

# ROBOTICS (ROB-UY)

## ROB-UY 2004 Robotic Manipulation and Locomotion (4 Credits)

*Typically offered Fall*

This class introduces basic notions of robotics, from sensors and actuators to kinematics, dynamics, motion planning and control with specific example applications for object manipulation and legged locomotion. Basic algorithms necessary for any robotics practitioner interested in robots with arms and legs are studied in the class. A special emphasis is made on providing a practical experience to students, with a laboratory enabling the implementation of the learned concepts in real applications. Background in calculus, physics, linear algebra and programming are necessary to follow the class. | Prerequisite: CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics)

**Grading:** Ugrd Tandon Graded

**Repeatable for additional credit:** No

**Prerequisites:** CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics).

## ROB-UY 3203 Robot Vision (3 Credits)

*Typically offered Spring*

Engineering systems are becoming smarter and more autonomous (e.g., construction robots, autonomous trucks/cars, intelligent transportation systems, domestic/warehouse mobile robots, etc.). This means they need to understand both their own positions/orientations and the surroundings to fulfill their tasks safely, accurately, and efficiently. This requires an intelligent extraction of both geometric and semantic information from sensory input (mainly visual sensors such as cameras/LIDAR). This course introduces basic knowledge of robotic vision, and provides hands-on project experiences of those emerging technologies in the context of intelligent robotic systems: including RGBD data processing for laser scanning, photogrammetric 3D reconstruction of buildings, visual simultaneous localization and mapping for AR/VR, machine learning applications in object recognition/tracking, semantic segmentation, place recognition from images when GPS is unreliable, and so on. Prerequisite: CS-UY 1114 and MA-UY 2034 or equivalents (see Minor in Robotics)

**Grading:** Ugrd Tandon Graded

**Repeatable for additional credit:** No

**Prerequisites:** CS-UY 1114 and MA-UY 2034 or equivalents (see Minor in Robotics).

## ROB-UY 3303 Robot Motion and Planning (3 Credits)

*Typically offered Fall*

This course covers the concepts, techniques, algorithms, and state-of-the-art approaches for robot localization, mapping, and planning. The course starts from basic concepts in 2D kinematics and probability and then introduces probabilistic approaches for data fusion. Then, the course introduces the trajectory planning problem in the time domain and free space. The motion planning problem is defined in a canonical version of the problem and the concept of configuration space is introduced. A selection of representative planning techniques is covered from probabilistic to heuristic techniques. Finally, some mapping representations and algorithms are presented. | Prerequisite: CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics)

**Grading:** Ugrd Tandon Graded

**Repeatable for additional credit:** No

**Prerequisites:** CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics).

## ROB-UY 3404 Introduction To Haptics and Telerobotics in Medicine (4 Credits)

*Typically offered Fall*

In this course, the theoretical bases and applications, of haptics technologies with a particular focus on medical applications (specifically surgical, and neurorehabilitative) are taught. Basic technological aspects, such as instrumentation, actuation, control and mechanisms, are introduced. Also, some theoretical aspects related to telerobotic systems are discussed. Students are expected to have basic knowledge of programming. As part of this course, students will participate in experimental and simulation labs to acquire hands-on expertise in haptics implementation and programming. | Prerequisite: CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics)

**Grading:** Ugrd Tandon Graded

**Repeatable for additional credit:** No

**Prerequisites:** CS-UY 1114 and MA-UY 2034 and PH-UY 1013 or equivalents (see Minor in Robotics).

## ROB-UY 4423 Special Topics in Robotics (3 Credits)

*Typically offered Spring*

This course covers topics of special interest in robotics to promote exposure to emerging issues in robotics not covered in the program's normal course offerings. Prerequisite: Advisor Approval.

**Grading:** Ugrd Tandon Graded

**Repeatable for additional credit:** Yes