Introduction & Syllabus

ECE 111 Introduction to ECE

Please visit Bison Academy for corresponding
lecture notes, homework sets, and solutions

What is Electrical / Computer / Software Engineering?

Electrical Engineering	Computer Engineering	Software Engineering
Devices that use electricity (Electronics, Filters, Interface to a Computer) May or may not include a computer	Software and Hardware tied to a computer Read inputs & control outputs using software Low Level Programming: *Read Sensors* *Drive Actuators* Mid-Level Programming: *Get a quad-copter to hover* *Typical: 100-1000 lines of code*	Focus purely on Software May include some hardware (It helps to know what the program does when you write it) High-Level Programming *Artficial Intelligence* *Get quad-copters to swarm* *Do a gradient search to find the gas leak* *1000+ lines of code*

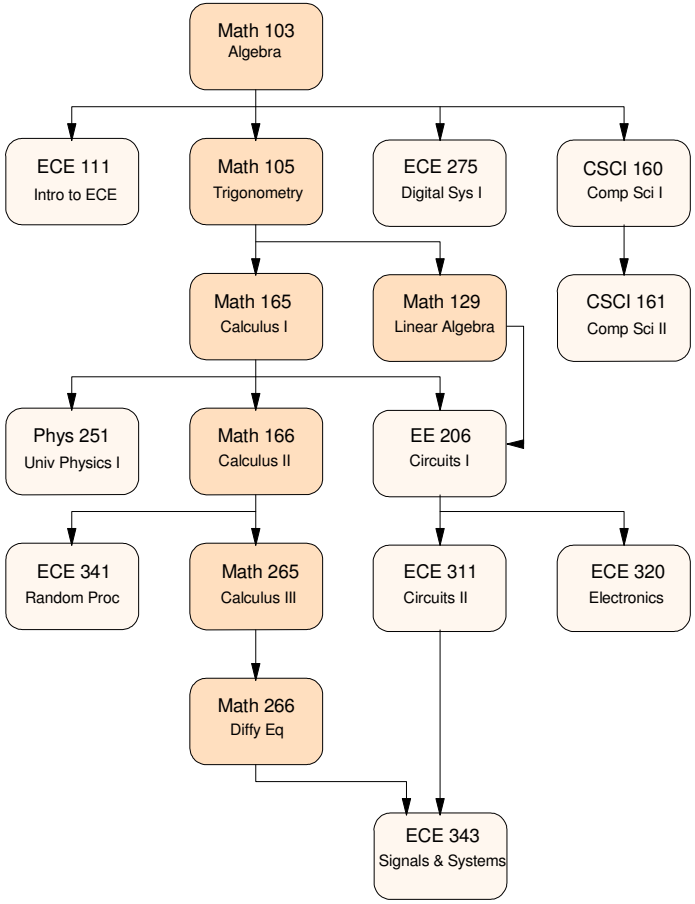
Why ECE 111 Exists

Recruiting

- We lose about half of our students in the math sequence
- ECE 111 exposes you to what you'll see in ECE early in the program
- It's a fun major. All that math is useful.
- Stick it out: it gets better.

Matlab Programming Class

- Matlab is a computer program used extensively in ECE
- (Matlab is essentially a calculator on steroids)
- Feedback from students: It would be nice if there was a course that taught you how to use Matlab
- That is ECE 111



Course Content: Week 2

Use Matlab to solve problems similar to what you'll encounter in various courses.

Use numerical techniques to solve these problems

- Focus is on use of Matlab

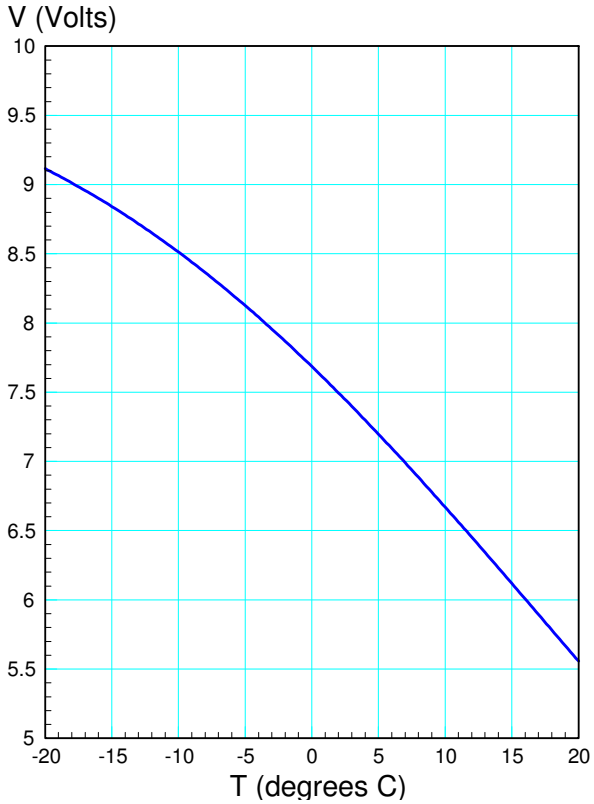
Theory & solving by hand comes later, when you take these courses

Math 103 Algebra I (Week 2)

- Solve 1 equation for 1 unknown
- Using Matlab, itterate to find the answer

Example:

- If V = 7.50, what is T?



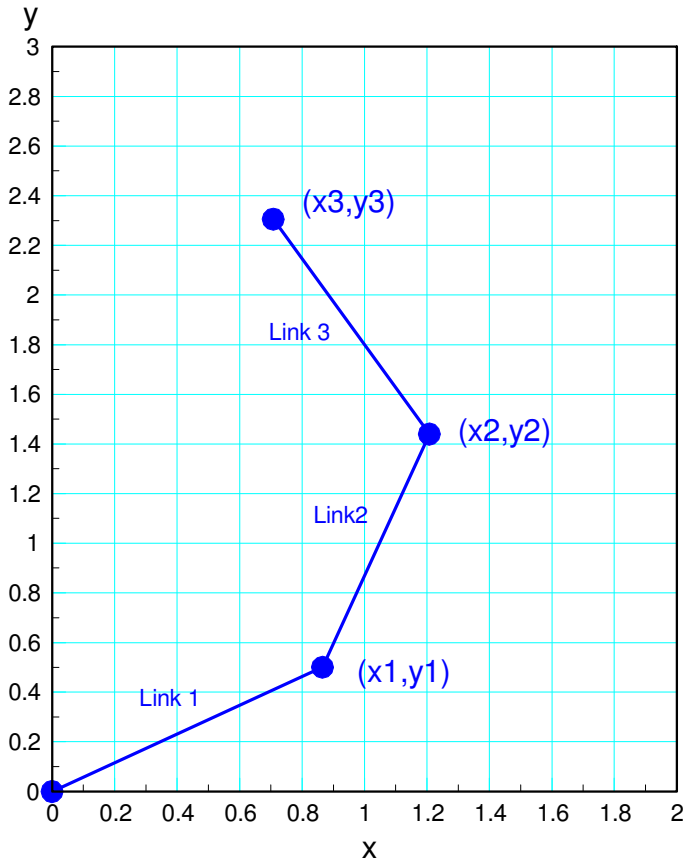
Course Content: Week 3

Math 105: Trigonometry

- Find the tip position of a robotic arm given the joint angles
  - Forward Kinmatics
- Find the joing angles given the tip position
  - Inverse Kinematics
- Show the motion of a roboic arm as it moves

Animation in Matlab

- Use Matlab to show the motion of the robotic arm
- (Matlab has really good animation)

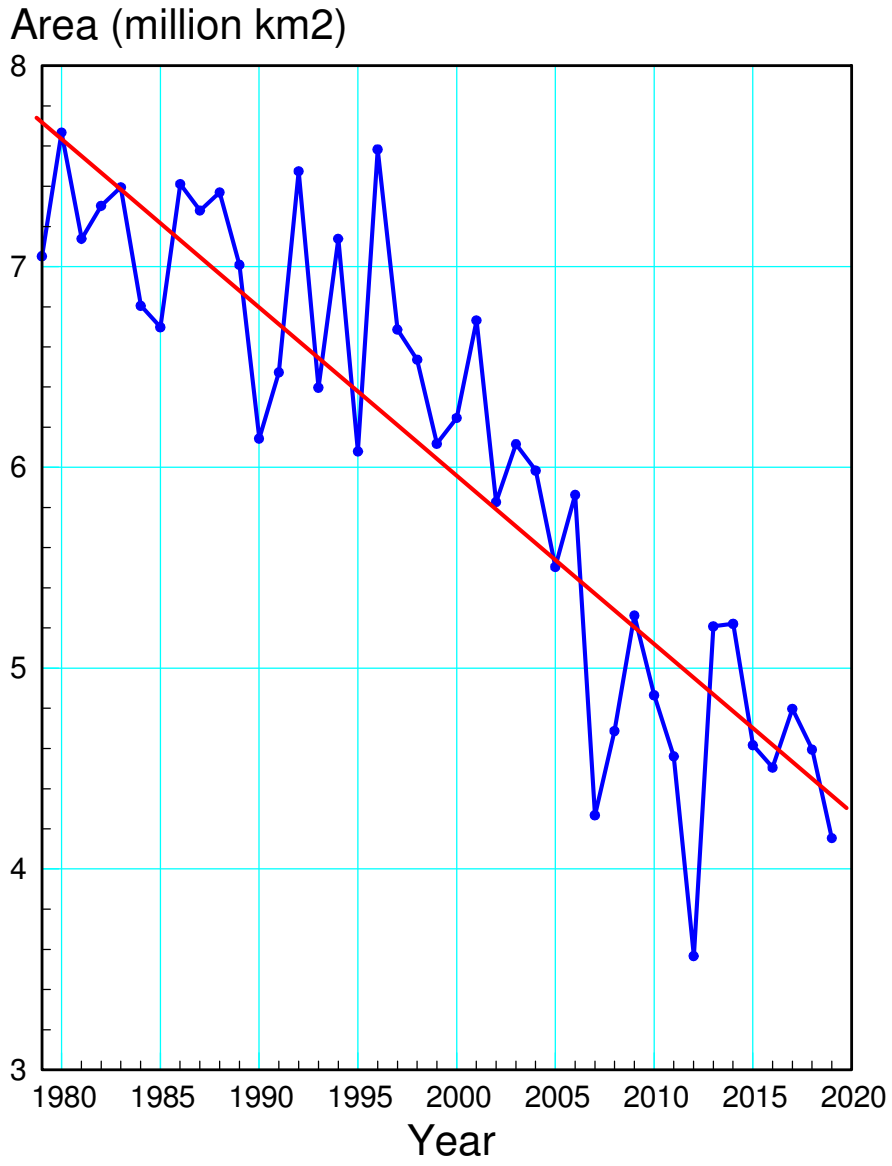


Course Content: Week 4

Linear Algebra

- Solve N equations for N unkowns
- Curve Fitting
  - Find a function to approximate your data
- Use real data to practice curve fitting
  - Example: Arctic Sea Ice Area

What does this imply?



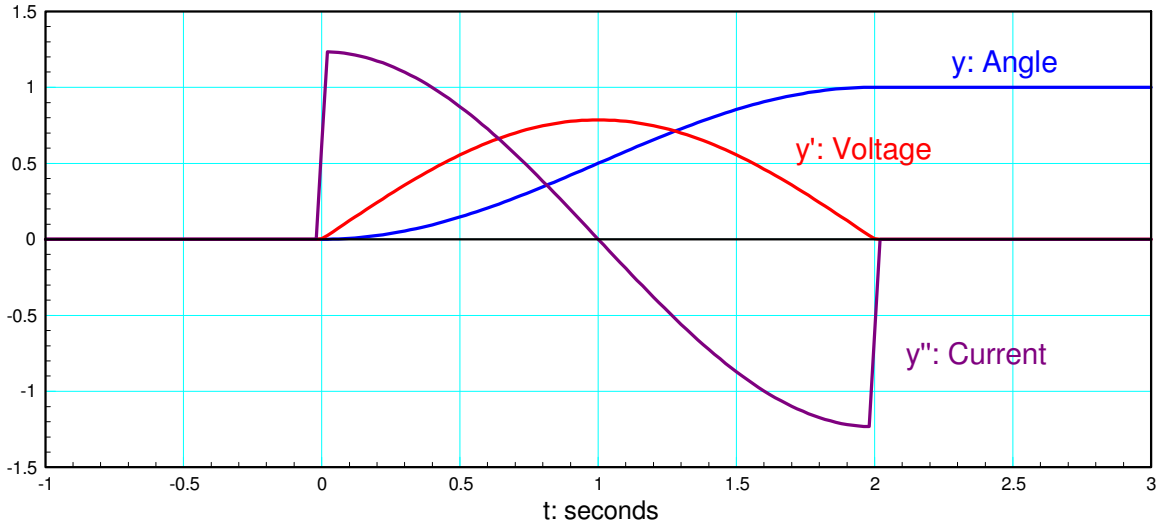
Course Content: Week 6

Math 165: Calculus I (Differentiation)

- Use numerical methods to determine the derivative of a function
- (Wait until you take Math 165 to find the derivatives by hand)

Using this numerical solution...

- Determine the voltages needed to drive a robotic arm
  - 1st derivative of angle
- Determine the currents needed to drive a robotic arm
  - 2nd derivative of angle



Course Content: Overall

16 weeks = 16 topics covered in ECE 111

- Using numerical methods and Matlab, you can solve problems from these courses
- Solution by hand will wait until you take these courses

Matlab is a really useful tool

- You can solve all sorts of problems with it

		Lecture (ECE & Matlab)
1	Aug 22	Introduction Slide 0: Introduction - Matlab Basics Week 1 Slides
2	Aug 29	Math 103: Algebra 1 Week 2 Slides Solving one equation for one unknown
3	Sept 5	Math 105: Trigonometry Week 3 Slides Polar to rectangular conversions
4	Sept 12	Math 129: Linear Algebra Week 4 Slides Solving N equations for N unknowns
5	Sept 19	Renewable Energy Week 5 Slides Wind and Solar Energy *South Australia & Renewable Energy (article)* *Renewables hit 146% in South Australia (article)* *Wind & Solar hit 61% in Australia (article)*
6	Sept 26	Math 165: Calculus 1 Week 6 Slides Differentiation
7	Oct 3	Math 166: Calculus II Week 7 Slides Integration
8	Oct 10	EE 206: Circuits I Week 8 Slides Kirchoffs Laws, Resistor Circuits, HP42 Calculator (Free42)

Course Information

Instructor:	Jake Glower
Lecture:	Tuesdays
	also live streamed on Zoom
	also available on YouTube
Recitation:	Thursdays
Office:	ECE 101
Office Hours	t.b.d.

Bulletin Description:

Introduction to electrical and computer engineering problem solving, design and professional issues. 3 lectures. Prereq: MATH 103.

Course Objectives:

By the end of the semester, students should:

- Know what courses he/she needs to take to graduate in Electrical or Computer engineering,
- Be able to solve problems from various areas of ECE using Matlab, and
- Be able to use functions of Matlab, including plotting, creating m-files, and writing scripts

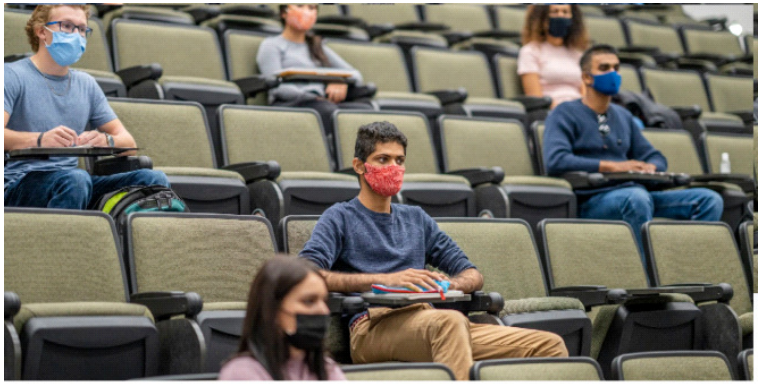
Hy-Flex Model for ECE 111

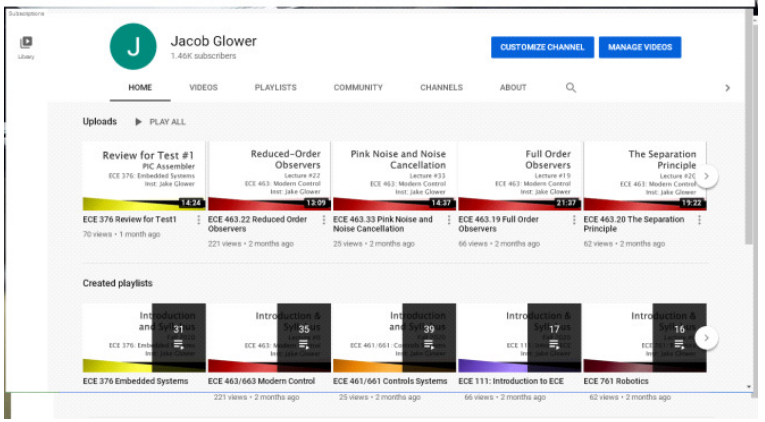
Students are welcome to take this course however they like:

- In-Person: Students are welcome to addend class at the designated class time and location.
- Live-Stream: Students are also welcome to live-steam the class. A link with how to connect will be sent out at the start of the semester on BlackBoard and to your NDSU email address.
- On-Line: Students are also welcome to take the class on-line and fit lectures into their own schedule.

It doesn't matter which section you signed up for

- You can attend however you like
- There's plenty of room



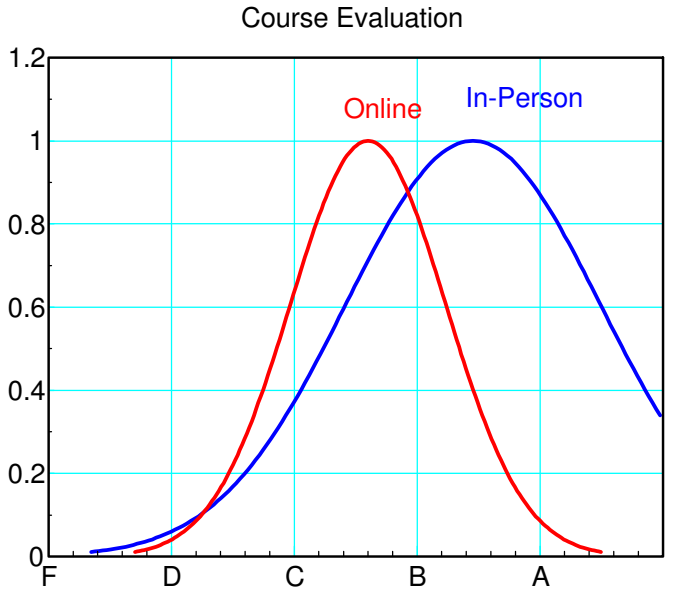


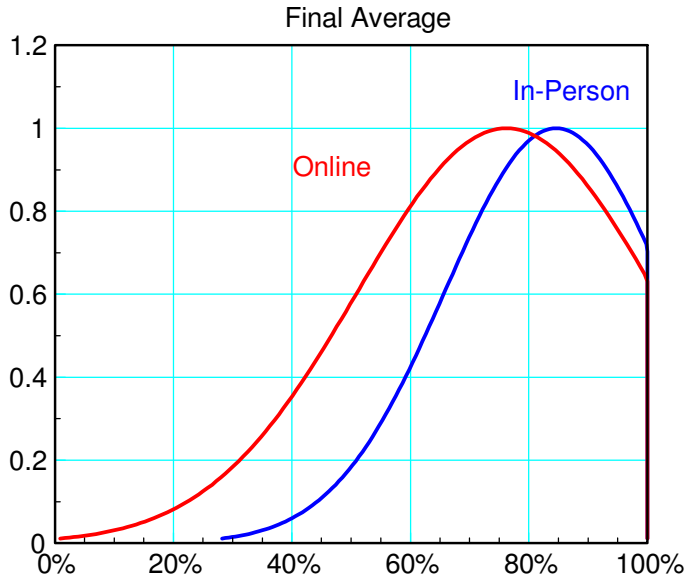
However....

In-Person is better than online

- Coure evaluations were a letter grade higher for people who took the course in-person vs. live-stream or online.
- Student's overall average was 7% higher for students who signed up for the in-person version of the class than the online version.

Given a choice, I'd take the class in-person

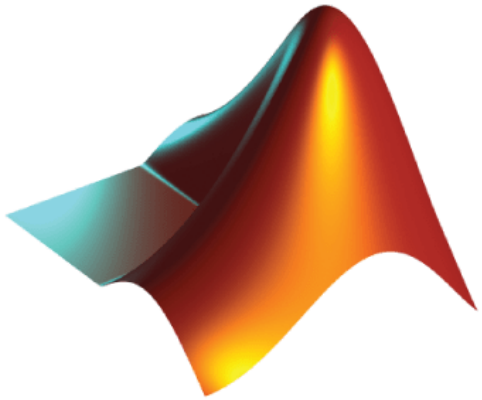




Required Student Resources:

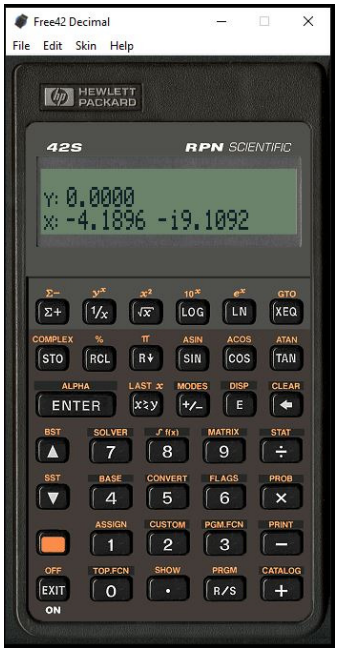
Matlab (free!)

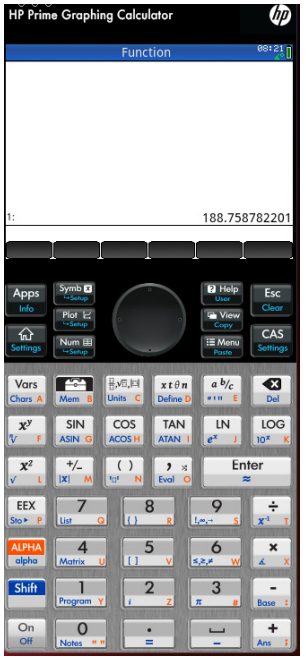
- Available on all computers in Engineering
- Also available for personal use
- Download instruction under ECE 111 / Resources



Calculator capable of complex numbers

- Free42: HP42s *highly* recommended
  - $345 on Amazon (DM42)
  - **Free app for your cell phone (Free42)**
  - Worth about 10 points on midterms
  - Does have a learning curve.
- HP-Prime also works
  - $136 from Amazon
  - *can sometimes find on ebay for $50*
  - Also worth about 10 points on midterms
- Most ECE students use TI84 Plus
  - $100 from Amazon





Text Book

- www.BisonAcademy.com (free!)
- Available to all current and former ECE students
  - Good reference if you forget something
- All lectures available as a pdf file or as a YouTube video (for online students)

ECE 111: Introduction to ECE

Syllabus - HW & Solutions - Resources - Comments

		Lecture (ECE & Matlab)	Videos YouTube Playlist	Handouts & Sample Code	Homework
1	Aug 22	Introduction Slide 0: Introduction - Matlab Basics Week 1 Slides	0: Introduction 1: Matlab Basics	Download Matlab Dice For Loop While Loop	HW #1
2	Aug 29	Math 103: Algebra 1 Week 2 Slides Solving one equation for one unknown	2: Algebra 1	2 Handout	HW #2

Homework & Solutions

Posted on Bison Academy

- Due the following class period
- Hardcopy, submit on Blackboard, or email me
- email: Include ECE 111 in the subject line

Solutions to these homework sets will be posted after they're due

- Plus we'll go over the solutions in class
- Plus there will be links to YouTube videos were I go over the homework (for online students)

Homework sets and solutions from previous semesters are also available

- Good resource if you get stuck and need help

ECE 111: Introduction to ECE

Homework Sets and Solutions

Syllabus - HW & Solutions - Resources - Comments

Fa21	Sp21	Fa20
1: Matlab Basics Solution #1 (pdf) Solution #1 (YouTube)	1: Matlab Basics Solution #1	1: Matlab Basics Solutions #1
2: Plotting Solution #2 (pdf) Solution #2 (YouTube)	2: Plotting Solution #2	2: Plotting Solution #2
3: Curve Fitting Solution #3 (pdf)	3: Curve Fitting Solution #3	3: Curve Fitting Solution #3
4: Wind Energy Solution #4 (pdf) Solution #4 (YouTube)	4: Wind Energy Solution #4	4: Wind Energy Solution #4
5: Kirchoff□s Laws Solution #5 (pdf) Solution #5 (YouTube)	5: Kirchoff□s Laws Solution #5	5: Kirchoff□s Laws Solution #5
6: KCL & KVN Solution #6 (pdf) Solution #6 (YouTube)	6: KCL & KVN Solution #6	6: KCL & KVN Solution #6
7: RC Circuits Solution #7 (pdf) Solution #7 (YouTube)	7: RC Circuits Solution #7	7: RC Circuits Solution #7
8: RLC Circuits Solution #8 (pdf)	8: RLC Circuits Solution #8	8: RLC Circuits Solution #8
9: Phasors Solution #9 (pdf) Solution #9 YouTube)	9: Phasors Solution #9	9: Phasors Solution #9
10: Filters Solution #10 (pdf) Solution #10 (YouTube)	10: Filters Solution #10	10: Filters Solution #10
11: Fourier Xform Solution #11 (pdf) Solution #11 (YouTube)	11: Fourier Xform Solution #11	11: Fourier Xform Solution #11
12: Statistics Solution #12 (pdf) Solution #12 (YouTube)	12: Statistics Solution #12	12: Statistics Solution #12

Submitting Homework Sets

Homework can be submitted as

- Hard copy (in-person),
- Uploaded to BlackBoard, or
- Email to the instructor

For electronic submission, MS Word works well

- Copy and paste Matlab code in to MS Word
- Use snipping tool to copy and paste images into Word
- Document that you're using Matlab and got the correct answer

jpg and pdf files are also OK

- As long as I can open and read your file, I'm OK

Resources

Where to go to get CircuitLab

- Free to NDSU students
- Use your NDSU email address when registering

Were to go to get Matlab

- Available on engineering computers
- Free to NDSU students
- Need to request a license from NDSU

Various Data Sets

- Backup in case the data set is removed
- Used throughout ECE 111

Circuit Simulators

- Cicuit Lab ($24/year)
- LTSpice
  - Instructions for using LTSpice (youtube)
- PartSim

Matlab

- Download Matlab (link to NDSU license)
- Matlab for Beginners

HP35s Calculator

- RPN and Stacks
- Complex Numbers
- Solving f(x) = 0

SciLab

- Dowload latest version of SciLab
- Scilab for Beginners
- Download SciLab 5.3.3
- Scilab Controls System Toolbox (for SciLab 5.3.3)
- Control Systems Toolbox Instructions

StatTrek

- Normal Distribution
- t-Tables
- Chi-Squared Tables
- F-Tables

Weather Data

- National Weather Service
- National Oceanic and Atmospheric Administration (CO2 Levels)
- National Oceanic and Atmospheric Administration: Global Temperatures
- National Snow and Ice Data Center (Arctic Sea Ice)
- NDAWN: North Dakota Weather

Data Sets (from above locations)

- CO2 Levels vs Year (from NOAA)
- Temperature Deviations (from NOAA)
- Arctic Sea Ice (from NSIDC)

Evaluation Procedures and Grading Criteria

Grades will be the average of the following:

Homework	Final Exam
100%	none

Grades are rounded to the nearest 1%, with your final grade being

F	D	C	B	A
59% or less	60% - 69%	70% - 79%	80% - 89%	90% or more

Note: The objective of this course is to expose you to areas of ECE and get you familiar with Matlab. If you do the homework and projects, I expect you will have no problem getting an A or B.

Lectures

- Tuesdays
- Also live streamed on Zoom
- Also recorded and posted on YouTube
- Present a typical problem you will see in different core classes
- Present how to use Matlab to solve these problems using numerical methods
  - How to solve these by hand is covered in the actual class

Note:

- Focus for ECE 111:
  - Using Matlab
  - Using numerical methods to solve problems
  - Foreshadowing of the ECE courses
- If you're a little fuzzy on the theory of the material, that's OK. The first time is always the hardest.

		Lecture (ECE & Matlab)	Videos & Sample Code YouTube Playlist
1	Aug 23	ECE 111 Syllabus Syllabus Matlab Basics Week #1: Slides *Input a matrix, addition, multiplication*	0 Syllabus 1 Matlab Basics
2	Aug 30	Math 105: Trigenometry Week #2 Slides *Plotting in Matlab.*	2 Trigenometry
3	Sep 6	Math 129: Linear Algebra Week #3 Slides *Solving N equations for N unknowns*	3 Linear Algebra
4	Sep 13	Math 165: Calculus Week #4 Slides *Integration, Differentiation, Functions in Matlab*	4 Calculus
5	Sep 20	EE 206: Circuits I Week #5 Slides Kirchoffs Laws, Resistor Circuits	5 Circuits I
6	Sep 27	EE 206: Circuits I Week #6 Slides Voltage Nodes, Current Loops	6 KVN/KCL
7	Oct 4	ECE 311: Circuits II Week #7 Slides *Capacitors & Heat Equation*	7 Circuits II Leyden Jar (EB)
8	Oct 11	ECE 351: Electromagnetics Week #8 Slides *Wave Equation, Reflection Coefficients*	8 Emag Magnetism (EB)
9	Oct 18	ECE 311: Circuits II Week #9 Slides RC Circuits with Sinusoidal Inputs	9 Circuits II HP42 Tutorial
10	Oct 25	ECE 343: Signals Week #10 Slides Filter Design, Poles and Zeros	10 Signals
11	Nov 1	ECE 343: Signals Week #11 Slides Frequency content of a signal	11 Signals
12	Nov 8	ECE 341: Random Processes Week #12 Slides Normal distribution and student t-test	12 Random

Recitation

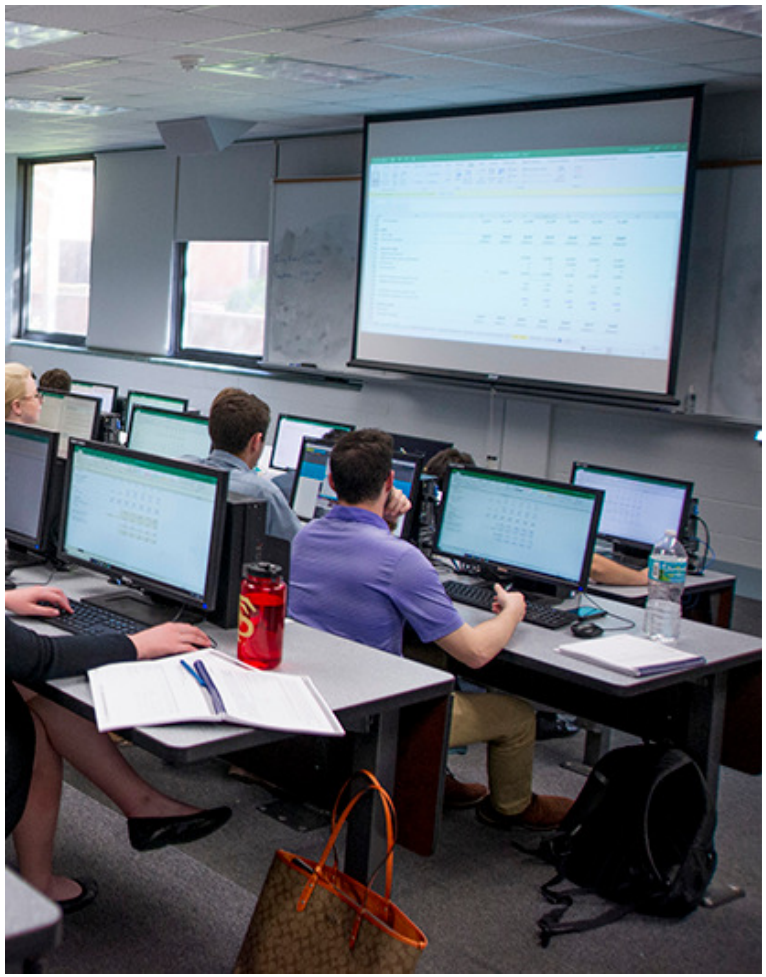
- Thursday
- In-Person only (zoom doesn't work for this)
- Plenty of room - feel free to attend regardless of which section you signed up for.

Recitation is held in a computer lab (ideally)

- TA & instructor will be there to help you with that week's homework
- With programming, its *much* easier to have someone show you rather than reading the manuals
- Solutions to previous homework sets are also useful

Recitation is optional

- If you would like help with Matlab, please feel free to attend recitation.
- If you can do the homework without the need of any help, you don't need to show up



Legal Stuff:

- Attendance: According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Students are responsible for the material covered in class and in assignments regardless of their attendance. Note that all lecture notes, homework sets, and solutions are available on-line at www.BisonAcademy.com
- Students with Special Needs: Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.
- Academic Honesty: The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.
- Academic Honesty Defined: All written and oral presentations must "respect the intellectual rights of others. Statements lifted verbatim from publications must be cited as quotations. Ideas, summaries or paraphrased material, and other information taken from the literature must be properly referenced" (Guidelines for the Presentation of Disquisitions, NDSU Graduate School).
- ECE Honor Code: On my honor I will not give nor receive unauthorized assistance in completing assignments and work submitted for review or assessment.
- Veterans and Student Soldiers: Veterans and student soldiers with special circumstances or who are activated are encouraged to notify the instructor in advance.