Instrumentation in Agriculture Engineering Research
ABE 6031 Section 18D5
Class Periods: M & W, 8th and 9th period, at 3:00PM to 4:50 PM
Location: 214 Rogers Hall and Zoom
Academic Term: Fall 2020

Special notes associate with COVID-19

***Please Note:** Due to COVID-19, no transportation to university units will be provided. It is the student's responsibility to provide their own transportation if attending face-to-face synchronous sessions.*

***Please Note:** Due to COVID-19, fall student consultations will be handled via phone, email or Zoom. If the University's guidelines permit, face to face meetings will be welcomed.*

***Please Note:** This course will be taught using a hybrid model of online asynchronous, Online synchronous, and face-to-face synchronous environments. As such, portions of this course has a face-to-face meeting requirement until university policy deems otherwise. This will consist of three individual 30 to 45 minute meetings in laboratory room (first week, mid-semester, and Thanksgiving week Monday), with only 1 student in lab at a time. Although encouraged to facilitate hands-on learning objectives, this face-to-face environment is optional and will be handled on an individual basis. For those opting to participate in the 30 minute, face-to-face synchronous session, the following public health and safety requirements must be followed during lab:*

1. **Face coverings are to be supplied by you (the student) and worn throughout the duration of the face-to-face synchronous session, *both indoors and outdoors while on UF property.* If you (the student) forget your face covering then one may be provided by the instructors if available. If one is not available, then you will be asked to leave. Instructors and teaching assistants will supply their own face coverings and wear them throughout the duration of the face-to-face synchronous session.**
2. **Social distancing must be observed throughout the duration of the face-to-face synchronous session – this is defined as maintaining a minimum physical distance of 6 feet between yourself (the student), your peers, instructors, and teaching assistants.**
3. **Upon entering the classroom, or lab space facility; students, instructors, and teaching assistants will be required to wash their hands for a minimum of 20 seconds. When handwashing stations are not available, hand sanitizer will be used instead. Additionally, hand washing or sanitizing will occur between uses of shared equipment during the lab. Hand sanitizer will be supplied by the instructors, but you (the student) are strongly encouraged to bring your own hand sanitizer for personal use.**
4. **If you (the student) do not feel well and/or are running a fever or displaying any other symptoms of illness, do NOT come to the face-to-face synchronous session. Please notify the instructors for alternative instructional options. Likewise, if an instructor or teaching assistant does not feel well and/or is running a fever or displaying other symptoms of illness, they will not attend the face-to-face synchronous session. If this happens it is recommended that that person begin a 14 day quarantine.**

Instructor:
Tom Burks
Email Address: tburks@ufl.edu
Office Phone Number: 352-294-6728
Office Hours: M or W, 5:00PM to 5:30PM, 225 Rogers Hall

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Name, email address, office location, office hours

Course Description: 3 Credits
Principles and application of measuring instruments and devices for obtaining experimental data in agricultural engineering research.

Course Pre-Requisites / Co-Requisites:
Students must have taken an undergraduate Differential Equations class, and will benefit from have taken an undergraduate engineering or physics based electrical circuits class. Familiarity with Matlab or other programming experience would also be beneficial.

Course Objectives
Student will study fundamental aspects of instrumentation and data acquisition applicable for Agricultural and Biological systems, such as, zero, first and second order systems characterization, uncertainty analysis, error sources and propagation, probability and statistics in data collection, data acquisition, analog and digital circuits, along with various typical sensors used in Ag & Bio Eng. They will also gain practical hands-on experience as they build electrical circuits, and learn to program and build data acquisition systems for various applications using Labview and Ardunio based devices, which will give them a breadth of exposure to various sensors, data management, and analysis tools. Students will also learn to use National Instrument's MultiSim to build, test and evaluate common circuits and devices such as; passive and active filters, operational amplifier circuits and other.

Materials and Supply Fees
$40 per student

Required Textbooks and Software

- *Theory and Design for Mechanical Measurements*, 5th ed
- Author: Figliola and D.E. Beasley
- Publication: John Wiley and Sons,Inc
- ISBN: 978-1118881279

Recommended Materials (Provided as desk reference in Lab)

- Title: *Introduction to MultiSim*, 11th ed.
- Author: Nilsson and Riedel
- Publication: Pearson Education, Inc.
- ISBN: 978-0134739342

Recommended Materials (Provided as desk reference in Lab)

- Title: *Hands-On Introduction to LabVIEW*, 4th ed
- Author: John Essick
- Publication: Oxford University Press.
- ISBN: 978-0190853068

Recommended Materials (Provided as desk reference in Lab)

- Title: *Instrumentation and Measurement for Environmental Sciences*,
- Author: Z.A.Henry,
- Publication: American Society of Agricultural and Bilogical Engineers
- ISBN: 0929355164 (Out of print, limited availability used at AddAll.com for under $10)

Course Meeting, Structure, and Objectives:

Lecture Period: Pre-recorded lectures provided via Dropbox share folder.

The lecture material will be used to develop a basic theoretical understanding of key issues in experimental/instrumentation design, signal conditioning, analog devices, data acquisition and sampling, and fundamental sensor applications. Due to Covid-19, all lecture material has been recorded using PowerPoint slides with audio. Each lecture period will be provided to a secured folder on Dropbox for students to examine at their own pace during the week of assignment, and then complete lecture quiz and associated homework problems.

Lab Period: Wednesday 8th and 9th period in room 214 Rogers Hall via ZOOM meeting.

Due to Covid-19, special arrangements and changes are being made to the lab experience for this course. On Wednesday morning of each lab meeting, students should check for Zoom Meeting invitation for 3PM on Wednesday. At the beginning of the Zoom lab period, the instructor will highlight content from that week's lecture material, and answer any questions. Then the lab will be used to provide hands on experience with instrumentation equipment such as oscilloscopes, function generator, data acquisition boards, bread boarding circuits, and other practical techniques. Additionally, the laboratory Zoom Meeting will be used to introduce the student to Arduino, Multisim, LabVIEW and Matlab programming applications in instrumentation. The student will be given moderate guidance with ample opportunity to explore and learn at one's own initiative using supplied kits and lab books. The students will be supplied with a remote desktop account and schedule for accessing Labview and Multisim on lab 214 PCs.

Individual Lab Period: By appointment in room 214 Rogers Hall

Due to Covid-19, special arrangements and changes are being made to the lab experience for this course. The students will meet with the instructor three times during the semester in lab room 214 Rogers Hall for individual instruction or student demonstration. **During this meeting, the student and instructor will wear masks and social distance**. **The student or instructor should notify if they are not feeling well and quarantine for 14 days, if tested positive for Covid-19.** An alternate date will be scheduled based on start of quarantine. During the first week of class the students will meet with the instructor to check out supplies for the Arduino experiments, Multisim textbook, Labview textbook and experiment components. Mid-semester a meeting will take place for student to demonstrate Arduino Project results, and experience a live session with test bench components. Meanwhile, at the end of semester during last week of class a meeting will occur for student to demonstrate Labview/Arduino experiment and return all checked out materials. Students must return all material in order to receive course grade.

Course Expectation and Tasks

1) There will be approximately one homework and/or lab assignment per week. Late homework will not be accepted without prior approval. You may discuss homework with others, but you may not copy verbatim homework from another student. Cheating on homework will affect all parties involved.

2) There will be a 10 to 15 minute quiz associated with every chapter lecture to insure completion that will be due the week of the assigned chapter. The quiz can be executed while watching the lecture. Likewise, there will be 7 reading assignments from *Instrumentation and Measurement for Environmental Sciences* manual, which will require a one page summary prepared. PDF of chapters will be provided.

3) Some laboratories will require preparation of a report, while others are primarily demonstrations. It is mandatory to attend Lab Zoom meetings. Get advance approval if you can't attend lab.

4) Each student will make a 10 minute technical presentation via Zoom and turn in a minimum 3 to 5 page typed summary report covering a topic in instrumentation and sensor technology not covered in the text. The presentation must be thorough and technically accurate. The student should select a topic based on his/her personal research interest.

5) Each student will complete two term instrumentation projects using Arduino and also LabView. The projects will incorporate data acquisition design, programming, data collection, and basic data analysis. Each student will complete a series of Arduino exercises using the supplied toolkits and user manuals, and then create a unique

Arduino mini-project. Then later the student will interface the Arduino with the Labview GUI interface use a National Instruments MyDaq to collect data from the Arduino and save to disk.
6) There will be a take home comprehensive final at the end of semester covering course materials.

Required Readings from Instrumentation and Measurements for Environmental Sciences to compliment textbook material (not on exam):

1) IMES-1: Planning the Experiments	ASAP
2) IMES-11: Systems Response	Chapter 3
3) IMES- 14: Indicating and Recording	ASAP
4) IMES-15: Analysis and Interpretation	Chapter 4
5) IMES- 10: Signal Conditioning	Chapter 6
6) IMES- 13: Digital Data Acquisition	Chapter 7
7) IMES- 16: Interfacing Microcomputers for Data Acquisition and Control.	Chapter 7

Lecture Material Covered:

There will be an approximate 1h and 15m lecture during the Monday meeting time from the primary textbook (MM). This will be available by recorded PowerPoint video.
Week 1. MM-1: Basic Concepts of Measurement Systems;
Week 2. MM-2: Static and Dynamic Characteristics of Signals; and Basic Circuits Review (Flipped Delivery)
Week 3. Labor Day Weekend Holiday on Monday; and Circuits Network (Flipped Delivery)
Week 4. MM-3: Measurement Systems Behavior; and RLC Circuits (Flipped Delivery)
Week 5. MM-4: Probability and Statistics
Week 6. MM-5: Uncertainty Analysis
Week 7. MM-6 Analog Electrical Devices
Week 8. MM-6 Analog Electrical Devices
Week 9. MM-7: Sampling, Digital Devices, and Data Acquisition
Week 10. MM-8: Temperature Measurements (Flipped Delivery)
Week 11. MM-9: Pressure and Velocity (Flipped Delivery)
Week 12. MM-10: Flow Measurement (Flipped Delivery)
Week 13. MM-11: Strain Measurement (Flipped Delivery)
Week 14. Labview as Needed
Week 15. Labview as Needed
Week 16. Finals Week

Laboratory Topics Covered:

The laboratory time will consist of both instructor lead demonstrations and teaching, and hands on laboratory experiments. In many cases, laboratory experiments will be introduced and started during the in-class laboratory time to be finished later by the student. A brief lab reported will be submitted on each lab experiment assignment.
Week 1: Introduction to Arduino self-paced exercise assignments
Week 2: Introduction to Multisim Circuit Simulation using passive Analog Devices
Week 3: Introduction to Multisim Circuit Simulation using passive Analog Devices
Week 4. Introduction to LabVIEW, and While Loop and Waveform Chart
Week 5. LabVIEW For Loop and Waveform Graph, Arrays and Clusters
Week 6. LabVIEW Mathscript Node and XY Graph
Week 7. LabView Data Files and Character Strings
Week 8. Introduction AC & DC laboratory Instruments using passive Analog Devices
Week 9. LabVIEW Data Acquisition using MAX, and DAQ Assistant
Week 10. LabVIEW Shift Registers and Case Structures
Week 11. LabVIEW Data Acquisition, and Signal Processing: Curve Fitting
Week 12. LabVIEW Data Acquisition, and Signal Processing: Fast Fourier Transform
Week 13. LabVIEW Term Project
Week 14 LabView Term Projects
Week 15. LabVIEW Term Project Demonstration in Lab
Week 16. Finals no activity

Attendance Policy, Class Expectations, and Make-Up Policy

a) No make-up exams will be given except for valid medical reasons or unless prior arrangements are made.
b) Cellphones may not be used during exam.
c) Lab Zoom attendance is mandatory, unless excuse is valid. Absence will affect your ability to do projects, so it is necessary to attend.
d) Students may drop one homework, and one quiz from their lowest score.
e) Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Grading Criteria:

Homework	25%
Chapter Quizzes	5%
Attendance Lab Zoom meeting	5%
Lab Reports	10%
Technical Presentation	15%
Term Projects	20%
Comprehensive Final Exam via Canvas	20%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the

evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.