

# Course Syllabus

## RAM205 – Microcontroller Systems Spring 2021



### Class Schedule

Section	Days	Times	Room Location
4525	Monday, Wednesday	10:15 PM – 12:15 PM	Zoom Virtual – See Moodle for link

### Instructor Information

Instructor: Keith E. Kelly  
Office: ~~Parsons-Stulen PS156~~ (Virtual – use Zoom link)  
Phone: 231-995-1312  
E-mail: [kkelly@nmc.edu](mailto:kkelly@nmc.edu)

### Office Hours:

Virtual Zoom office hours to be determined – see course discussions

### Course Description:

This course is a continuation of RAM 155 – Microcontroller Programming. Students implement additional abilities for their robot created during RAM155, utilizing custom sensors, actuators, and interfaces. Activities require the application and extension of both hardware and software skills developed in prerequisite Engineering Technology courses. Students determine requirements, build hardware, code software, troubleshoot, evaluate, and iterate as they create solutions. (3 Credit Hours /4 Contact Hours)

### Prerequisite Courses / Placement:

EET 103, RAM 155

### Teaching Methods

We'll use lecture, homework, exercises, activities, and projects to understand course content. In the first section you will review GPIO control presented in RAM155 and add your understanding of basic electronics. At the completion of this section, you'll be able to create both the circuitry and the code to control input and output.

The second section of the course will introduce the concept of programming with classes. You'll create Python classes that represent the piRover components including the ping sonar sensor. These enhanced structures will be used to create additional smart phone functionality demonstrated in RAM155 including line following, obstacle detection, and camera gimbal control.

The final section of the course will investigate the use of the camera feed and associated services.

During the course you will also work through online content that reviews and expands your abilities to code in Python. A Python certification test is required at the end of the course and functions as the final exam.

Most piRover activities will be completed as a class during the Zoom class session. There may be some additional actions related to the piRover outside of class time, but these will be minimal. You are expected to spend most of the homework time completing the Python lessons.

The Python course is listed as a 42-hour experience, so you'll need about 2.5 hours/week to complete. The amount of time may be significantly reduced based on your prior experience with Python in RAM155. We will do some review on new concepts like data structures and review all assessments. You can ask questions during class time, but most of the effort related to the Python certification is outside class time.

If you did not complete RAM155 last semester, then you will need to pick up a RAM155 kit and complete the build and configuration of the piRover. This must be completed by the third week of class. The initial power supply activity will be swapped with your build activity. We'll discuss details during the first class period.

**Required Course Material:**

- Textbook: A textbook is not required for this course
- piRover kit with Raspberry Pi
- Toolkit
- RAM205 part kit – available in the Makerspace. Additional parts may need to be picked up during the semester depending on activities.
- Computer
- Internet connection
- Microphone
- Smart phone
- Wi-Fi connection (EngTech Wi-Fi is on NMC campus)
- Ethernet connection (this may require a USB adapter cable for your laptop)

**Suggest Supplemental Material: (links are sample items)**

[Video camera with USB cord](#)

[Headset with microphone](#)

**Course Objectives / Learning Outcomes:**

- Assemble mechanical and electrical systems from documentation
- Create and test Python programs
- Control input and output with code
- Interpret documentation and solve input/output control problems
- Integrate, test, and report results

**Course Objectives / Learning Outcomes:**

Area	Learning Outcome	Assessment Tool
Knowledge	<ul style="list-style-type: none"> <li>Interface the physical world to a microcontroller using actuators and sensors</li> <li>Use test and manufacturing equipment</li> </ul>	Implement features demonstrated by piRover manufacturer's code
Application	<ul style="list-style-type: none"> <li>Interpret problem statements</li> <li>Apply specific methodologies for problem-based learning and project management</li> </ul>	Implement features demonstrated by piRover manufacturer's code
Integration	<ul style="list-style-type: none"> <li>Apply the problem-solving process to address various scenarios (CT)</li> </ul>	Implement features demonstrated by piRover manufacturer's code
Human Dimension	<ul style="list-style-type: none"> <li>Recognize their ability to solve common problems using technology</li> </ul>	Implement features demonstrated by piRover manufacturer's code
Caring – Civic Learning	<ul style="list-style-type: none"> <li>Appreciate technology as a craft</li> </ul>	piRover application builds using professional tools and structures
Learning How to Learn	<ul style="list-style-type: none"> <li>Use web-resources for independent learning and skill validation</li> </ul>	Python certification prep and exam

**General Education Outcomes:**

Critical Thinking: Students will skillfully conceptualize, apply, analyze, synthesize, and evaluate information gathered from observation, experience, reflection, reasoning, or communication.

**Grade Determination:**

Final grades will be determined as follows: Total of all deliverables including tests, quizzes, worksheets, homework, lab scores, and tests divided by the total possible points x 100%

**Grading Scale:**

4.0 = 93% or above

3.5 = 85 – 92%

3.0 = 80 – 84%

2.5 = 75 – 79%

2.0 = 70 – 74%

1.5 = 65 – 69%

1.0 = 60 – 64%

0.0 = below 60%

**Proposed Assignments / Grading Criteria:**

<b>Assignment</b>	<b>Points</b>	<b>Percentage of Final Grade</b>
Weekly production work	300	50%
Projects	150	25%
Python Modules	40	7%
Python Summary	30	5%
Python Certification	60	10%
Reflections	20	3%
<b>TOTAL</b>	<b>600</b>	<b>100%</b>

## **Attendance/Participation**

You are expected to attend each class session. Students are expected to actively participate in class by asking questions, working on in-class exercises, giving presentations as individuals or as part of their team projects, and sharing personal experiences and opinions related to the topics discussed. Students who do not participate in class or miss more than 4 in-class hours without a pre-approved excuse will have their final grades reduced by one grade (i.e. 4.0 to 3.5). Be sure to contact me BEFORE you miss a class, if possible. Extended or initial absence can result in the instructor dropping you from the course.

Let me know about last minute emergencies via email or phone as soon as you can.

## **Late Work**

Work must be submitted by the stated deadline. There is an opportunity to make-up missed points at the end sprints 1 and 2. The instructor will discuss the concept of technical debt and the for process making up points. This policy applies only to production and project work. Test point cannot be made-up. See the course web site for descriptions of homework assignments. If you have a special circumstance, let me know in advance.

## **Makeup Tests and Presentation Date Changes**

Requests for makeup tests or presentation date changes must be made in advance with the instructor or the student will get no credit for that item.

## **Honesty**

I'm very aware of how easy it is to share your work when it is in electronic form. Be sure you are aware of the Student Code of Conduct found in the Student available here. Assisting others with assignments and coding is expected. Providing copies of your work for others to copy is cheating. If you cheat, you fail the course.

## **How to Get the Most Out of This Learning Experience**

Below are a few simple steps that will make this learning experience even better:

- Take charge of your own learning. Raise questions, prove, explore, go after what you need
- Be open. Use your imagination, consider new possibilities, and create something new
- Give as well as receive. Give liberally to co-learners and be prepared to receive a great deal from them
- Have fun!!! Plan to thoroughly enjoy this opportunity to learn and to grow in your professional competence and satisfaction
- Take advantage of all the great equipment we have in the lab and your chance to experiment.

## **Syllabus Changes:**

- The instructor reserves the right to make changes to the syllabus and will inform the class of any changes.

## **College-wide Syllabus:**

- Visit the college syllabus available in the main menu to Moodle to view college policies and learning services information.

**Tentative Course Itinerary:** (subject to change)

The specific day-to-day activities, assignments and topics are located on the course Moodle page.

Week	Topic	Assignments , etc.
1	Introductions – Course, piRover, Python Cert	
2	Power Sources (piRover Build)	PE1:Module 1 Quiz
3	Digital Inputs	Power/Build due PE1:Module 1 Test
4	Digital Outputs	
5	Lamp Driver Project	Input/Output code due PE1:Module 2 Quiz
6	Infrared Sensor Project	PE1:Module 2 Test
7	Remote Drive Review	Infrared Sensor Project due
8	Line Follower Project	PE1: Module 3 Quiz
9	Introduction to Classes	Line Follower Project due PE1: Module 3 Test
10	Line Follower Drive Project	
11	Ping/Sonar Class	Line Follower Drive Project due PE1: Module 4 Quiz
12	Sonar/IR Drive Project	PE1: Module 4 Test
13	Servo Class	Sonar/IR Drive Project due PE1 Summary Test
14	Camera and gimbal control	PE1 Summary Test Review
15	Wrap up Python Certification Testing	Camera/gimbal project due Python Exam completed
16		