

# CS 354: Introduction to Autonomous Robotics

## James Madison University

### Fall 2020 (3 credits)

## 1 Basic Course Information

### 1.1 Course Description and Goals

A hands-on introduction to programming autonomous mobile robots. The focus of this course is on designing robotic systems that navigate independently in complex environments. Specific topics include localization, mapping, kinematics, path planning and computer vision.

At the conclusion of this course students should be able to:

1. Write software that interacts with robotic hardware.
2. Implement and apply algorithms that address several key problems in robotics, including:
  - Sensor fusion
  - Localization and mapping
  - Visual object detection
  - Path planning
  - Forward Kinematics
3. Understand the current application and limitations of mobile robots.
4. Read and understand journal and conference papers describing current research in the area of robotics.
5. Work effectively in a team to solve challenging problems without clearly prescribed solutions.

### 1.2 Meeting Times and Locations

Days	Time	Location
T/Th	2:45-4:00	Virtually in Zoom EnGeo Building Room 1203

### 1.3 Instructors

<i>Name</i>	Dr. Kevin Molloy	Dr. Nathan Sprague
<i>Office</i>	ISAT/CS 216	ISAT/CS 226
<i>Email</i>	molloykp@jmu.edu	spragunr@jmu.edu
<i>Office Hours</i>	T 16:30 - 18:30 W 14:30 - 16:30 F 11:00 - 12:00	<a href="https://w3.cs.jmu.edu/spragunr/schedule.html">https://w3.cs.jmu.edu/spragunr/schedule.html</a>

### 1.4 Website: [https://w3.cs.jmu.edu/molloykp/teaching/cs354/cs354\\_2020Fall](https://w3.cs.jmu.edu/molloykp/teaching/cs354/cs354_2020Fall)

Much of the information for this course will be disseminated via this website. You should check this website often (at least once a week) for announcements and updates.

### 1.5 Prerequisites

A grade of “C-” or better in CS 240 (Data Structures) or permission of instructor.

### 1.6 Required Texts

There is no required textbook for this course. All readings will be made available as handouts or electronic resources.

### 1.7 Hybrid Class – COVID-19 Accommodations

Due to the COVID-19 pandemic, this class is being offered in a hybrid format. Almost all classes will be synchronous and conducted via zoom. Although these sessions will be recorded, you are expected to attend class and actively participate.

This is motivated by the fact that group work will be difficult in person. In some cases this group work will need to be completed after class, and you will be responsible for establishing an environment for safely working with your group.

Starting in week 5, some projects may require hands-on interactions with some of our physical robots. In these cases, we will coordinate an environment in the lab that will adhere to JMU’s guidance at that time.

If you are uncomfortable coming to an in-person meeting, please contact one of the instructors at least one week prior to the activity and suitable accommodations will be made.

## 1.8 Camera Use

In general, we will expect you to have your camera on during online class sessions. There are several reasons for this:

- It can be helpful for us to see your expressions during discussion. If we see skeptical and bewildered faces, that provides a cue that we need to slow down or clarify the point.
- Being on camera provides some helpful social pressure to stay attentive. We fully understand the temptation to multi-task during a video meeting. It is very easy to convince yourself that you can work on something else while paying enough attention to tune in when something "important" comes up. In fact, we believe you will get more out of this class if you give it your undivided attention for the full class period.
- At its best, education is not a solitary enterprise. This University and this Department each represent a community of learners. Seeing the people we are working with is one small way we can to maintain our sense of community in the face of the challenges raised by COVID-19.

While we expect you to have your camera on when possible, We understand that there may be times when it is inconvenient or inappropriate. There is no requirement that you keep your camera on at all times. If you have concerns about appearing on camera during class, please contact one of us so that we can discuss the situation.

## 1.9 Computing Resources

You **must have access to a computer** for this class. A machine running Windows, Mac OS, or Ubuntu/Linux will work fine. You will also need a stable Internet connection capable of supporting live streaming and interaction (e.g., Zoom).

The software suite utilized in this class (the Robot Operation System, or ROS2) is best suited for Ubuntu/Linux, and thus, a virtual machine configuration will be made available on the class website. This is the only environment that will be supported by the instructors, so, it is advised **NOT** to run these components on Windows or Mac OS directly (but rather, in a virtual machine running on top of these operating systems).

## 1.10 Communication

We will use a number of different tools for communication in this course. These include:

- [https://w3.cs.jmu.edu/molloykp/teaching/cs354/cs354\\_2020Fall](https://w3.cs.jmu.edu/molloykp/teaching/cs354/cs354_2020Fall) is our central course web site. The announcements, discussion board, videos, and documents posted there are part of the required reading for the course.
  - Use public posts on Piazza to discuss the material related to this course.
  - **Canvas** will be used to submit assignments and disseminate grades
  - **Mail the professor(s)** if you have logistic or personal issues to discuss such as setting up an appointment outside of office hours, if a health problem arises, or if you have a personal emergency.
- **Office Hours** No appointments are required to attend office hours or you can make an appointment with an instructor.

## 2 Methods of Evaluation and Grading Policies

Class time will be divided between lectures and hands-on work.

Your final course grade will be determined according to the following percentages:

Component	Count	Weight
Labs/In-class work	6-8	20%
Homework/Programming	2 to 3 larger programming assignments	20%
Quizzes	weekly	5%
Final Project	1	15%
Paper presentation	1	10%
Midterm Exam	1	15%
Final Exam	1	15%

Letter grades will be assigned on the scale A=90-100, B=80-89, C=70-79, D=60-69, F=0-59, with potential minor adjustments after considering the overall performance of the class and actual distribution of numeric scores. We will use + and - grades at our discretion.

### 2.1 Grading Disputes

If you believe we have made an error while grading your work or calculating your final score, please bring it to our attention after class or during office hours. If we determine that there has been a simple mistake, we will fix it immediately and no formal request is necessary.

If you believe an exam question or assignment has been graded unfairly, you must submit a written formal request for a regrade via email. Such requests must be submitted within one week of when

the assignment in question is returned to you. **Any coursework submitted for reconsideration may be regraded in its entirety, which could result in a lower score if warranted.**

### 3 Course Policies

Important announcements will be made via Canvas and/or on the class website. Please make it a habit to check the web page and or your email daily during the week.

Although every effort has been made to be complete and accurate, unforeseen circumstances arising during the semester could require the adjustment of any material given here. Consequently, given due notice to students, we reserve the right to change any information on this syllabus or in other course materials.

You are permitted to use course materials for your own personal use only. Course materials may not be distributed publicly or provided to others (excepting other students in the course), in any way or format unless explicitly allowed.

#### 3.1 Missed and Late Assignment Policy

It will not be possible to receive credit for in-class work that is missed due to absence except in the case of prearranged absences for sports, academic conferences, or other CS related activities. Missing class for these reasons requires coordination with an instructor prior to missing class (no consideration will be given for coordinating this after the missed class). In recognition of the fact that absences are occasionally unavoidable, we will drop one score (the lowest score) for in-class activities.

Assignments may be submitted up to 48 hours late for a 15% penalty per 24-hour period. For example, a submission that would have earned 90 points in an on-time submission will earn  $90 \times 0.85 = 76.5$  points if submitted up to 24 hours late, or  $90 \times 0.60 = 54$  points if submitted up to 48 hours late. If you make multiple submissions, we will typically grade the latest submission. If you wish us to grade a different submission, you must indicate this before the 48-hour late period is over.

Regardless of the above policy, we reserve the right to refuse to grade any programs submitted after the beginning of the second class period following the project deadline, because we may discuss the solution in class.

Project extensions will not necessarily be granted due to server congestion, system problems, network problems, power outages, etc., so do not wait to submit a program until the night it is due. No consideration in grading will be made for errors made in transferring files or submitting the wrong version of your project. Having a working, non-submitted version will not count; only submitted code will be counted.

You will be responsible for developing your own techniques for testing your projects before submitting it. We will grade your assignment based on test cases not provided to you in advance. Your code will be graded on a combination of correctness, completeness, documentation, and code style.

We will be exploiting electronic methods to detect plagiarism. You should be able to explain your code to us. See Section 4.2 for more details.

### 3.2 Adding and Dropping the Course

Students are responsible for adding and dropping the course and verifying these actions in MyMadison. The last date to drop this class with a "W" grade is October 24th. Please consult the appropriate [registrar dates](#) for other deadlines. We will not give “WP” or “WF” grades to students requesting a drop after the deadline except in extraordinary circumstances.

### 3.3 Disability Accommodations

If you need an accommodation based on the impact of a disability, you must contact the [Office of Disability Services](#) if you have not previously done so. Disability Services will provide you with an Access Plan letter that will verify your need for services and make recommendations for accommodations to be used in the classroom. Once you have shown us this letter, we will sit down and review the course requirements, your disability characteristics, and your requested accommodations to develop an individualized plan appropriate for this course. We will not make any accommodations without the appropriate documentation, as we are not qualified to diagnose disabilities.

### 3.4 Excused Absences

All University’s policies apply during the semester. Some of these policies appear in the Undergraduate Catalog.

Missing an exam for reasons such as illness, religious observance, participation in required university activities, or family or personal emergency (such as a serious automobile accident or the funeral of a close relative) all are circumstances that *may* qualify as an excused absence. Where possible you should attempt by all means necessary to attend and take exams at their regularly scheduled class period.

If you must be absent during an exam for a legitimate reason, you must contact us at least one week beforehand to make special arrangements. Failure to make prior arrangements for a missed exam will result in a zero grade. Excused absences will be granted at our discretion and only with appropriate documentation. Please contact us as soon as possible if you wish to request an excused absence.

Observance of religious events will be accommodated for students of any faith.

### 3.5 Classroom Behavior

Students are expected to maintain a high level of civility for all participants in and out of class meetings. This includes respecting the beliefs of participants of all genders, ethnicities, and social

backgrounds. Harassment of any type will not be tolerated and failure to behave in a respectful manner will result in referrals to University Counseling or the Office of Student Judicial Affairs. Any instances of sexual harassment will be reported to the Office of Equal Opportunity according to the following policy:

<https://www.jmu.edu/JMUpolicy/policies/1340.shtml>

### **3.6 Inclement Weather**

This class will operate in accord with JMU's inclement weather policy available at <http://www.jmu.edu/JMUpolicy/1309.shtml>.

### **3.7 Religious Observation Accommodations**

We will give reasonable and appropriate accommodations to students requesting them on grounds of religious observation. If you require such accommodations you must notify us at least two weeks in advance.

## **4 Academic Honesty and Collaboration**

### **4.1 Academic Honesty**

You are expected to comply with the JMU Honor Code as stated in the Student Handbook and available from the [Honor Council website](#) on all assignments, projects, and exams.

Consulting with other students about problems and solutions is not necessarily a violation of the honor code, depending on the particular assignment. All final work turned in for an assignment must be your own unless it is a group project. In particular, you may not share source or binary code on programming assignments unless the project specification explicitly allows it. If you are in doubt about whether something is an honor code violation, please contact us immediately.

If we find evidence of a violation of the honor code, we will bring the matter to the attention of the involved individuals via email and request a face-to-face meeting. As per section IV of the honor code, first time student offenders may agree that a violation has occurred and accept an appropriate penalty by submitting an "Informal Resolution Agreement Form" to the honor council. If the student is not a first-time offender or if there is disagreement about the violation or penalty, the matter will be referred to the honor council under section V of the honor code.

### **4.2 PRIME DIRECTIVE**

**PRIME DIRECTIVE: Be able to explain your own work including homework code and exam solutions.**

Nearly all cheating in programming can be averted by adhering to the PRIME-DIRECTIVE. Students may be asked at any time to explain code or exam solutions they submit. Inability to do so will be construed as evidence of misconduct. More specific guidelines are given below.

### **Thou Shalt Not**

For the purposes of this course, the following actions constitute scholastic misconduct (cheating):

- Directly copying someone else's solution to a homework problem, including student solutions from a previous semester
- Directly copying an answer from some outside source such as the Internet or friend for a homework problem
- Making use of an Instructor Solution manual to complete homework problems
- Paying someone for a homework solution or submitting someone else's work as your own
- Posting solutions to any web site including our course web site
- Collaborating or copying someone else's answer during an exam
- Aiding or abetting any of the above
- Witnessing any of the above and failing to report it the instructor immediately

### **Fair Collaboration**

The purpose of this course is to learn about programming and learning from one another is a great help. To that end, the following actions **will NOT be considered cheating in this course**.

- Talking to other students in the course about HW problems and informally describing how a problem may be solved.
- Getting or giving help fixing a bug or two: a second set of eyes is a great boon to finding that misplaced semicolon that is preventing your code from compiling.
- Searching the Internet for alternative presentations of a programming concept.
- When unsure whether collaboration is fair or not, stop the activity until it can be cleared with instructor.

### **4.3 Penalties**

Any instance of misconduct will be referred to the honor council.