# **MECH 464/563: Industrial Robotics, Term 2 2016, UBC**

**Course Structure**

* Credits: 3, 2nd Term, 2015/16
* 3 hours of lecture per week, Tuesdays and Thursdays 8am-9:30am, CEME 1204

**Course Description**

MECH 464/563 (Industrial Robotics) is an introductory level course in robotics intended for graduate and senior undergraduate students of mechanical/electrical/mechatronics engineering. The course serves as the foundation for more advanced level courses in the field of robotics.

Following is the summary of topics that the course covers:

Kinematics (description of position and orientation of rigid bodies, the DH convention, forward and inverse kinematics, differential kinematics, singularities), Dynamics (dynamics of rigid bodies, the arm equation in closed and recursive forms), Motion planning (point-to-point motions, interpolation and path primitives, planning trajectories for manipulators), and Control (position control, computed-torque control (feedback linearization), interaction control).

**Instructor**  
Dr. Muhammad Tufail, tufail AT alumni.ubc.ca  
Office Hours: Tue 12:00-2:00pm (or by appointment), ICICS 065 (Robotics Lab)

Teaching Assistant: Farzad Hemmati, farhemmati AT gmail.com  
Office:ICICS X221

**Textbook & References**

Spong, M. W., Hutchinson, S., and Vidyasagar, M., [*Robot Modeling and Control*](http://ca.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000518.html), John Wiley and Sons, 2006.

References:

* Craig, J. J., *Introduction to Robotics: Mechanics and Controls*, Third Ed., Pearson/Prentice Hall, 2005 [[TOC](http://catdir.loc.gov/catdir/toc/fy0604/2004275113.html)]
* Schilling, R. J., *Fundamentals of Robotics: Analysis and Control*, Prentice Hall, 1990.
* Corke, P., [*Robotics, Vision, & Control, Fundamental Algorithms in MATLAB*](http://www.petercorke.com/RVC/), Springer, 2011
* de Silva, C. W., *Control, Sensors and Actuators*, Prentice Hall, 1989.

**Course Grading**

* MECH 464: Homework 20%, Midterm Exam 30%, Final Exam 50%
* MECH 563: Homework 20%, Midterm Exam 30%, Final Exam 30%, Project 20%

Student must take both midterm and final exams.

**Lecture Schedule**

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| **Dates** | **Module** | **Lectures** |
| Jan 05,07 | INTRODUCTION | * Introduction to the Field * Overview of the course |
| Jan 12, 14 | KINEMATICS | Rigid Motions and Homogeneous Transformations |
| Jan 19,  21 | Forward Kinematics |
| Jan 26, 28 | Inverse Kinematics |
| Feb 02, 04,11 | * Differential Kinematics * Statics |
| Feb 16,18,23 | TRAJECTORY PLANNING | * Trajectory Planning in Joint-space * Trajectory Planning in Task-space |
| Mar 01,03,08,10 | MANIPULATOR DYNAMICS | * The Lagrange Equation of Motion * The Recursive Newton-Euler Formulation * Direct and Inverse Dynamics |
| Mar 15, 17, 22, 24, 29, 31, Apr 05 | CONTROL | * Robot Motion Control * Actuator Dynamics * Single-Joint Control * Computed-torque Control * Interaction Control |