THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON. DC

SCHOOL OF ENGINEERING AND APPLIED SCIENCE
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
ECE 2115: ENGINEERING ELECTRONICS LABORATORY

Introduction to the ECE 2115 Lab

All communication from GTA to the student will take place via email, typically through Blackboard. Blackboard delivers email to your GWU email account by default. Ensure that your GWU account is active and is set to forward to an email account that you check regularly.

LABPOLICY and SAFETY RULES:

·Do **NOT** eat, drink, or smoke in the lab (you are responsible for damaged lab equipment).

·Do **NOT** play with unknown equipment (ask the GTA or lab staff if you are interested).

·Do **NOT** leave live/turned on circuits, experiments, soldering irons, etc. unattended.

·Do **NOT** touch live circuits (turn the power supply output off first).

·Do **NOT** wear loose/long metal jewelry that can short a circuit.

·Do **NOT** wear open-toed shoes.

·Do **NOT** work alone in the lab.

·If any faults with equipment are suspected, notify the GTA and lab staff immediately.

·Be aware of energy storage devices, e.g. capacitors, they can discharge and hurt you if mishandled.

·**ALWAYS** use the current limiting function of the power supply to keep the current either at or below 100mA (consult the GTA if you need more).

·**ALWAYS** clean up lab bench and work area after completion of an experiment:

  ○ Throw away all trash, used resistors, stripped wire pieces, etc.
  ○ Turn off all equipment (except the PCs).

·If an electrical accident occurs:
  ○ Immediately turn off the main circuit breaker.
  ○ Be aware of the location of the emergency "stop" and "trip" buttons of all equipment used in the lab.
  ○ Use the Emergency phone to call UPD at **4-6111.**
  ○ Notify your GTA and Staff in SEH 5450.

IMPORTANT LINKS

ECE 2115 Lab Website: https://blogs.gwu.edu/ece2115/
ECE Labs Website:
ECE Department Website: http://www.ece.seas.gwu.edu/
GWU Blackboard Website: http://blackboard.gwu.edu/
Lab Safety Information:
https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment

Textbooks and Manuals

1. *Microelectronic Circuits*, 6th edition, A. S. Sedra and K. C. Smith, Oxford. ISBN 0195323033

2. *Multisim User Manual*, National Instruments.
   http://www.ni.com/pdf/manuals/374483d.pdf

3. *Multisim Component Reference Guide*, National Instruments.
   http://www.ni.com/pdf/manuals/374485a.pdf

Supplies and Software

Parts Kits

Parts Kits must be purchased from the equipment room (SEH 5450) **before** Lab 1. They contain all the necessary components for the entire ECE 2115 laboratory. This includes the specific components necessary for ECE 2115. Check in the equipment room for the current prices. **Only checks** or **money orders** are accepted and must be made out to The George Washington University.

Extra Parts

Additional parts may be purchased from the equipment room or any of the vendors listed in the Vendors Pages. As mentioned above, the parts kit includes everything you should need for the entire ECE 2115 lab, so you may want to double check with your GTA first before purchasing any additional components.

Software

National Instruments Multisim 12.0 (Education Edition) is already available on all laboratory PCs on the third floor of Tompkins Hall. A free, but limited, Academic Evaluation Edition is available to download and install on your own PC from National Instrument's website. In addition, there is a Student Edition available at a reduced cost that can be downloaded and installed as well. The Student Edition is not quite the same as what is installed on the laboratory PCs. You are required to come to the lab if something is not working from home. A tutorial is posted on the ECE 2110 lab website explaining in detail how to install NI Multisim on your own PC. **Installing Multisim at Home**

Video Links

1. Tutorial on how to use AD2 part 1:

    a. https://www.youtube.com/watch?v=AeryCkdaapw&feature=youtu.be (18:37)

        i.   Intro: 00:00

        ii. AD2 Wire Overview: 01:20

        iii. Waveforms Intro: 03:56

        iv. DMM: 06:23

2. Tutorial on how to use AD2 part 2:

    a. https://www.youtube.com/watch?v=XS4EEofNc6Y&feature=youtu.be (29:41)

        i.   Intro: 00:00

        ii. Function Generator: 01:49

        iii. Oscilloscope: 05:30

3. Introduction to the AD2: https://www.youtube.com/watch?v=HUAy0J3XqaU (8:30)

4. General Software Download Video: https://www.youtube.com/watch?v=2nAvh28o-t4 (3:14)

    a. Windows:https://www.youtube.com/watch?v=Sz0nDa8TVYw&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=3

    b. Mac:https://www.youtube.com/watch?v=4-O6-vTMIHg&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=4

    c.   Linux: https://www.youtube.com/watch?v=uYc8-HwGNCA&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=5

5. Waveforms Download Page: https://mautic.digilentinc.com/waveforms-download?_ga=2.176040740.706418812.1597965181-790061554.1594219010

6. Oscilloscope:https://www.youtube.com/watch?v=ln1ETnKmKk8&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=7 (10:44)

7. Waveform Generator (Wavegen):https://www.youtube.com/watch?v=OhRMF2jn8co&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=8 (11:51)

8. Power Supply:https://www.youtube.com/watch?v=EL5u7xVUBho&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=12 (2:50)

Figure 1 – Analog Discovery 2

LABORATORY PROCEDURE

Prelab

·It is graded separately from the lab itself and is a percentage of your final lab grade.

·You must complete the prelab *prior* to coming to the lab.

·It is due before the start of the lab, *no exceptions*. You must submit an electronic copy of the prelab to your GTA via email or Blackboard.

·Because your GTA may need to markup your prelab, a hard copy is necessary. Your electronic copy serves merely as proof that you completed the assignment on time.

·**Be sure to bring a 2ⁿᵈ hard copy of your prelab to lab, so that you can use it during lab.**

Experiment

·Write down all data from the experiments. Use of a logbook is recommended and may be required by your GTA. Use of **Microsoft Excel** for tabular data is useful as you are going along, but a logbook is preferred.

> *Note:* The lab manuals themselves have been designed to allow you to record your data directly in the tables in the PDF.

·Answer all questions pertaining to each experiment as required. Your data should include all calculations, circuit diagrams, graphs, and data tables. Your interpretation and comprehension of the experimental results should be described in a concluding statement and placed in your report.

Report

·You must submit both an electronic (Word doc and PDF formats) and paper copy of your lab reports before the beginning of the following lab.

·You must submit the electronic copy through Blackboard or email *prior* to coming to lab.

·You must use the lab report format and template posted on the lab website. Ask your GTA if you are uncertain before submitting your first lab report.

·See the ECE 2115 Lab website to find the current lab report format and template. This will be covered in detail by your GTA during this lab. If there is anything you do not understand regarding the lab report format, be certain to ask your GTA prior to submitting your first lab.

Grading

·For a percentage breakdown of your lab grade, refer to the **Grade** section of the ECE 2115 website or ask the GTA.

·Grades will be regularly posted to Blackboard.

GENERAL LAB INFORMATION

Midterm and Final Project

·There will be a Midterm Project and a Final Project for the course. Each project grade consists of a working demonstration of your design, a professional oral presentation of 5-10 minutes, and a formal written report.

Office Hours

·Your GTA will have 2 hours of office hours each week. The time and location of your GTA's office hours as well as those for other GTAs for ECE 2115 will be posted on the lab website. You may come to any GTA's office hours to ask questions regarding the lab or homework.

Attendance

·You are expected to be present at every lecture and laboratory session. No make-up sessions will be held. Please arrive to the lab on time with all necessary materials (toolbox, parts kit, etc.). **Do not forget to sign the attendance sheet at the beginning of each lab.**

Academic Integrity

·Students in this lab are expected to do their own work, turn in all work on time, and attend all classes (there will be no make-up classes). Academic dishonesty will not be tolerated. Your lab reports must be fully your own, and it will be very easy for a GTA to recognize plagiarism. Do not try to use lab reports from previous students or shared simulation data. It is critical that you do your own work in this lab. Please review the University's **Code of Academic Integrity**.

REVIEW OF ECE 2110: CIRCUIT THEORY

·**Simulate**, **Build**, and **Measure** all of the current and voltages of a simple series-parallel resistive circuit.
  - ○ Make sure you know how to limit the current of the DC power supply.
  - ○ Know how to properly connect the DMM to measure the current.

·**Design**, **Simulate**, **Build**, and **Measure** the frequency response of a passive low-pass filter.
  - ○ Be familiar with the oscilloscope and function generator.

REFRENCES

1. Introduction to the AD2: https://www.youtube.com/watch?v=HUAy0J3XqaU

2. General Software Download Video: https://www.youtube.com/watch?v=2nAvh28o-t4

    a. Windows:

        https://www.youtube.com/watch?v=Sz0nDa8TVYw&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=3

    b. Mac: https://www.youtube.com/watch?v=4-O6-vTMIHg&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=4

    c. Linux: https://www.youtube.com/watch?v=uYc8-HwGNCA&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=5

3. Waveforms Download Page: https://mautic.digilentinc.com/waveforms-download?_ga=2.176040740.706418812.1597965181-790061554.1594219010

4. Waveforms Reference Manual: https://s3-us-west-2.amazonaws.com/digilent/resources/instrumentation/waveforms/waveforms-2015_rm.pdf

5.
    Oscilloscope:https://www.youtube.com/watch?v=ln1ETnKmKk8&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=7

6. Waveform Generator
    (Wavegen):https://www.youtube.com/watch?v=OhRMF2jn8co&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=8

7.
    Voltmeter:https://www.youtube.com/watch?v=TckeAlHbH0k&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=9

8. Power
    Supply:https://www.youtube.com/watch?v=EL5u7xVUBho&list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91&index=12

9. Impedance Analyzer (Just the first two minutes to understand setup. Then use the meter tab, not the Analyzer Tab): https://www.youtube.com/watch?v=PTgfcvFuMa8&t=156s

10. Entire Video Playlist:https://www.youtube.com/playlist?list=PLSTiCUiN_BoLtf_bWtNzhb3VUP-KDvv91