# SYLLABUS
## ADVANCED ROBOTICS - SPRING 2012

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| Instructor: | Youngshik Kim, 6-407, youngshik@hanbat.ac.kr, 821-1163. |
| Office Hours: | TH 5:00pm-6:00pm, or by appointment. |
| Lecture Time: | TBA |
| Lecture Location: | N7-TBA |
| Course Objectives: | Modeling and control of static and dynamic characteristics of manipulation and mobility are mainly discussed. Cases studies highlight classical approaches and students will independently explore contemporary topics in a course project. |
| Prerequisites: | Graduate Standing or Instructor Consent |
| Text: | Robotics |
| Class Website: | http://robot.hanbat.ac.kr -> Teaching -> Advanced Robotics<br>visit the site for class handouts and additional information |

Quiz/homework Policies:

1. Quizzes will be given out infrequently at the beginning of class (~15 minutes). These will be based entirely on the reading material covered in previous classes.
2. No cheating in quizzes (no cheating papers, no text books, no talking, no lecture notes)
3. Grading: each homework problem will be evaluated on a 3-point scale: 3 = good effort, results, and technique; 2 = modest effort with some incorrect technique or results; 1 = poor effort or technique; and 0 = no attempt.
4. Homework must be submitted in class on the date due.
5. Late homework will be marked down 10% per business day unless prior arrangements exist.
6. Discussion of homework and teamwork is encouraged, but each student must complete each assignment individually. Figures and computer programs CANNOT be shared.
7. Homework may be discussed in class, but it is the students' responsibility to compare their results to homework solutions to resolve errors in their work.

Exam Policies:

1. Examinations must be taken at the scheduled time unless prior arrangements are made at least two weeks before the exam.
2. Any students cheating on an exam will receive a failing grade for the class.

Grade Weightings:

Midterm Exam: 30%
Final Exam: 30%
Term Project: 30%
Class Participation: 10%

**SCHEDULE** (subject to change)

| Week | Topics | Contents |
|---|---|---|
| 1 | Introduction | |
| 2 | Planar transformations and displacements | ♦ 2D vectors<br>♦ 2D coordinate systems<br>♦ Planar transformations |
| 3 | Planar transformations and displacements | ♦ Homogeneous transformations<br>♦ Operators |
| 4 | Spatial transformations and displacements | ♦ 3D vectors, rotations<br>♦ Composition of rotations, transformations<br>♦ Angle-axis |
| 5 | Spatial transformations and displacements | ♦ Matrix to angle-axis<br>♦ Euler parameters<br>♦ Euler angles |
| 6 | Forward kinematics for position | ♦ Types of robots, basic DH parameters<br>♦ DH special cases, end and base links |
| 7 | Midterm Exam | |
| 8 | Forward kinematics for position | ♦ DH parameters to manipulators<br>♦ Manipulators to DH parameters<br>♦ Forward kinematics, tool transform |
| 9 | Inverse kinematics for position | ♦ Two-link manipulators, spatial arm<br>♦ Spatial arm with shoulder<br>♦ Wrist solution, 6-DOF manipulator |
| 10 | Trajectory planning | ♦ Polynomial and LSPB trajectories<br>♦ Cartesian trajectory planning: position |
| 11 | Velocity and acceleration | ♦ Time derivatives of rotation matrices<br>♦ Euler angle rates<br>♦ spatial motion of objects |
| 12 | Velocity and acceleration | ♦ Joint-constrained motion<br>♦ Velocity Jacobians<br>♦ Acceleration<br>♦ Inverse kinematic velocities |
| 13 | Statics | ♦ Forces and torques<br>♦ Center of mass<br>♦ 1D and 2D manipulator force and torque |
| 14 | Dynamics | ♦ 3D manipulator force and torque; Momentum, inertia<br>♦ Properties of the inertia matrix<br>♦ Newton-Euler equations<br>♦ 1D, 2D, and 3D manipulator dynamics |
| 15 | Final Exam | |