cancelled Lectures: Dr. Wiens will be on travel February 9-10 (tentative, will confirm closer to date), February 11-15, February 17-19 and February 23-24. Hence, there will be no class on February 14 and 23. These and any other cancelled lectures will be made up via use of the extra class hour in the TR 9th and 10th periods.