

ENPM 701 – Autonomous Robotics: Spring 2024 Syllabus
Master of Engineering Program in Robotics

Lecture Details	Section 0101 Mondays 1:00 pm to 3:40 pm JMP 2216	Section 0201 Tuesdays 4:00 pm to 6:40 pm JMP 2121
	Course Zoom: https://umd.zoom.us/j/96640199008	
Instructor	Steven E. Mitchell, Ph.D. Office: EGR 2128 Office Hours: Mon & Wed in lecture hall and via Zoom lecture link Preferred Means of Contact: mitchels@umd.edu	
Teaching Assistant	TBD (TBD@umd.edu) Office Hours: TBD in the JMP TA lounge	
Course Description	<p>This is a hand-on course exploring the principles of robotic autonomy. Students will explore the theoretical, algorithmic, and implementation aspects of autonomous robotic modeling and controls, perception, localization and SLAM, planning, and decision making. These techniques will be applied through completion of a semester-long hands-on project employing the course material, ground-based mobile robots, and Python. Each student is required to build and test their own robot this semester.</p> <p>Students will perform hands-on exercises in most lectures to gain a deeper understanding of how a selected set of these technologies can be applied to real-world robotic environments.</p>	
Required Technology	Students will need a personal computer on which Python can be installed (installation details provided during first lecture) along with a Raspberry Pi and robotics kit (both available for purchase).	
Textbook(s)	<p>There exists no single textbook that comprehensively covers the material included in this course. The following resources are optional and will augment the lecture materials:</p> <ul style="list-style-type: none">• Introduction to Autonomous Mobile Robots by Siegwart, 2011• Probabilistic Robotics by Thrun, 2005• Planning Algorithms by LaValle, 2006• Intro to Mechatronics and Measurement Systems, by Alciatore, 2012• Introduction to Sensors for Ranging and Imaging by Booker, 2009• Python Programming and Visualization for Scientists by DeCaria, 2016• Practical Python and OpenCV by Rosebrock, 2014• Raspberry Pi for Computer Vision by Rosebrock, 2019	

Grading Policy Course grades will be based on the following *approximate* grade weights:

Assignments & Exercises	80%
Final Project	20%

Assignments and exercises will be performed both in and outside class hours. Attendance and participation will be self-evaluated and considered with final grade decisions made by the professor.

NOTE: NO LATE HOMEWORK WILL BE ACCEPTED.

It is your responsibility to confirm the proper grades are recorded on ELMS for all graded work. You have **two weeks from the date graded work is returned to dispute a grade.**

Academic Integrity By enrolling in this course, each student assumes full responsibility as a participant in UMCP's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.shc.umd.edu>.

Syllabus Note This course syllabus is subject to change. The most recent version is available on the course website (ELMS). ***Please check regularly for updates.***

ENPM 701 – Autonomous Robotics: Spring 2024 Class Schedule

Master of Engineering Program in Robotics

Week	Dates	Topic / Event	Reading / Other
1	1/22 1/23	(NO class)	Siegwart Chp. 1 DeCaria Chp. 1-5, 7, 10
2	1/29 1/30	Course Introduction Introduction to Python Python & the Raspberry Pi Python Fundamentals sanitycheck.py Ground-up setup/config of Raspberry Pi Homework #0.1	Siegwart Chp. 4 DeCaria Chp. 1-5, 7, 10
3	2/5 2/6	Introduction to Course Project Perception OpenCV Fundamentals via VNC QR codes Homework #1 due: data in Python & Bill of Materials confirmation	Siegwart Chp. 4 Toth Chapter 1 IntroRemoteSensing.pdf
4	2/12 2/13	Perception Lidar & Velodyne demo GPIO Sonar & coding interface with distance sensor Homework #2 due: confirm RPI up and running, cv2.videoWriter()	Siegwart Chp. 4 IntroLidar.pdf VLP-16
5	2/19 2/20	Locomotion & Kinematics Assemble vehicle Mount RPI camera Homework #3 due: object tracking with RPI	Siegwart Chp. 2-3
6	2/26 2/27	Locomotion & Kinematics Assemble vehicle Overview of DC motors & H-bridge Teleoperated control of vehicle Homework #4 due: arrow tracking & orientation with RPI	Siegwart Chp. 2-3
7	3/4 3/5	Locomotion & Kinematics Open vs. closed-loop control Servo motors & Gripper	Siegwart Chp. 2-3
8	3/11 3/12	Localization Motor encoders Repeatedly drive robot in user-defined straight line Homework #5 due: complete assembly of ground vehicle, teleoperation	Siegwart Chp. 5
9	3/18 3/19	<i>SPRING BREAK</i>	
10	3/25 3/26	Localization SMTP & IoT sending videos/data back to control station Map trajectory using Matplotlib Homework #6 due: servo gripper functionality, localization basic theory	Siegwart Chp. 5
11	4/1 4/2	Localization / Sensor Fusion IMU sensor fusion Homework #7 due: motor encoder tracking, forward reverse left right	Siegwart Chp. 5 BNO055 datasheet
12	4/8 4/9	Planning & Navigation Auto-rotation using block tracking algorithm Autonomous object retrieval Homework #8 due: IMU functionality	Siegwart Chp. 6
13	4/15 4/16	Grand Challenge Practice Homework #9 due: sequence of moves, plot trajectory in Matplotlib	
14	4/22 4/23	Grand Challenge Practice	
15	4/29 4/30	Grand Challenge Practice	
16	5/6 5/7	Grand Challenge - Final Project Videos Due 11:59pm Wednesday 5/15 -	