

## **Spring 2019 Syllabus**

### **Mixed Signal IC Test 1**

#### **EEE4404 Mixed Signal IC Test I, Spring Course Summary**

We will meet regularly on Monday and Wednesday for Class 6<sup>th</sup> Period in Larsen 330.

Laboratory will be weekly for 3 hours, times TBA

Occasionally, Friday's class for Exams and makeup classes (Holiday's and missed days due to instructor travel). There will be some pre-recorded videos to present course topics, not covered on Monday and Wednesday too.

The course scheduling and a few topics may be adjusted/changed during the semester.

There will be a Midterm and a Final Exam.

#### **Course Outline:**

Weekly Date, (No. of Class Meetings) Class topics, Readings, In Class Notes in pdf form.

01/07 (2) [Test Class Notes 1 Syllabus Preliminary 2019](#), [Introduction to mixed Signal IC test](#), [Permission and survey](#), [Labview Video Tutorials](#), [NI STS Tester Links](#), [Installing LabView](#), [LabView Example VI](#), [Intro to NI STS Tester](#),

**To use the Labview Video Tutorials, set up a new account on the National Instruments training website and then login and following the links on the NI training page.**

[LabView Quick Reference](#)

[LabView Project 1](#)

[Lab 1A SMU measurement and Resistance Measurement on the NI Tester](#)

Reading Chapter 1 Overview of Mixed Signal Testing and Chapter 2 Tester Hardware, Roberts, Taenzler and Burns.

[In Class Notes Lecture 1](#), [In Class Notes Lecture 2](#)

[Audio Lecture 1](#), [Audio Lecture 2](#)

01/14 (2). [Test Specification TestStand Notes](#), [TestStand Basics](#), [SMU Article 1](#), [NI Tutorial](#), [SMU Article 2](#), [How to SMU](#). [SMU Article 3 SMU source measurement](#), [Kelvin Connection article](#)

[Lab 1A SMU measurement and Resistance Measurement on the NI Tester](#)

[Schematic for Lab 1A loadboard](#)

[Homework1.pdf](#)

[Chapter 2 All homework problems, you are only assigned 3.](#) (See Homework 1 assignment)

[NI TESTER AND VI FILES FOR LAB 1A](#) See the Software Quick Start Guide

Remote access information link for UF ECEL: <http://www.ecel.ufl.edu/remote.html>

[TestStand 1 Exercises \(zip file\)](#)

[TestStand 1 Solutions \(zip File\)](#)

Reading Chapter 3.1 to 3.6 DC and Parametric Measurements Roberts, Taenzler and Burns,

Homework 1 assigned from the Text book, Roberts et al, 2nd Edition Problems 2.4, 2.5. and 2.7 and other problems, Due January 23

[In Class Notes 3](#), [In Class Notes 4](#)

Audio Lecture 3 (Bad audio recording), [Audio Lecture 4](#)

01/21 (2) ML King Holiday, [Tester Hardware Chapter 2](#), [NI LabView Review \(Friday Class\)](#),

[Lab 1B, Capacitance Measurement on the NI STS Tester](#)

Reading Chapter 3.1 to 3.6 DC and Parametric Measurements Roberts, Taenzler and Burns

[Homework 1 Solution](#)

[In Class Notes 5](#), [In Class Notes 6](#),

[Audio Lecture 5](#), [Audio Lecture 6](#)

01/28 (2) [Chapter 3 DC measurements on the Tester.](#), [Chapter 3 Exercise Examples](#), [Capacitance Measurement Techniques Article](#), [Device Capacitance Measurement Article](#), [Chapter 3 Example Problem Solutions](#).

Reading Chapter 3.7 to 3.12, DC and Parametric Measurements, Roberts, Taenzler and Burns

[Lab 1B, Capacitance Measurement on the NI STS Tester](#)

[Homework 2](#)

[Matlab Code for Problems worked for Chapter 3](#)

[Analog Engineer Pocket Reference](#)

[In Class Notes 7](#), [In Class Notes 8](#)

[Audio Lecture 7](#), [Audio Lecture 8](#)

02/04 (2) [Chapter 4 Data Analysis](#), [Statistics for IC test](#),

[Lab 2 LDO Measurements Part 1 and 2](#)

Reading Chapter 4.1 to 4.3, Data Analysis and Probability Theory, Roberts, Taenzler and Burns

[In Class Notes 9](#), [In Class Notes 10](#),

[Audio Lecture 9](#), [Audio Lecture 10](#)

02/11 (2) [Understanding LDO Device Operation](#), [LDO Terms and Measurement](#), [TI LDO chip Data Sheet](#), [LDO Dropout Measurements](#), [LDO Transient Measurements](#),

**[LDO Lecture from Texas Instruments](#)**

[Lab 2 LDO Measurements Part 1 and 2](#)

[LDO Load Board Schematic](#)

Reading Chapter 5 Yield Measurement, Accuracy and Test Time, Roberts, Taenzler and Burns

[Homework 3](#)

[In Class Notes 11](#), [In Class Notes 12](#)

[Audio Lecture 11](#), [Audio Lecture 12](#)

02/18 (2) [Example Exam 1 2017](#), [Example Exam 1 2016](#), [Exam 1 2019](#), [Exam 1 Study Guide](#), [Chapter 5 Yield and Measurement Accuracy](#), [NI Measurement Examples](#), [Validation Talk from TI](#),

[Homework 2 Solution](#)

[Homework 3 Solution](#)

[Lab 2 LDO Measurements Part 1 and 2](#)

Read Chapter 5, Yield Measurement Accuracy and Test Time, Roberts, Taenzler and Burns

[In Class Notes 13](#),

[Audio Lecture 13](#)

02/25 (3) [TI Op Amp Test Lecture](#), , [OPA277 Spec Sheet](#), Midterm March 1, 2019

Makeup Lab week (no assigned lab)

[Homework 4](#)

Read and outs op amp testing, Chapter 10 Analog Channel Testing, Roberts, Taenzler and Burns

03/04 (0) [Spring Break, have a great vacation](#)

03/11 (2) [TI OP Amp Testing Notes 1](#),

[Lab 3, Op Amp Measurements on the NI STS Tester](#)

[Schematic of LAB 3 Loadboard and NI Tester](#)

[Exam 1 Solution](#)

Read Chapter 10 Analog Channel Testing, Roberts, Taenzler and Burns

[In Class Notes 14](#), [In Class Notes 15](#)

[Audio Lecture 14](#), [Audio Lecture 15](#)

03/18 (2) [Analog Channel Testing](#), [OP-AMP Test Article Part 1](#), [OP-AMP Test Article Part 2](#), [OP-AMP Test Article Part 3](#), [OP-AMP Test Article Part 4](#),

[Lab 3, Op Amp Measurements on the NI STS Tester](#)

[Homework 5](#)

[Homework 4 Solution](#)

Reading TINA spice simulators

TINA-TI Spice download site: <http://www.ti.com/tool/tina-ti> You must set up an account at [www.ti.com](http://www.ti.com) to download the software and install on your PC.

[TINA-TI Quick Start Manual](#)

[In Class Notes 16](#), [In Class Notes 17](#),

[Audio Lecture 16](#), [Audio Lecture 17](#),

3/25 (2) [Analog Channel Testing](#),

[Lab 3, Op Amp Measurements on the NI STS Tester](#)

Read Chapter 10 Analog Channel Testing, Roberts, Taenzler and Burns

Read Temperature Sensor Handouts

[In Class Notes 18](#), [In Class Notes 19](#)

[Audio Lecture 18](#), [Audio Lecture 19](#)

04/01 (2) [DIB Board Design](#), [Transmission Line TDR Tektronics](#),

[Homework 6](#)

[Homework 5 Solution](#),

[Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester, Part 1](#)

[Loadboard Schematic for Lab 4](#),

[TMP 20 Data Sheet](#)

Read Chapter 15 Tester Interfacing DIB Design, Roberts, Taenzler and Burns

[In Class Notes 20](#), [In Class Notes 21](#)

[Audio Lecture 20](#), [Audio Lecture 21](#)

04/08 (2) [TI Temperature Sensor Test Lecture](#), [Transmission Line TDR Tektronics](#),  
[Transmission Line TDR HP](#), [S-Parameter Handout](#),

[Solution to Exam II 2017](#)

[Solution to Final Exam 2017](#)

[TMP 175 Data Sheet \(or new Temp Sensor data sheet\)](#)

[Study Guide Final Exam](#)

[Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester, Part 1](#)

Read Chap. Handouts, Chapter 15 Tester Interfacing DIB Design, Roberts, Taenzler  
and Burns

[In Class Notes 22](#), [In Class Notes 23](#)

[Audio Lecture 22](#), [Audio Lecture 22](#)

04/15 (2) [Chapter 15 DIB board Practice Problems](#), [Transmission Line TDR HP](#),

Read Chapter 16 Design for Test techniques

[Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester, Part 1](#)

[Study Guide Final Exam](#)

Matlab Homework 6 Problems

[In Class Notes 24](#), [In Class Notes 25](#),

[Audio Lecture 24](#), [Audio Lecture 25](#),

4/22 (2) [S-Parameters](#), [Review for Exam Final](#), [Design for Test Techniques](#),

[Homework 6 Solution in Matlab](#)

Read Chapter 16 Design for Test

[In Class Notes 25](#), [In Class Notes 26](#),

[Audio Lecture 25](#), [Audio Lecture 26](#),

**Cumulative Final Exam for Undergraduate and First Year Graduate Courses,  
Required by ECE Department, Monday April 29, 2019, 10:00am to 12:00am.**

## **EEE 4930/5934 Mixed Signal IC Test I, Fall 2019 Syllabus (Data Sheet)**

### Mixed Signal IC Test Contact Information

**Professor:** William R. Eisenstadt,

**Assistant:** TBA

**Office:** 529 NEB

**Office:**

**Telephone:** (352) 392-4946

**Telephone:**

**Facsimile:** (352) 392-8381

**Facsimile:**

**E-mail:** [wre@tec.ufl.edu](mailto:wre@tec.ufl.edu)

**E-mail:**

**Web:** <http://www.tec.ufl.edu/~wre/>

**Course Sequence Goals:** Develop understanding of the production testing and validation of mixed-signal ICs and systems. The testing of mixed-signal ICs include both analog and digital circuits and requires an understanding of both and the IC test environment to be successful. This is a two semester sequence in Mixed Signal IC testing with the this class, the first semester covering basic test topics and the second semester class Advanced Mixed Signal IC Test 2 topics.

This course was jointly developed by the UF ECE and Texas Instruments, Tucson, TX. These experiences of this course sequence will make better engineers of all of us (including the TA and the instructor). This course sequence is supported heavily by Texas Instruments and National Instruments and the students who do well will be in great hiring demand by US semiconductor and US test companies. The course sequence is limited to 40 students at this time.

**Course Topics:** Fundamentals of Testing IC Devices and systems: test specifications, parametric testing, measurement accuracy, test hardware, sampling theory, digital signal processing based testing, and calibrations. Circuit analysis and circuit design with analog and mixed-signal systems. Labs on testing passive components, LDOs, Op-amps, DACS/ADCs, Mixed-Signal ICs Labview and the National Instruments Savage Tester.

**Prerequisite:** EEE 3308C and EEE 3701 or an undergraduate degree in electrical engineering.

**Class Period and Location:** MWF 6<sup>th</sup> period, LAR 330. Most weeks we will meet for 2 lectures only. Three hour Laboratory times will be announced. Occasionally, Friday's class for Exams and makeup classes (Holiday's and missed days due to instructor travel). There will be some pre-recorded videos to present course topics, not covered on Monday and Wednesday too.

**Lab Period and Location:** Labs TBA, There will be 3 hours of lab every week that replaces 1 in class period.

**Office Hours:** MWF Noon to 12:40 and 2:00pm to 2:40pm.



**TA:** Nikolas Horn, nhorn9@ufl.edu, Office Hours TBA.

**Required Text:** Gordon Roberts, Friedrich Taenzler, Mark Burns, **An Introduction to Mixed-Signal IC Test and Measurement**, 2<sup>nd</sup> Edition, Oxford Press, 2011, ISBN-13: 978-0199796212.

**Alternate Text:** M. Burns and G. Roberts, **An Introduction to Mixed-Signal IC Test and Measurement**, 1<sup>st</sup> Edition, Oxford Press ISBN-13: 9780195140163, 2000.

**Course Materials:** I will be using the Syllabus on the Canvas system to index of the daily class materials posted for you to review and to learn from. So, you can find most learning materials by clicking on a link from the Syllabus. I try to post all written materials and video materials used in the lectures to assist in your learning.

There will be folders that contain course materials (Course Notes, LabView notes, In Class Notes, etc) in the Resources section of Canvas (see tabs on the left of the Canvas section).

**Computer and Software Required:**

Workstations with LabView system on campus, off-campus you can use X-Windows or X-terminal on a high-speed internet link to UF Campus Computers.

All students are required to have a Gator link account and use Canvas for course handouts, grade information, course notices, etc, see [e-learning and Canvas](#)

**Course Study Requirements:**

Students are responsible to study all in class materials including those written on the board and presented orally, all Class Handouts all assigned readings, all projects and homework. Absence from class can result in missing materials tested on exams.

**Work Requirements:**

Homework: 6-10 Homework and SPICE Assignments  
Computer Laboratories and projects: Weekly laboratory work  
Midterm Exams  
Final Exam

**Examinations:**

Midterm Tentatively, March 1, 2019  
Final Exam: Tentatively, Monday April 29, 2019 10:00am to Noon

**Make Up Exam Policy** : Students are expected to attend exams at the scheduled times. Exams can be made up if there is a genuine medical emergency with a doctor's or clinic medical note or a family emergency with some documentation.

**Preliminary Grading Policy:**

Undergraduate Exams, Laboratories and Homework will be less difficult than Graduate Exams, Laboratories, and Homework.

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets	10 points each	10%
Laboratories	20 points each	30%
Midterm Exam	100	25%
Final Exam	100	35%
		100%

More information on UF grading policy may be found at:  
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Tentative Grading Policy, I will look carefully at each individual's class work accomplishments.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
92.0 - 100.0	A	4.00
90.0 - 91.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

**Academic Honesty:**

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action.

This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide documentation to the instructor when requesting accommodation.

### ***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 feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

### ***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: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

**U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**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 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 support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto: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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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