

Remote/Online Operation of Physics Labs at UCLA in Spring 2020

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UCLA PHYSICS 4 LABS

New Announcements

Summer Session A will start on June 22.

- 1,200 students /year
- 1st year
- Physical Science
- Engineering

Mechanics

Physics 4AL in 2020 Spring quarter

Unit 1: Training

3 weeks

Unit 2: Motion

2 weeks

Unit 3: Oscillation

2 weeks

Unit 4: Project

3 weeks

E&M, Sound

Physics 4BL in 2020 Spring quarter

Unit 1: Training

Unit 2: Sound

Unit 3: Circuits

Unit 4: Project

Revision of Physics Labs since Summer 2019

Overview of New Physics 4 Labs

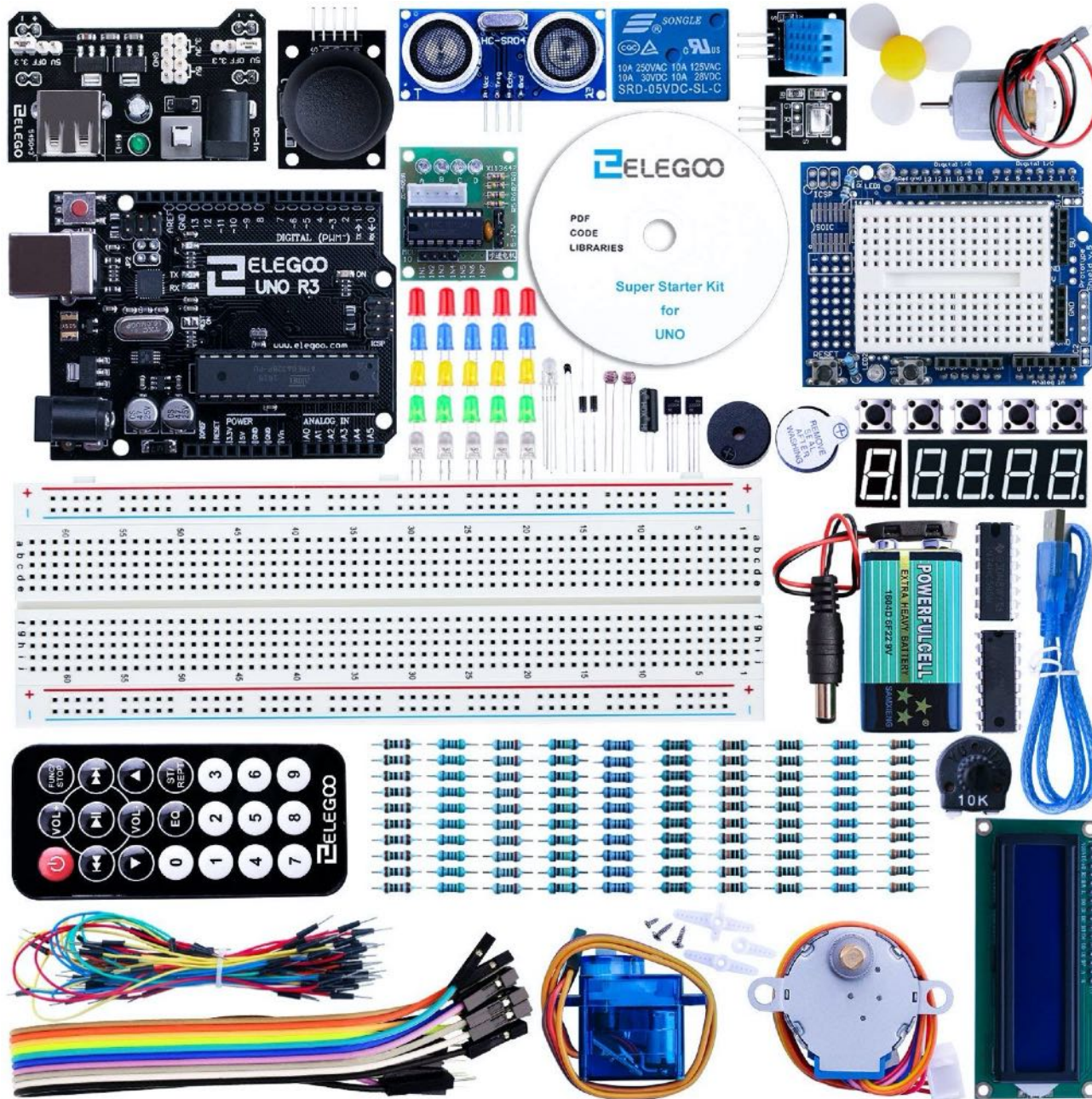
➤ Integration of three steps:

- Physics Laws → Prediction
- Modern Hardware → Arduino
- Modern Software → Python (Jupyter Notebook)

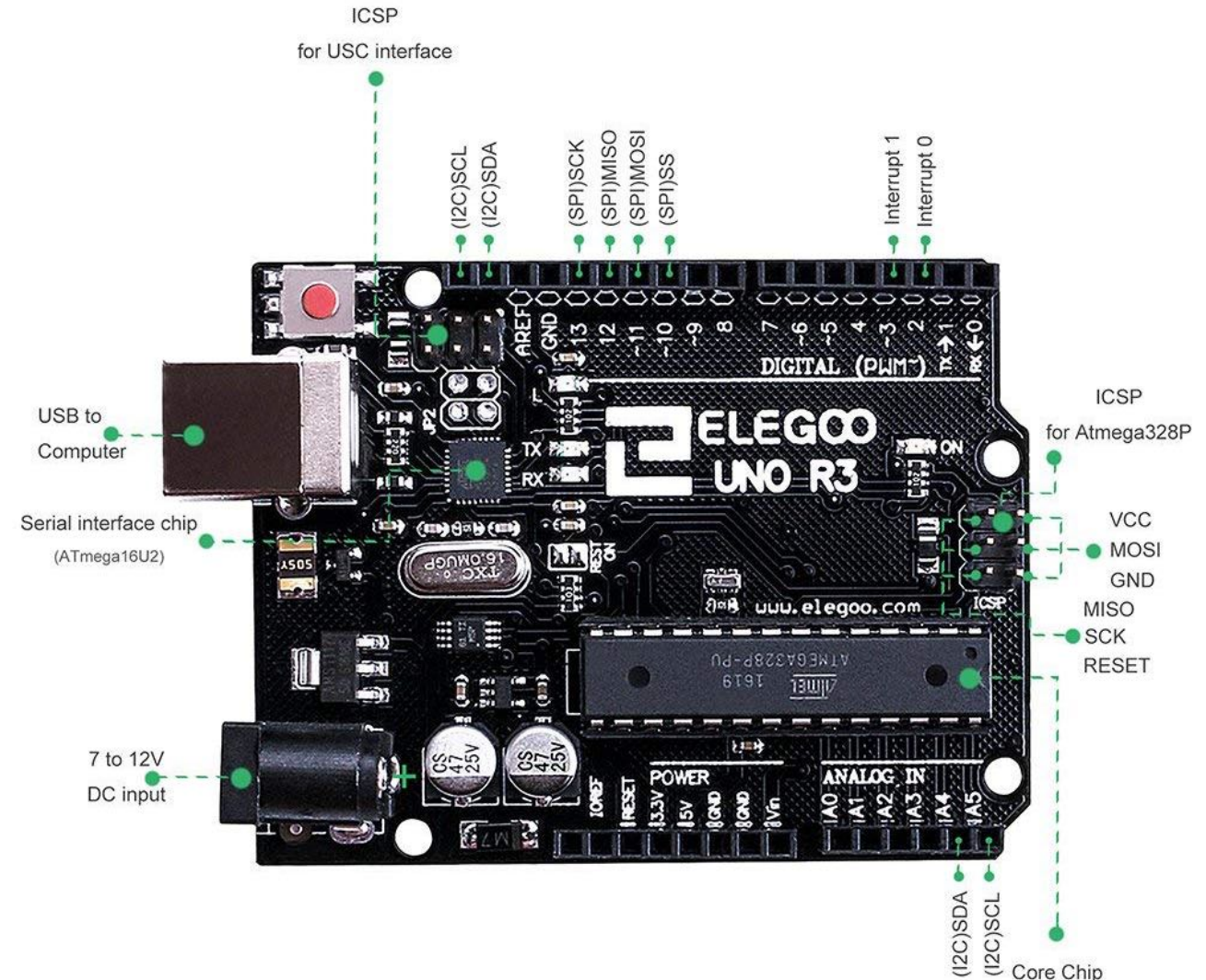
➤ Project oriented:

- No more cookbook-like manual
- No more pre-wired hardware
- Based on hypothesis

ELEGOO UNO R3 Project Super Starter Kit

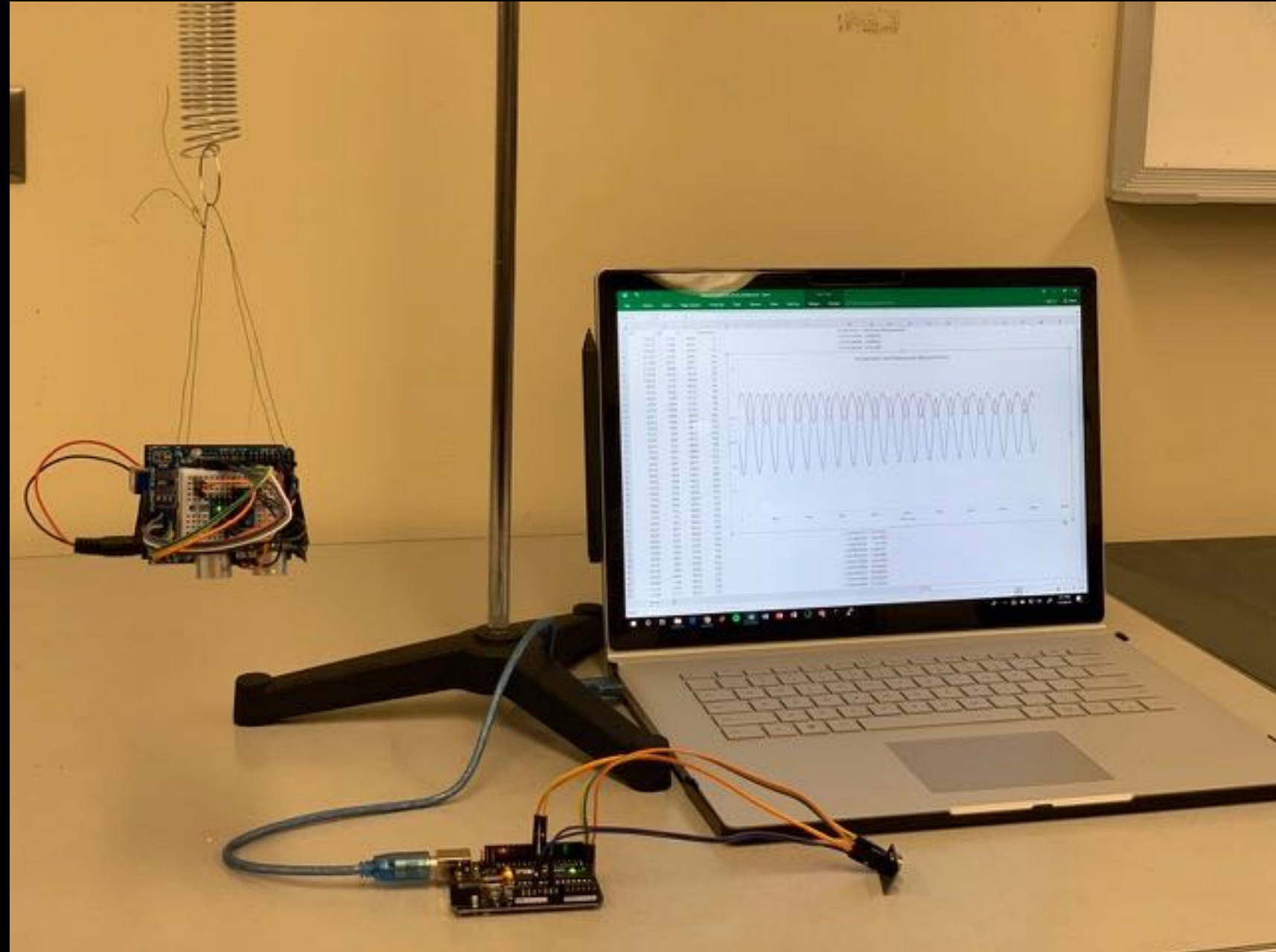
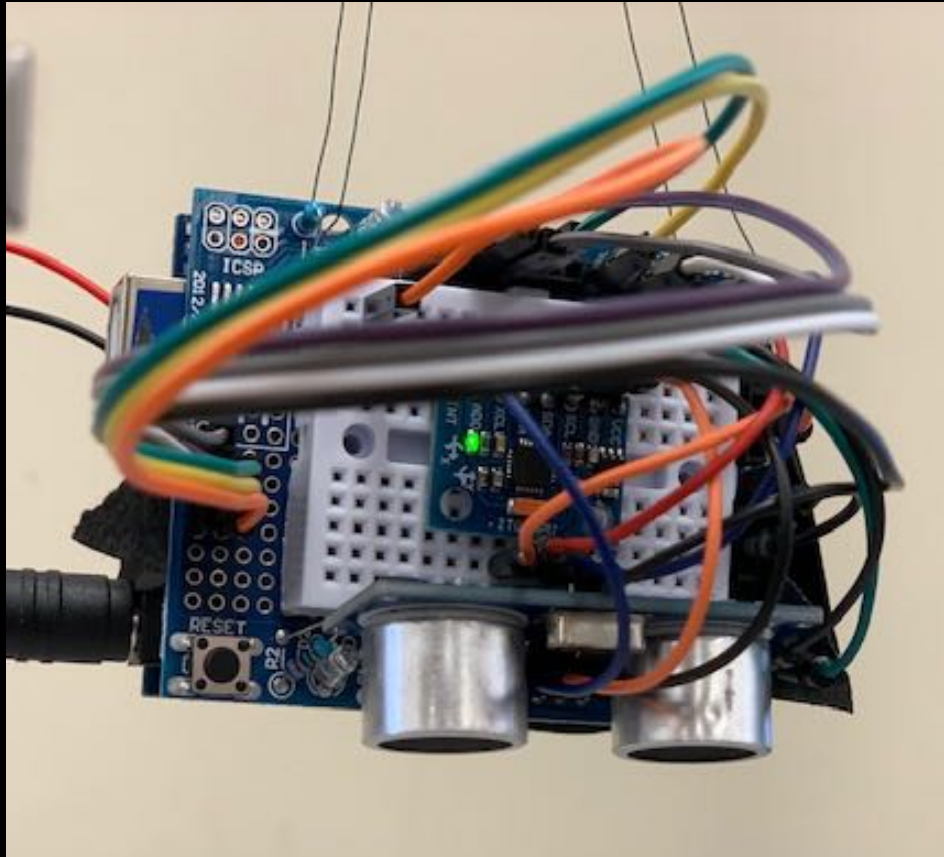


\$36



Vertical Mass-Spring system

Ultrasonic Distance Sensor
+ Accelerometer + WiFi



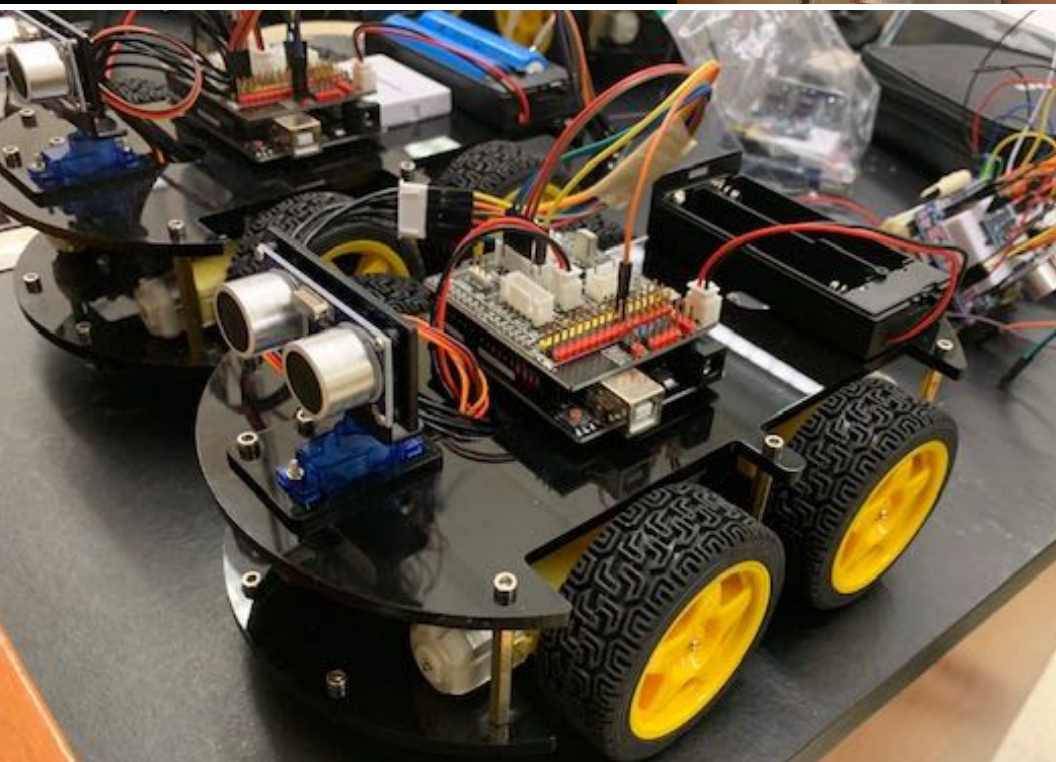
also 4-173
will be there.

1941
Authentic Style
Made in America



Robot Car Project

Ultrasonic
Distance Sensor
+ Accelerometer +
WiFi on Robot Car



Remote Online Labs in Spring 2020

Key Concepts for Remote Operation

➤ Flipped Lab

- Zoom breakout rooms
- Arduino setup at home
- Weekly check list

➤ Asynchronous Operation

- Well defined prelab
- Out-of-lab training
- Short video clips
- Python programming

➤ Group Activities

- Group reports
- Final group projects

Integration of 10 Online Resources

➤ Online Communication Tools:

- Homepage: Hub of public contents
- CCLE: Hub of secure contents, E-mails
- Zoom: Online labs, Breakout rooms for group activities
- Gradescope: Report submission, grading
- Campuswire: Informal communication, Q&A

➤ Google-based Resources:

- Google Drive: Shared data & files among students and TAs
- Google Slides: Weekly Lab Instructions
- Google Sheets: Weekly Checklists
- Google Docs: Group Reports
- Google Forms: Survey, Big data collection

4AL/4BL joint Friday TA meeting (~3 hours)

Developing TA

Instructor

Lead TA



10 TA + 10 LA

06:01

Participants (21)

Search

- KA Katsushi Ari... (Co-host, me)
- JC Javier Carmona (Host)
- CK CHANDAN KITTUR (Co-host)
- DR Derek Reitz (Co-host)
- EE Edgar Elias (Co-host)
- EK ERIK KRAMER (Co-host)
- GM GRANT MITTS (Co-host)
- JL Josh Larson (Co-host)
- NEEL BHUSKUTE (Co-host)

Invite Mute All Unmute All More

Chat

everyone:

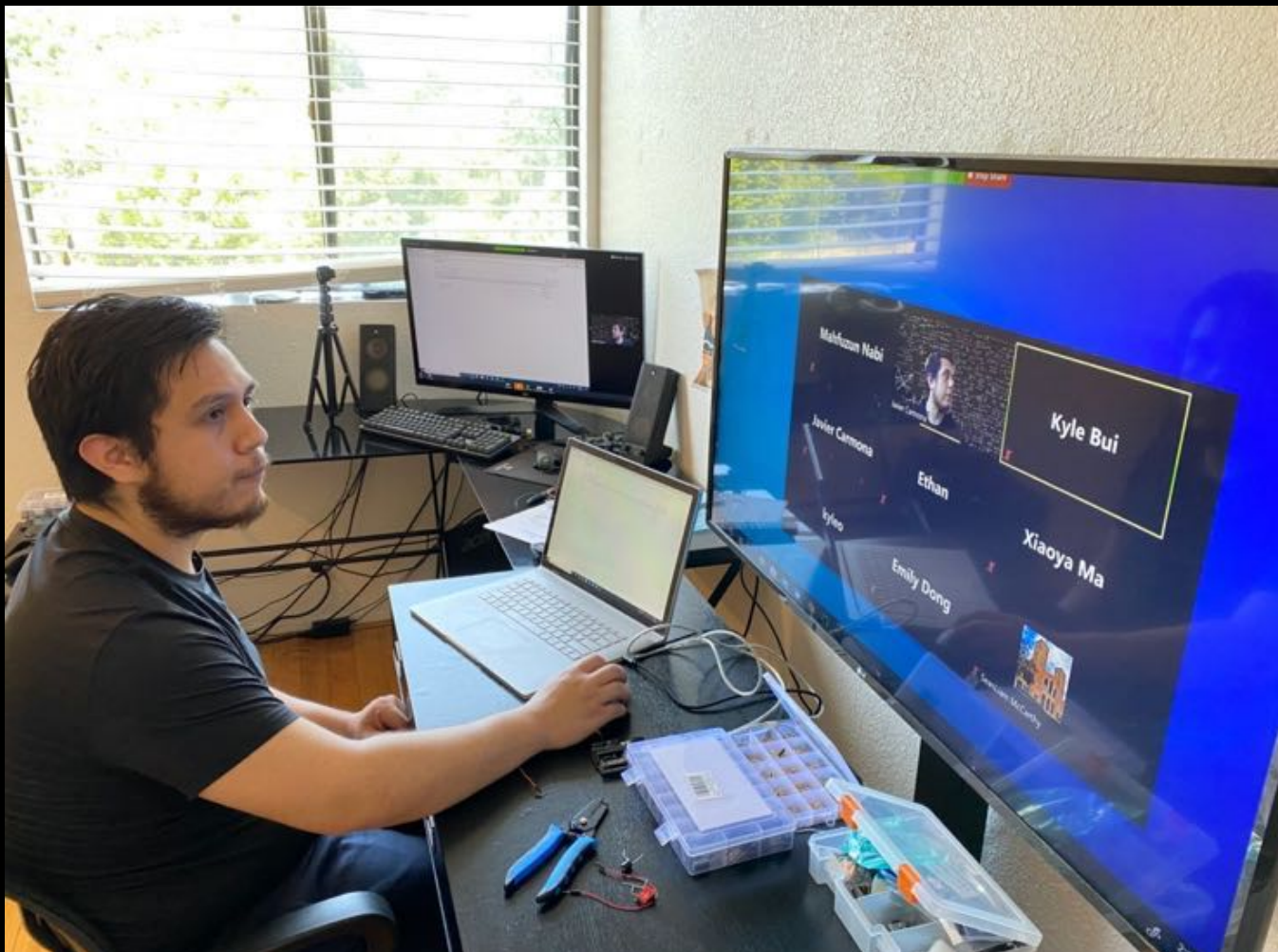
integral part of achieving these goals was to create a curriculum where the students would build their own sensors and do all analysis in Python. The students now use microcontroller Arduinos kits to program driving motors, LEDs, RC cars and read out inputs from ultrasound distance distance sensors and accelerometers.

To: Everyone

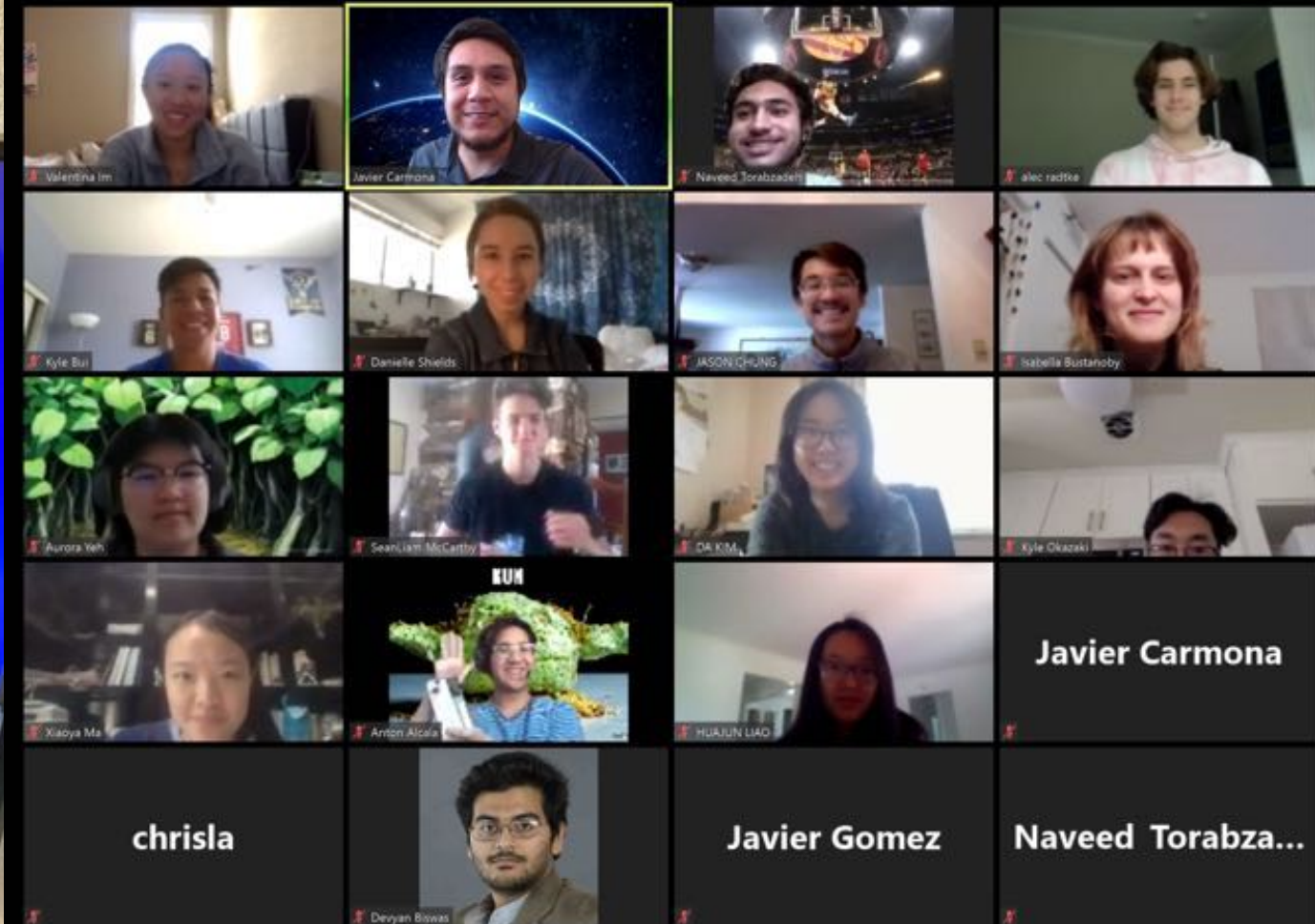
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Screenshot

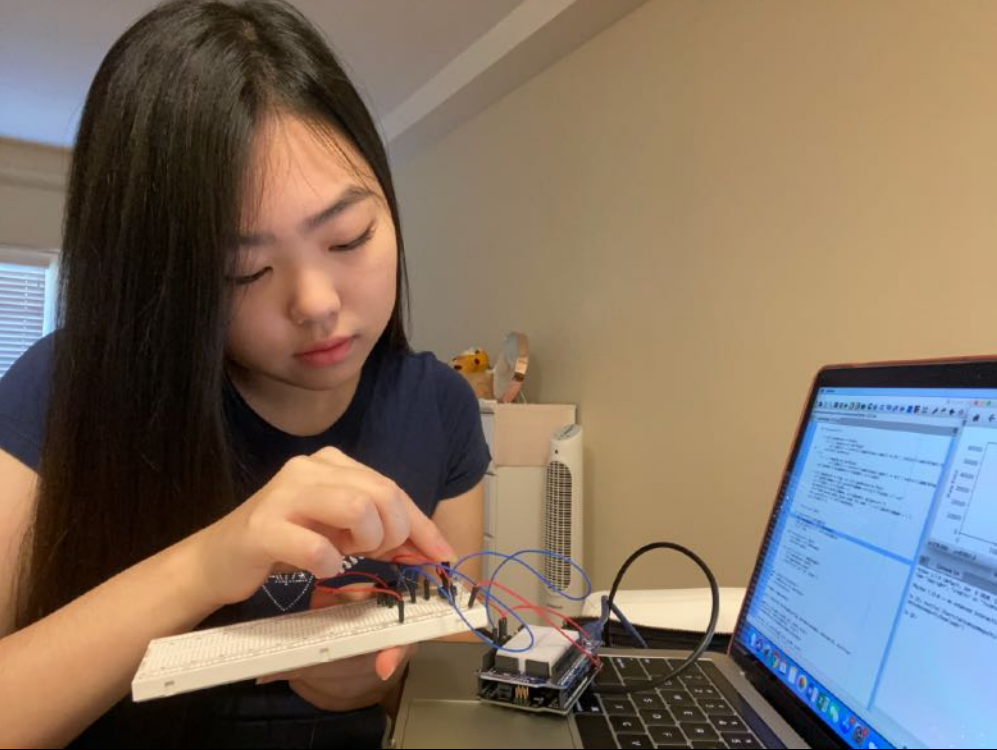
Physics 4BL – Javier teaching AC Circuit by Arduino



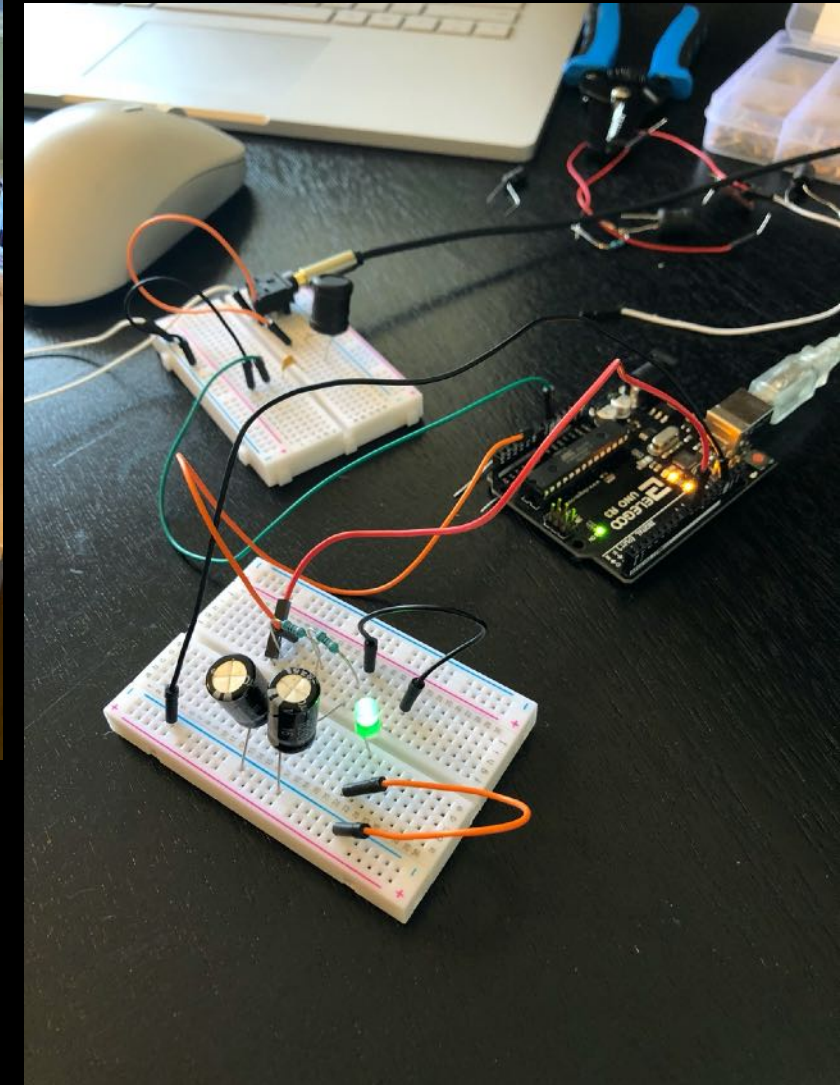
TA Javier teaching at home



20 – 30 students /section
Total 22 sections



**Students
setting Arduino
at home**



Activities at students' Home

Weekly structure of Outline of Course Instructions

- **Pre-Lab** (~1 hour)
- 1st In-Lab (Mon/Tue) (2 hours)
 - **Setting up Arduino**
 - **Initial data taking**
 - **Plotting**
- **Between-Labs** (~1 hour)
- 2nd In-Lab (Wed/Tue) (2 hours)
 - **More data taking**
 - **Analysis & Significance**
- **After-Lab (by the next Sun)** (~4 hours / 2 weeks)
 - **Group Report**

Example of Weekly Checklist

Example from
Week 2 – 4AL
Monday 8 -10 am

(Snapshot at 9 am)

Legend

0: Not Started

1: Done

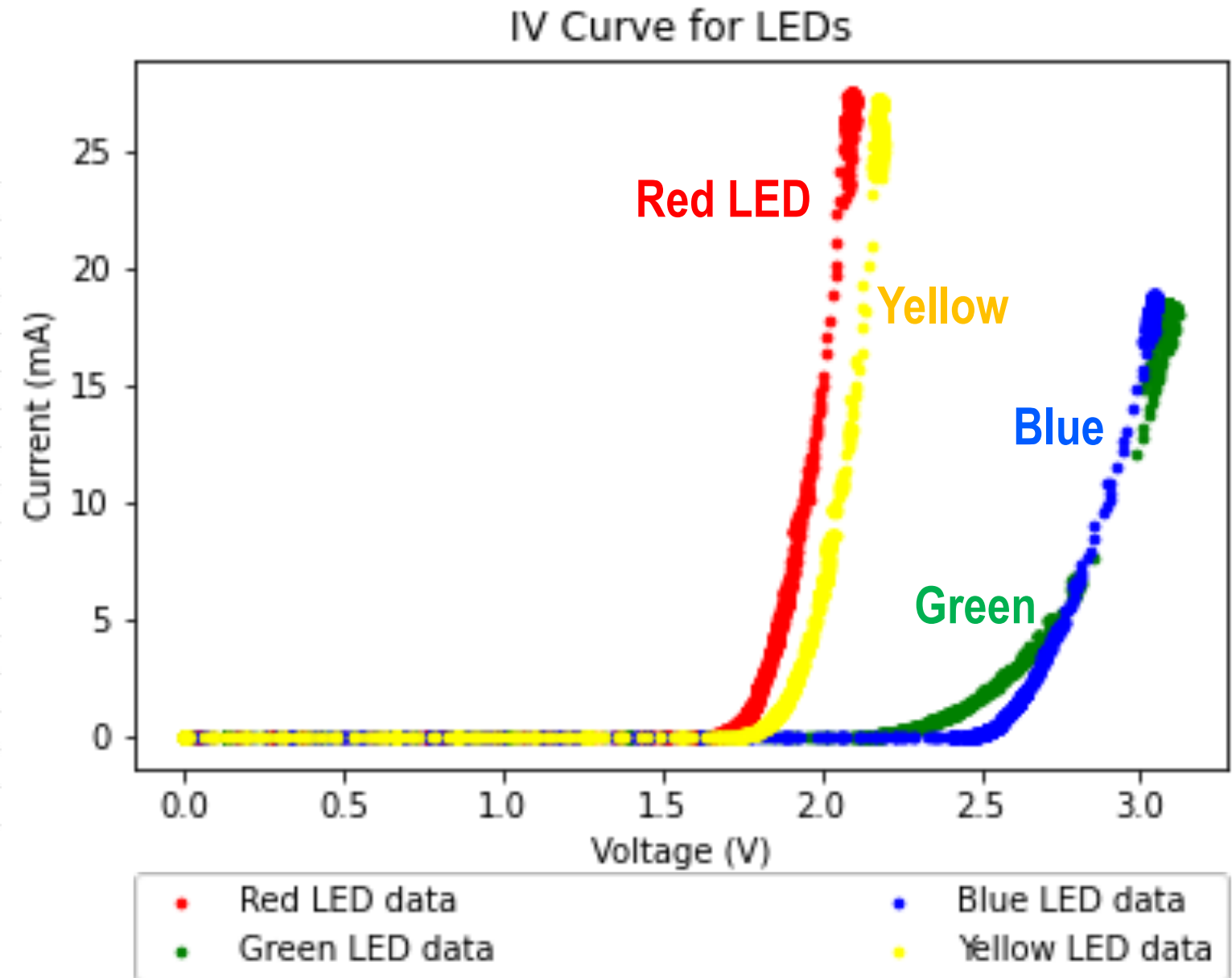
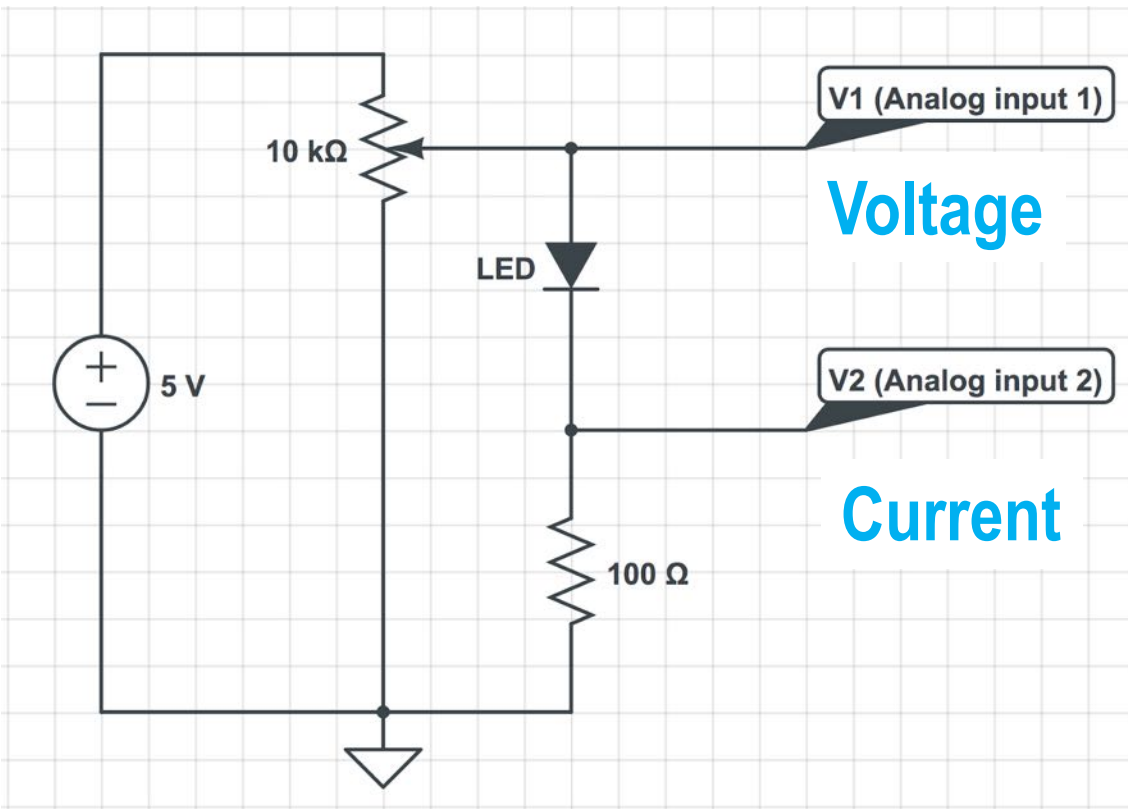
2: in Progress but Struggling

3: Need Help!

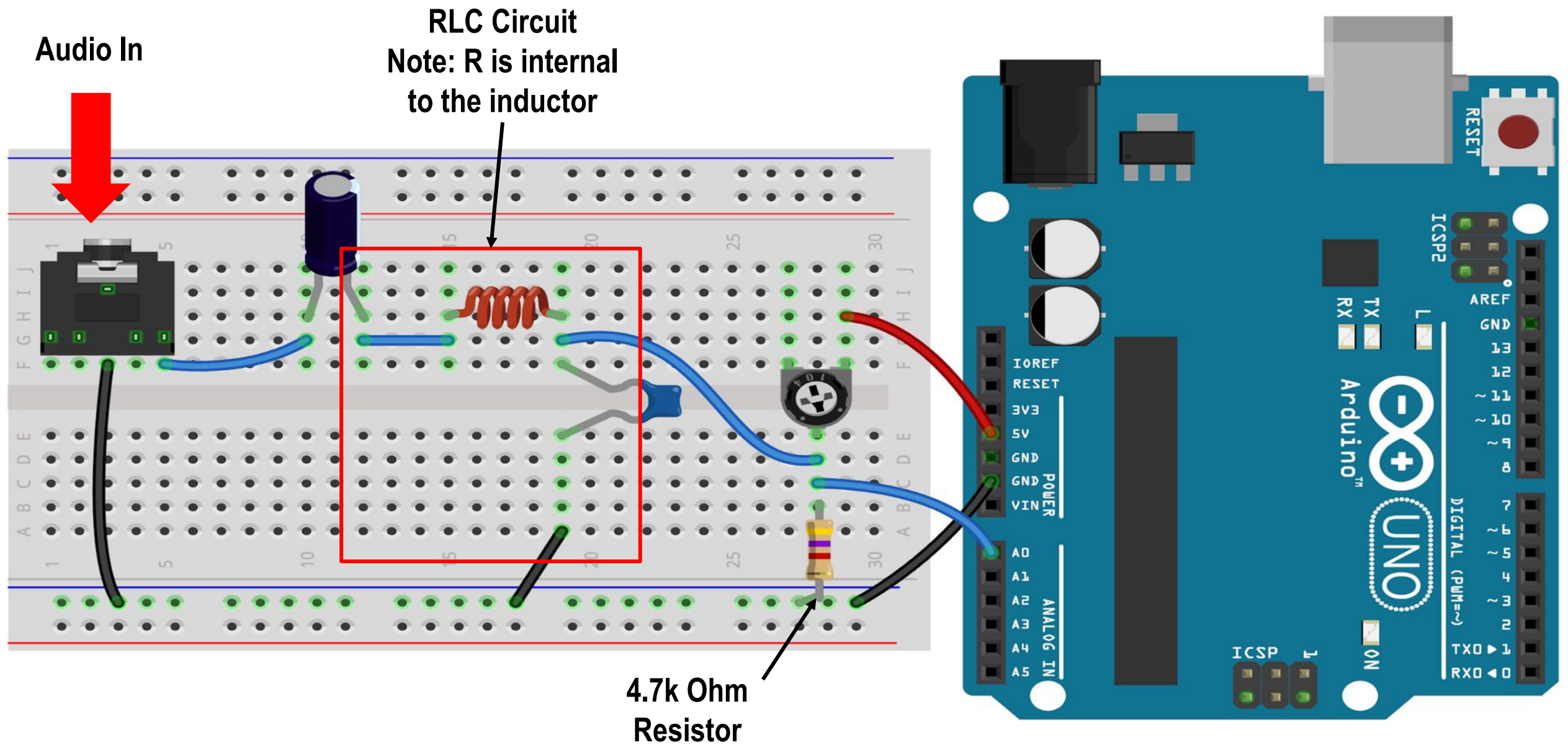
2	Table No.	Student Code	Name (if not Present, add to the bottom of list in bold)	Pre Lab Assignment	Zoom Participation	Objective 1	TA Check Point 1	Objective 2	Objective 3	Objective 4	TA Check Point 2	Objective 5	TA Check Point 3	Lab 1C In-class Assignment	Lab 1D Prelab	Zoom Participation	Objective 1: Build 2kohm circuit
3	Expected Minutes (Breakout Time)			30		5+10	5	10+15	10+15	15	5	10+20	5	40	20		15
4	T1																
5		T1a		1	1	1	0	0	0	0			0	0		0	0
6		T1b		1	1	1	1	1	1	1			0	0		0	0
7		T1c		1	1	1	1	1	1	1			0	0		0	0
8		T1d		1	1	1	0	1	1	1			0	0		0	0
9	T2																
10		T2a		1	1	1	0	1	1	1			0	0		0	0
11		T2b		1	1	1	0	1	1	1			0	0		0	0
12		T2c		1	1	1	1	1	1	1		3	0	0		0	0
13		T2d		1	1	1	0	1	1	1		0	0	0		0	0
14		T2e		1	1	1	0	1	1	1	0		0	0		0	0
15		T2f		1	1	1		1	1	1							
16	T3																
17		T3a		1	1	1	0	1	3	0			0	0		0	0
18		T3b		0	1	1	0	1	0	0			0	0		0	0
19		T3c		1	1	1	0	1	0	0			0	0		0	0
20		T3d		1	1	1	0	1	0	0			0	0		0	0
21		T3e		1	1	1	0	1	1	2			0	0		0	0
22	T4																
23		T4a		1	1	1	0	1	1	1			0	0		0	0
24		T4b		1	1	1	0	1	1	1			0	0		0	0
25		T4c		1	1	1	0	1	1	3			0	0		0	0
26		T4d		1	1	1	0	1	1	1			0	0		0	0
27		T4e		1	1	1	0	1	1	1			0	0		0	0
28	T5																
29		T5a		1	1	1	0	1	1	0			0	0		0	0
30		T5b		1	1	1	0	1	1	1			0	0		0	0
31		T5c		1	1	1	0	1	1	1			0	0		0	0
32		T5d		1	1	1	0	1	1	1			0	0		0	0
33		T5f	ow	0	0	0	0	0	0	0			0	0		0	0
34	T6																
35		T6a		1	1	1	0	1	1	1			0	0		0	0
36		T6b		1	1	1	0	1	1	0			0	0		0	0
37		T6c		1	1	1	0	1	1	1			0	0		0	0
38		T6d	in	0	0	0	0	0	0	0			0	0		0	0
39		T6f		1	1	1	0	1	1	0			0	0		0	0
40																	

I-V Curve Lab

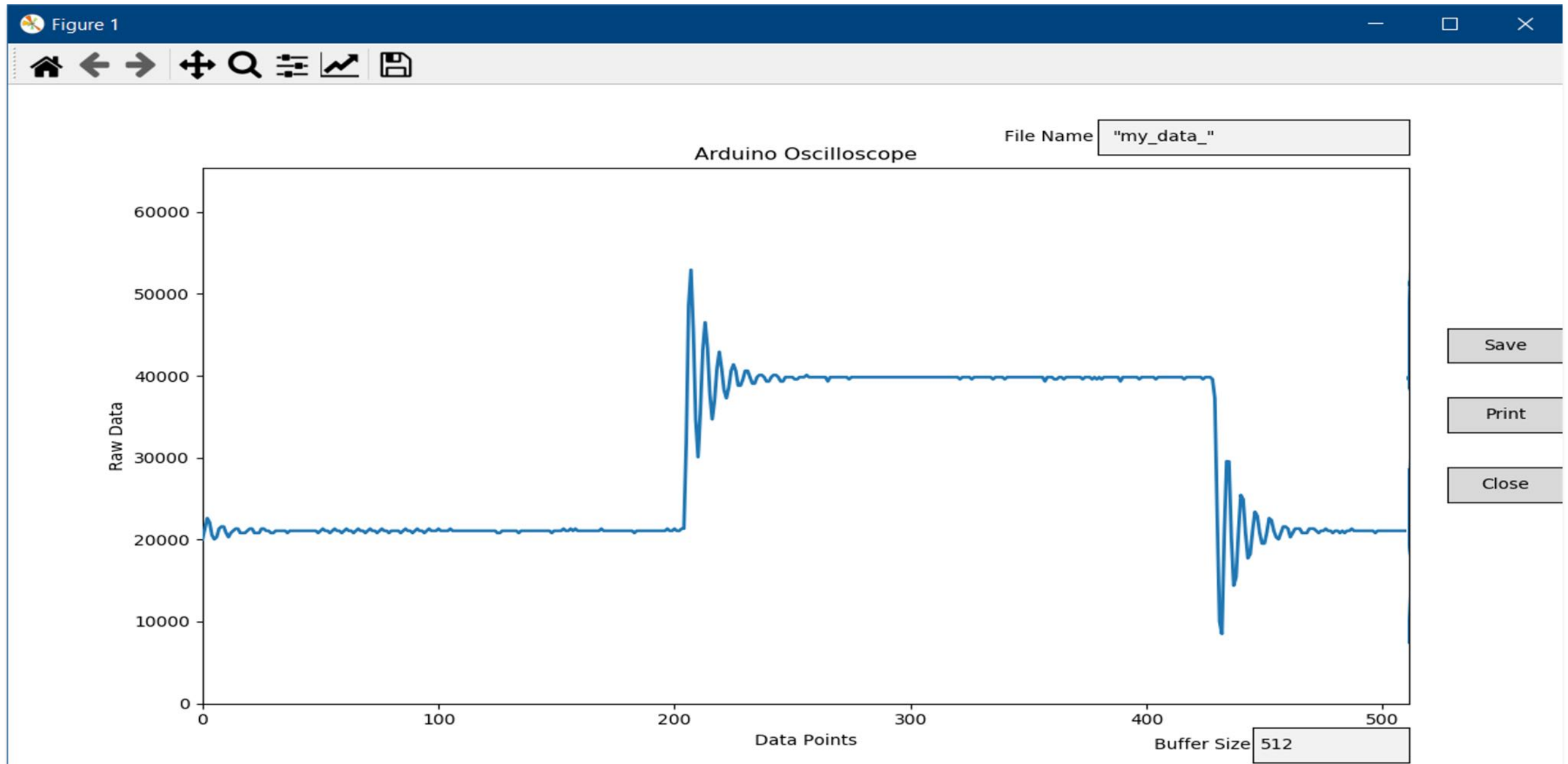
Week 2: V-I Curve of LED by "Arduino - DMM"



Week 7: RLC Damped Oscillation observed by "Arduino Oscilloscope"



Week 7: RLC Damped Oscillation by "Arduino Oscilloscope"



Final Presentations (106 groups, 486 students)

Section	Day	TA	Time	Group	Abstract	Slides	Video	Project Short Title	Member 1	Member 2	Member 3	Member 4
1	Wed	Grant, Edgar										
			8:00 AM	1	Abstract	Slides	Video	Ultra-sonic radar measurements				
			8:15 AM	2	Abstract	Slides	Video	Reaction Time in Peripheral Vision				
			8:30 AM	3	Abstract	Slides	Video	Reaction Time of Printed Simuli				
			8:45 AM	4	Abstract	Slides	Video	Tonal Signatures of Different Instruments				
2	Wed	Javier, Derek										
			10:00 AM	1	Abstract	Slides	Video	Voice Recognition Through Python ML				
			10:30 AM	2	Abstract	Slides	Video	Instrument Tuner Using Python and Arduino				
			10:15 AM	3	Abstract	Slides	Video	Reaction Time by Differing Brightness				
3	Wed	Chandan, Derek										
			12:00 PM	1	Abstract	Slides	Video	Ultrasonic Position and Shape Detection				
			12:15 PM	2	Abstract	Slides	Video	Peripheral Reaction Time				
			12:30 PM	3	Abstract	Slides	Video	Band Pass Filter				
			12:45 PM	4	Abstract	Slides	Video	R-2R Resistor ladder Waveform Generator				
4	Wed	Derek, Chandan										
			2:00 PM	1	Abstract	Slides	Video	Frequency Filtering with Band Pass Filters				
			2:15 PM	2	Abstract	Slides	Video	Thermal Conductivities of Liquids				
			2:30 PM	3	Abstract	Slides	Video	Frequency-Domain Analysis of Oscillations				
			2:45 PM	4	Abstract	Slides	Video	Factors Affecting the Observed Properties of Sound				
5	Wed	Derek, Grant										
			4:00 PM	1	Abstract	Slides	Video	Reaction Time for Various Frequencies of Sound				
			4:15 PM	2	Abstract	Slides	Video	Frequency Response of an RC Low Pass Filter Syster				
			4:30 PM	3	Abstract	Slides	Video	Doppler Effect				
			4:45 PM	4	Abstract	Slides	Video	AM Radio Transmitter				

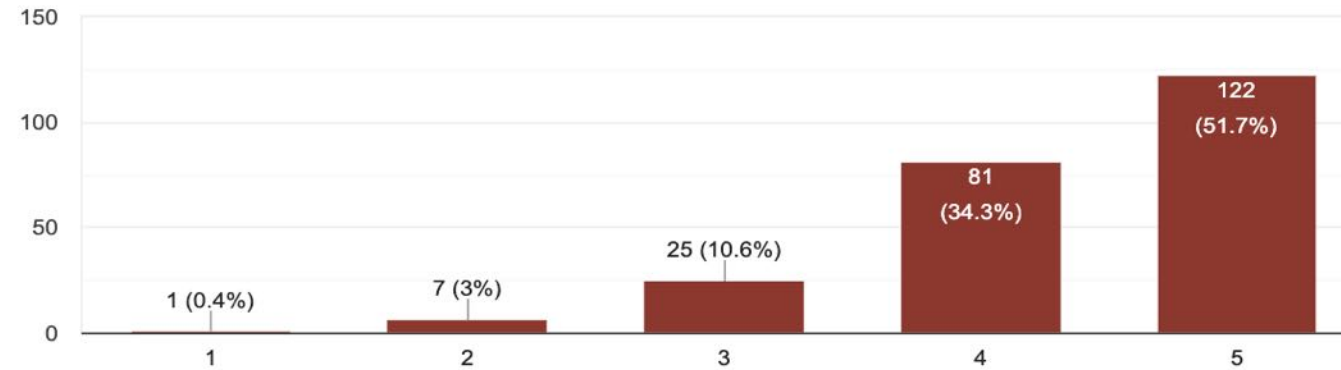
Students' Survey Results

Arduino/Python is useful and fun to learn?

Arduino

Do you think Arduino is useful and fun to learn?

236 responses



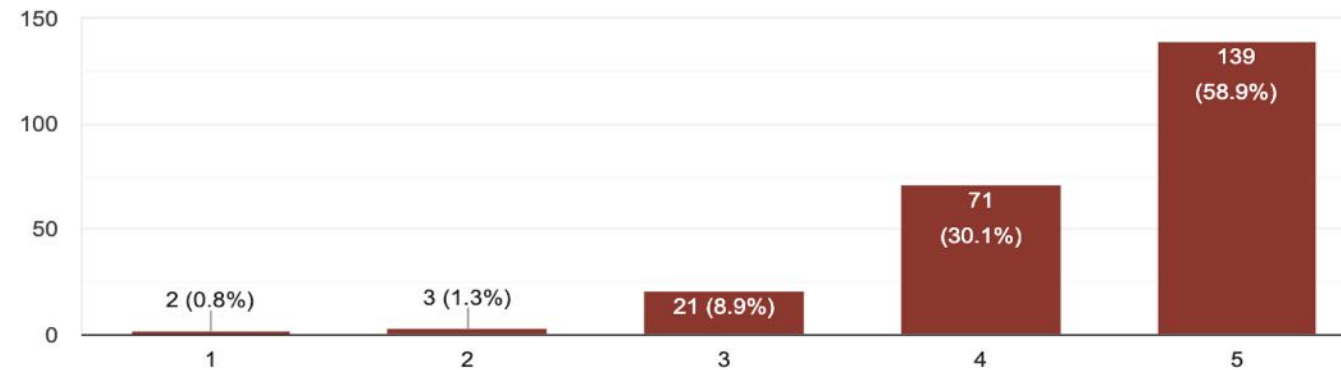
No!

Yes!

Python

Do you think Python is useful and fun to learn?

236 responses



No!

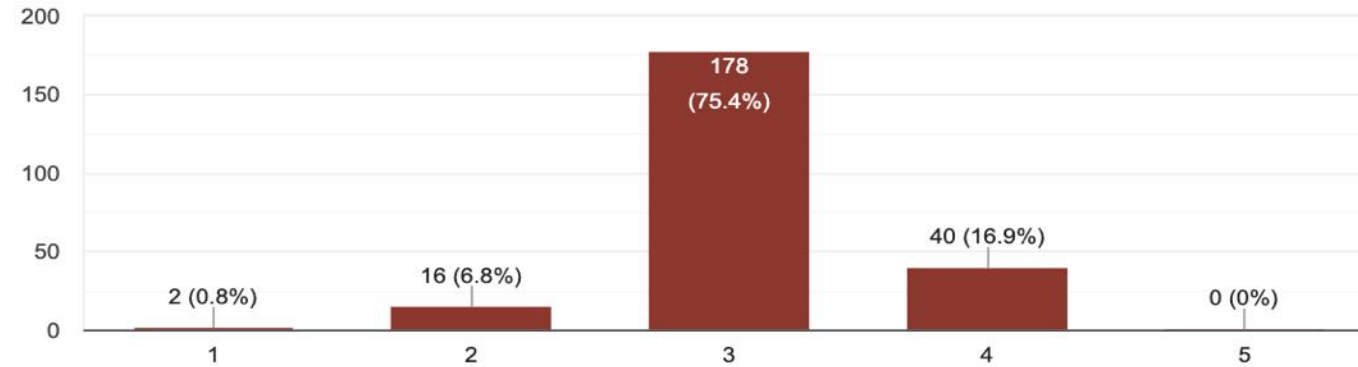
Yes!

Difficulty and Workload are appropriate?

Difficulty

Is the material too easy or too difficult?

236 responses



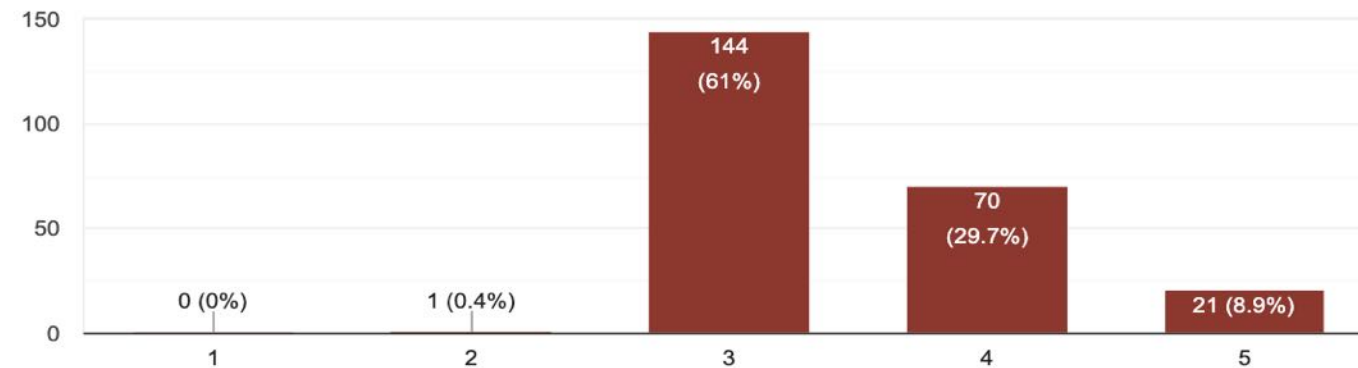
Too easy

Too difficult

Workload

Is the course load appropriate?

236 responses



Too low

Too much

Students' Suggestions and Comments

- You all are doing great, by far the most fun class I have this quarter, thank you for all the effort you guys have been putting into this, I figure it's got to be really hard putting together a remote lab, but you guys are doing a pretty dang good job :)
- I think this course is a great improvement over the previous 4AL/4BL. We are learning marketable skills with Arduino and Python and the course development team is very receptive to feedback and constantly tries to make the class better. Thank you!
- The videos demonstrating how to use python and how to set up experiments have been extremely helpful, especially to someone like myself who has no experience with this as I've not taken 4AL.
- I actually enjoy going through the python code and writing code for the Arduino. As one who does not have too much coding experience nor like coding as much, it's actually beneficial to go line by line for me to understand what is going on in the program.
- Labs are more enjoyable than regular classes because they are less intense and more hands-on.
- I'm having fun with this lab class!! I like how everything seems appropriate and the extra optional things you allow for the more advanced students to explore, or for those who finish early. Thank you!!

June 10, 2020

Newsroom

[Categories](#)[For news media](#)

STUDENTS + CAMPUS

Instructors' foresight leads to remote learning success for physics labs

COVID-19 pandemic further confirmed the benefits of letting students design their own experiments

