ECE 2031: Electric Circuits Fundamentals Lab

1. ECE 2031 - Electric Circuits Fundamentals Lab

2. 1 credit, 2.5 contact hours, 2.5 hour lab

3. Course Coordinator: Dr. Alan Johnston

4. Text Book

    None

5. Specific Course Information

    a. Catalog Description Laboratory exercises cover electrical safety and laboratory practice, basic instrumentation, computer-aided circuit analysis, and application of electronic devices

    b. Prerequisites: None; Co-requisites: ECE 2030

    c. Required for B.S. Electrical Engineering

6. Course-specific Goals

    a. To become familiar with operating laboratory instrumentation, including power supplies, digital multimeters, signal generators and oscilloscopes. To become competent in building electric circuits and troubleshooting them to make them work successfully. To experimentally verify circuit concepts being learned in the theory section of the class. To learn about practical, real world issues in building electric circuits.

    b.

Student Outcomes						
1	2	3	4	5	6	7
X		X				

7. List of Covered Topics

    1. Basic Concepts
    2. Resistive Circuits
    3. Analysis Techniques
    4. Network Theorems
    5. Energy Storage Elements & Transient Behavior of First-Order Circuits
    6. AC Circuit Analysis
    7. 2nd Order Circuits
    8. AC Power

Approved by: Dr. Alan Johnston

Class Meetings

Section 001: T from 08:00 am to 10:30 am in CEER 208/Hybrid - Johnston

Section 002: M from 03:00 pm to 05:30 pm in CEER 208/Hybrid - Johnston

Section 003: T from 02:30 pm to 05:00 pm in CEER 208/Hybrid - Singh

Section 004: R from 02:30 pm to 05:00 pm in CEER 208/Hybrid - Wynne

Section 100: T from 06:10 pm to 08:40 pm online/Distance Learning - Konyk

Section 101: R from 06:10 pm to 08:40 pm in CEER 206/Hybrid - Wynne

Instructors

Sections 001 and 002:

Dr. Alan Johnston

431B Tolentine

610 -519-4972

alan.johnston@villanova.edu

Office Hours on Zoom by appointment

Section 003:

Dr. Pritpal Singh

406 Tolentine

610-519-7378

Pritpal.singh@villanova.edu

Office Hours: M 3:30-5:00 PM, other times by appointment

Sections 004 and 101:

Dr. Rosalind M. Wynne

429 Tolentine (USPS Mail), Blackboard Collaborate (Fall 2020 office hours)

(610) 519- 4294

Rosalind.wynne@villanova.edu

Office Hours: Tues. 12pm-2:30pm, other times by appointment

Section 100:

Dr. Stephen Konyk

440 Tolentine

(610) 519-4983

stephen.konyk@villanova.edu

Office Hours on Zoom by Appointment

TAs:

TBD

Office Hours

See above for each instructor's Office Hours.

Remember that the ECE department also has tutoring hours set up by all the TA's. Schedule will be set shortly after classes start.

Course Objectives

The objectives of this course are as follows:

1) **To become familiar with operating laboratory instrumentation, including power supplies, digital multimeters, signal generators and oscilloscopes**
2) **To become competent in building electric circuits and troubleshooting them to make them work successfully;**
3) **To experimentally verify circuit concepts being learned in the theory section of the class;**
4) **To learn about practical, real world issues in building electric circuits, interpreting schematic diagrams, and laying out circuits on a protoboard.**

You will conduct 11 laboratory experiments during the course of the semester. These are indicated below and are interspersed with the theory concepts that you will be learning. This ties the theory course to this lab course.

Course Objectives/Topics:

Basic Concepts

Charge, Current, Voltage, Energy and Power, Independent

and Dependent Sources.

Resistive Circuits

Resistance and Ohm's Law, Kirchhoff's Laws, Series-connected

Resistances, Voltage Divider Formula, Parallel-connected Conductances,

Current Divider Formula, Analysis of Series/Parallel Combinations of Resistances,

Resistive Bridges and Ladders, Practical Sources and Loading, Instrumentation.

Analysis Techniques

Nodal, Mesh and Loop Analysis Techniques.

Network Theorems

Linearity and Superposition, Source Transformations,

Thevenin's and Norton's Theorems, Maximum Power Transfer Theorem.

Energy Storage Elements & Transient Behavior of First-order Circuits

Capacitance, Inductance, Complete Response of First-order RC and RL Circuits.

AC Circuit Analysis

Sinusoidal Signals, Phasor Domain, Kirchhoff's Laws in Terms of Phasors,

Phasor Domain Analysis, Impedance Transformations, Equivalent Circuits.

2nd order circuits 1

Chap 6: 2nd order circuits – initial/final conditions 2nd order circuits; series and parallel RLC circuits

AC Power

P, Q, S, power factor, power factor compensation

Grading Policy

Your final grade will be determined from the following:

- Lab Reports: 100%

Late reports will have 25% per calendar weekday deducted from the grade. As part of the lab report grade, pop quizzes may be given and would count as part of the lab report grade.

The scale used to assign letter grades is:

Numerical Grade	Letter Grade	Numerical Grade	Letter Grade
A	93 to 100	C	73 to 76
A-	90 to 92	C-	70 to 72
B+	87 to 89	D+	67 to 69
B	83 to 86	D	63 to 66
B-	80 to 82	D-	60 to 62
C+	77 to 79	F	Less than 60

Inclusive Classroom

We consider this classroom to be a place where you will be treated with respect; and, we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

Attendance

Attendance policy will be set per instructor based on the Hybrid nature of the course. Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for *excused* absences to the appropriate Associate Dean. The form for requesting an *excused* absence can be found here:

https://www1.villanova.edu/content/villanova/engineering/students_secure/forms/studentAbsence.html

Submit one excused absence for each date that classes are missed. For illness or injury, this form must be submitted within 24 hours of missing class.

The University's list of excused absences for all students includes the following:

- participation in NCAA athletic competitions
- participation in special academic events (e.g., conferences, field trips, project competitions)
- participation in official university business (e.g., student representatives attending meetings related to university governance)
- attendance at significant events involving the immediate family (e.g., funerals, weddings)
- religious holidays - see the University's policy on Religious Holidays
- college-approved participation in placement activities (e.g., job interviews, graduate school interviews, attending job fairs)
- documented serious illness or disability (see below how to document)

Any lab missed because of one of the valid, excused absences listed above must be made up as soon as possible by arranging a makeup lab session with the course TA.

Course Materials

There is no separate textbook for this lab course. The course textbook for the theory course as listed below will be used as the textbook for this lab course.

Online Textbook: zyBooks: https://learn.zybooks.com/zybook/VILLANOVAECE2030Fall2020 (The first time you will need to click on the Create Account button and follow the instructions).

Free PDF Version for Download: Ulaby, Maharbiz and Furse, "Circuit Analysis & Design", Michigan Publishing, 2018. https://www.publishing.umich.edu/publications/ee/ (Note that problem and example numbers are different from zyBooks version)

Academic Integrity

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs.

The University's academic integrity policy can be found here: https://www1.villanova.edu/villanova/provost/resources/student/policies/integrity.html.

The College of Engineering has adopted the following exam/lab final guidelines:

- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must write and sign the following statement, "*I have neither given nor received any unauthorized assistance in the completion of this exam.*"

General guidelines:

- Each student is expected to work individually during the exam with no interaction with other students.
- Students can work together on assignments, but each person must turn in their own copy.
- In the lab, work is to be done individually, however, you can ask questions of other students.

Adherence to the Student Code of Conduct and the CARITAS Commitment

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Students, faculty, and staff are expected to comply with the CARITAS Commitment. Students must wear masks, practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

Online Expectations

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

Students with Disabilities

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability please contact me after class or during office hours to make arrangements.

If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at learning.support.services@villanova.edu as soon as possible. Registration is needed to receive accommodations.

The Office of Disability Services collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities @ 610-519-3209 or visit the office on the second floor of the Connelly Center.

Schedule

This lab course is being taught in a new Hybrid mode using new equipment. As a result, the following schedule is tentative and may change. If the labs take longer than one week to perform, then we will adjust the schedule and number of labs accordingly.

Lab	Monday	Tuesday	Thursday	Title
	8/17	8/18	8/20	Online Safety Training
	8/24	8/25	8/27	Pickup Kit
	8/31	9/1	9/3	Introduction to Course
Lab 1	9/14	9/8	9/10	Resistors
Lab 2	9/21	9/15	9/17	Kirchhoff Voltage and Current Laws
Lab 3	9/28	9/22	9/24	Power Supplies
Lab 4	10/5	9/29	10/1	The Wheatstone Bridge
Lab 5	10/12	10/6	10/8	Circuit Simulations
Lab 6	10/19	10/13	10/15	Maximum Power Transfer
Lab 7	10/26	10/20	10/22	DC Behavior of Capacitors
Lab 8	11/2	10/27	10/29	Inductors
Lab 9	11/9	11/3	11/5	AC Response of Inductors and Capacitors
Lab 10	11/16	11/10	11/12	Inductor-Capacitor Networks and Max. Power Transfer for AC Circuit

Assignments and Assessments

All assignments are to be submitted online on Blackboard in PDF format. You will be required to use the Respondus lockdown browser and other related tools during assessments. All assignments are to be submitted individually.

The Learner's Studio

Villanova's Learners' Studio provides free 1:1 and small group (max of 10 students) content tutoring for over 100 courses on campus (excludes writing, math, and entry level VSB courses). From quick homework clarification questions to prep for final exams, we can help! Our peer tutors are each endorsed by two faculty members and are trained according to CRLA national standards. Pop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length. We are located in Old Falvey 301.

Walk-ins welcome, or book in advance online:

1. Visit Villanova.mywconline.com

2. Register for an account and select “The Learners’ Studio” from the drop-down menu on the sign-in page
3. Use the “limit to” menu to locate your course by code (For example, PHY 2400). This feature will sort the schedule and show you all tutors approved to cover your class
4. White boxes represent available sessions. Click any white box to book

Don’t see your class listed? Request a tutor for a missing subject with this link: tutorrequest.villanova.edu

For more information, contact juliana.studer@villanova.edu 610-519-5862.

Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, etc., during class is limited to use according to the Student Code of Conduct and Student Handbook.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University’s Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the University which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course Materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, PowerPoints, etc., provided by a course instructor. Course Materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in Blackboard are copyrighted material. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g., uploading to websites, sale, exchange, etc.) without permission of the copyright owner.

Follow these links for more information about intellectual property, copyright, and computer acceptable use.

Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results… to name just a few.

VILLANOVA UNIVERSITY

EMERGENCY PROCEDURES

GENERAL GUIDELINES

For general emergencies and to report a crime:

- Get to a safe place if possible
- **Call (610) 519-4444**

In an emergency evacuation (including but not limited to a fire alarm):

- Move quickly and safely to the nearest exit
- Close doors and windows if time permits
- Do not use elevators
- Assist disabled individuals who cannot evacuate themselves by proceeding with them
  - Proceed with them to the nearest fire stairway or safe haven and wait inside with the doors closed until rescue personnel arrive to assist. Immediately get word to rescue personnel of the exact location of the disabled individual
- Remain a safe distance from the building and be aware of responding emergency vehicles

MEDICAL EMERGENCIES

- Do not move a seriously injured or ill person unless the situation is life threatening
- Call Public Safety at (610) 519-4444
- Give the dispatcher your name, location, and telephone number and as much information as possible regarding the nature of the injury or illness
- Do not hang up until the dispatcher ends the call
- Administer first aid if you are trained to do so. Otherwise remain with the victim until Public Safety or medical personnel arrive

SHELTER IN PLACE

Shelter in place is design to keep you safe while indoors if dangerous environmental conditions exist, such as extreme weather or a hazardous materials release. **If a shelter in place is ordered:**

- If outside, seek shelter in the nearest building, preferably in an interior room with few windows
- Close all exterior doors, windows and any other openings to the outside
- Avoid overcrowding by selecting several rooms if necessary
- Monitor Nova Alert and email for further instructions
- Report any emergency or unusual condition to Public Safety
- Do not leave the building until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

UTILITY FAILURES AND ELEVATOR EMERGENCIES

Report utility failures to Facilities Management by calling (610) 519-4420 during normal business hours. After hours, report utility failures to Public Safety by calling (610) 519-4444.

ALCOHOL EMERGENCIES

Consuming too much alcohol can result in serious injury or even death. **Call Public Safety at (610) 519-4444 if a person:**

- Cannot be roused by shaking or shouting
- Has cold, clammy or bluish skin
- Is disoriented, incoherent, or cannot stand, walk or talk
- Sustained a blow to the head or any injury that caused bleeding
- Has shallow or irregular breathing
- Drank alcohol in combination with other drugs

IN AN ACTUAL FIRE

- Activate the fire alarm system by pulling a fire alarm station on your way out of the building
- Leave the building via the nearest exit
- Do not use elevators
- Feel doors before opening, and close doors and windows as you leave if safe to do so
- Report the fire to Public Safety by calling (610) 519-4444 once outside
- If trapped, keep the doors closed and place cloth under them to keep out smoke

  Signal for help by hanging an object (e.g., such as a jacket or shirt) out window to attract attention

LOCKDOWN

An imminent threat of violence may be cause for a lockdown of all or part of campus. Some exterior doors will lock automatically. Emergency responders will lock others manually. The goal is to limit exposure of students, faculty and staff to danger by preventing dangerous persons from entering campus buildings. **If a lockdown is ordered:**

- Stay Inside! Do not leave the building unless an imminently dangerous situation arises inside. If outside, seek shelter in the nearest building
- Take shelter in a lockable room if possible
- Close windows, shades and blinds, and avoid being seen from outside the room if possible
- Monitor Nova Alert and email for updates and further instructions. A description of the actor will be disseminated as soon as possible using these methods
- Report any emergency or unusual condition to Public Safety
- Use discretion in admitting anyone into a secure building. Require that all backpacks and other bags be left outside at least 30 feet from the building. Require that the person seeking shelter open all outer garments for visual inspection before allowing entry
- Once in a secure location, do not leave until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

Nova Alert is Villanova University's primary emergency communication method. To sign up, go to **alert.villanova.edu**.