EEE 4930/5934 Mixed Signal IC Test I, Spring 2015 Course Outline

Note: This course is being revised from the first time course offering in Fall 2015 to include more mathematical analyses and LabView programming examples.

Course Outline:

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

01/07 (2) Syllabus (this document) , Introduction to mixed Signal IC test, Permission and survey, Labview Video Tutorials, NI STS Tester Links, NI LabView Review, LabView Example VI, Chapter 2 Test Specification

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

LabView Quick Reference

LabView Project 1

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

01/12 (3). TestStand Notes, Chapter 2 Lecture: Tester Hardware, Chapter 2 Figures, Chapter 3 DC measurements on the Tester.

Lab 1A SMU measurement and Resistance Measurement on the NI Tester

NI TESTER AND VI FILES FOR LAB 1A See the Software Quick Start Guide

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

Chapter 2 ALL problems.

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

In Class Notes 3, In Class Notes 4, In Class Notes 5

Audio Lecture 3, Audio Lecture 4, Audio Lecture 5

01/21 (2) Martin Luther King Holiday, STS Tester Hardware, STS Tester Software, DC measurements, Chapter 3 Figures, Reading, Kelvin Connection Reference,

Lab 1B, Capacitance Measurement on the NI STS Tester

Homework 1 Solutions

In Class Notes 6, In Class Notes 7,

Audio Lecture 6, Audio Lecture 7,

01/26 (2) System-Level Validation (TI Talk), Capacitance Measurement Techniques Article, Device Capacitance Measurement Article, Chapter 3 DC measurements on the Tester. Chapter 4 Measurement Accuracy

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

Lab 1B, Capacitance Measurement on the NI STS Tester

Homework 2

In Class Notes 8, In Class Notes 9

Audio Lecture 8, Audio Lecture 9

02/02 (2) Chapter 4 Measurement Accuracy, Example Chapter 3 Problems worked,

Lab 2 LDO Measurements Part 1 and 2

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

Homework 2 Solution

In Class Notes 10, In Class Notes 11,

Audio Lecture 10, Audio Lecture 11,
02/09 (2) Basics of TestStand, LDO Device Operation, LDO Measurement, TI LDO chip Specifications

Lab 2 LDO Measurements Part 1 and 2

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

Homework 3

In Class Notes 12, In Class Notes 13

Audio Lecture 12, Audio Lecture 13

02/16 (2) Lab 2, LDO Measurements, LDO Load Board schematic, NI Power and NI HSDIO, Chapter 5 Problem solutions, Data and Probability Lectures (Chapter 4).

Lab 2 LDO Measurements Part 1 and 2

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

Homework 3 Solution

In Class Notes 14, In Class Notes 15

Audio Lecture 14, Audio Lecture 15

02/23 (2) TI OP Amp Testing Notes 1, Midterm 1,

Schematic of LAB 3 Loadboard and NI Tester

Makeup Lab week

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

Homework 4

In Class Notes 16

Audio Lecture 16

03/02 (0) University of Florida Spring Break, March 2 to March 6. Have a great vacation, no classes.

03/09 (2) TI OP Amp Testing Notes 1, Data and Probability Lectures (Chapter 4).
Lab 3, Op Amp Measurements on the NI STS Tester

Schematic of LAB 3 Loadboard and NI Tester

Midterm 1 Solution

Homework 4 Solution

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

In Class Notes 17, In Class Notes 18

Audio Lecture 17, Audio Lecture 18

03/16 (2) Analog Channel Testing Data and Probability Lectures (Chapter 4), Op amp Testing Lecture from Chris Stephens

Homework 5

Circuits Test Key Op amp Parameters

TI OPA277

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

Lab 3, Op Amp Measurements on the NI STS Tester

In Class Notes 19, In Class Notes 20,

Audio Lecture 19, Audio Lecture 20,

03/23 (2) Analog Chapter Problem Solutions, Analog Channel Testing

Homework 5 Solution

Lab 3, Op Amp Measurements on the NI STS Tester

TI Op Amp load board schematic

Read Temperature Sensor Handouts, Chapter 15, Tester Interfacing, DIB design Roberts, Taenzler and Burns,

In Class Notes 21, In Class Notes 22

Audio Lecture 21, Audio Lecture 22
03/30 (2) Interfacing DIB Design, Chapter 15 Figures Transmission Line TDR

Homework 6
Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester
Loadboard Schematic for Lab 4
Read Chapter 15 Tester Interfacing DIB Design, Roberts, Taenzler and Burns
In Class Notes 23, In Class Notes 24
Audio Lecture 23, Audio Lecture 24

04/04 (2) Interfacing DIB Design, Example Problems for Chapter 15, Study Guide for Midterm II

Homework 6 Solution
Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester
Read Chap. Handouts, Chapter 15 Tester Interfacing DIB Design, Roberts, Taenzler and Burns
S-Parameter Handout
In Class Notes 25, In Class Notes 26
Audio Lecture 25, Audio Lecture 26

4/13 (2) Interfacing DIB Design, Analog Temperature Sensor Spec Sheets, Midterm II

Read Chapter 16 Design for Test techniques
Lab 4, Analog and Digital Temperature Sensor on the NI STS Tester
In Class Notes 27
Audio Lecture 27

04/20 (2) Design for Test Techniques, Mixed Signal Test 2

Makeup Lab week
Read Chapter 16 Design for Test
There is no final exam.

**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 first semester covering basic test topics and the second semester Advanced Mixed Signal IC Test topics.

This course was jointly developed in the last six months 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 but will expand next year as the laboratories get established.

**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:** Monday, Wednesday, and sometimes Friday, 8th periods, 3:00pm to 3:50pm, Larsen 330. Students will go to lab most weeks on Thursday or Friday or perform lab and video work at home.
Lab Period and Location: Labs will be given Monday through Thursday in NEB 289 on a sign up basis. Computer labs will be done at home.

Office Hours: Monday, Wednesday and Friday: 1:45pm to 2:45pm, NEB.

TA: Manuel Moreno, contact information to be announced.


Course Materials: I will be using the Syllabus on the Sakai 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 Sakai (see tabs on the left of the Sakai 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 Sakai for course handouts, grade information, course notices, etc, see e-learning and Sakai

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 Assignments
Computer Laboratories and projects: Weekly laboratory work
Exams: 2 Exams during the semester, No final Exam

Examinations: (No Final Exam)
Quizzes for reading and video learning topics

Exam 1: Tentatively, Middle of February
Exam 2: Tentatively, Second week of April
**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.

**Passing Grades and Grade Points Effective Summer A 2009**

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**Preliminary Grading Policy:**

Homework and Projects - 50%
Exams and Quizzes - 50%

**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.