San José State University
Electrical Engineering Department
EE174: Analog Peripheral for Embedded Systems, Section 1, Fall 2018

Instructor:	Tan Van Nguyen
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Office Hours:	MW 18:00 -19:30
Class Days/Time:	MW 19:30-20:45
Classroom:	Dudley Moorhead Hall 160
Prerequisites:	EE110 and EE112 with C grade or better
Lab Room:	ENG 244 (If needed)

Faculty Web Page

Course materials such as syllabus, handouts, lecture notes, lab assignment instructions and homework can be found on my faculty web page at http://www.sjsu.edu/people/tan.v.nguyen/courses..

Course Description

Introduction to analog peripherals for embedded systems such as ADC/DAC, DC-DC Converters, Energy harvesting and solar cells, near field communication, RF-IDs, phase lock loops, clock generators, displays and touch screens. Industry based projects and applications are integral to the course.

Learning Objectives

1. Students will be able to design Op-Amp circuits and understand thoroughly Op-amp specifications and applications
2. Students will be able to explain the challenges of the Data conversion and associated performance metrics such as INL, DNL, ENOB, SNDR.
3. Students will be able to design DC to DC convertor and understand different architecture and associated performance metrics such as efficiency, loading.
4. Students will be able to evaluate different techniques and methods for energy harvesting in an embedded system.
5. Students will be able to develop a short range communication using standard protocols such as NFC and RFID
6. Students will be able to construct clock generator and understand the phase locking concepts and associated performance metrics such as jitter, eye-opening, skew, phase noise.
7. Students will be able to develop image sensing and displays system using an embedded system.

Course Goals

This course introduces analog peripherals for embedded systems. In an embedded system on top of a general purpose microcontroller or DSP processor, there are other components to talk to the outside world. These components, peripherals, are such as Data converters, DC-DC Converters, Energy harvesting, solar cells, near field communication (NFC), RF-IDs, phase lock loops and clock generators, displays and touch screens. The course aims to establish an environment to expose students to other important block in embedded system architecture. This platform will be based on technical discussion, and lab experiences. The goal is students gain technical expertise to design and develop peripherals system in conjunction with an embedded system.

Required Texts/Readings

Textbook

Instructor notes and handouts.

Other Readings

Different white papers, hardware and software tools by vendors.

Course Requirements and Assignments

Labs and Projects

There are several labs and one project for this course. Project is mainly based on designing an embedded system application, using studied analog peripherals such as ADC, PLL, Display, NFC. Each group (maximum 3 students) must write a formal project report using a word processor (i.e. Microsoft Office) and submit the original write-up.

Quizzes and Homework

There are two midterm examinations and several quizzes/homework for this course. There will be no make-up exam or quizzes and those absent will receive no credit. Students must write their answers clearly in an organized fashion. Further instructions will be provided during exams.

Assignments and Grading Policy

There will be no make-up exams/quizzes and those absent will receive no credit. Students must write their answers clearly in an organized fashion. Further instructions will be provided during exams. This course must be passed with a C or better as a CSU graduation requirement.

Evaluation Instruments

Exam 1	15%
Exam 2	15%
Homework/Quizzes	10%
Labs	20%
Design Project	15%
Final Exam	25%

Grading Policy

A+	≥ 97	A	≥ 93, < 97	A-	≥ 90, < 93
B+	≥ 87, < 90	B	≥ 83, < 87	B-	≥ 80, < 83
C+	≥ 77, < 80	C	≥ 73, < 77	C-	≥ 70, < 73
D+	≥ 67, < 70	D	≥ 63, < 67	D-	≥ 60, < 63
F	< 60				

Classroom Protocol

Use common sense during lectures and office hours. Show respect for all members of the class. If you are not sure if something is allowed, ask.
Arrive on time, no food in class or lab, turn off cell phone, NO private discussion in class.

Honor Code

The Electrical Engineering Department will enforce the following honor code that must be read and accepted by all students:

I have read the honor code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- *Take an exam in place of someone, or have someone take an exam in my place*
- *Give information or receive information from another person during an exam*
- *Use more reference material during an exam than is allowed by the instructor*
- *Obtain a copy of an exam prior to the time it is given*
- *Alter an exam after it has been graded and then return it for re-grading*
- *Leave the exam room without returning the exam to the instructor*

Measures Dealing with Occurrences of Cheating:

- Department policy mandates that the student or students involved in cheating will receive an "F" on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University
- A student's second offense will result in a Department recommendation of suspension

Professional Attitude

In addition to the honor code, students understand that a professional attitude is necessary to maintain a comfortable academic environment. For example:

- Do not skip the lecture and then later ask the instructor to summarize the lecture
- Come to the lectures on time and remain for the entire duration of the session
- To minimize possible tension during exams, follow the exam rules closely

University Policies (Required)

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus

Information web page at http://www.sjsu.edu/gup/syllabusinfo/" Make sure to review these policies and resources.

EE174: Analog Peripheral for Embedded Systems, Fall 2018 Tentative Course Schedule

Subject to change with fair notice as announced by the instructor in class.

Week	Date	Topics, Readings, Assignments, Deadlines
1	08/22	Introduction to Analog Peripheral for Embedded Systems
2	08/27	Op-Amp: Introduction
2	08/29	Op-Amp: Gain, Offset, Comparator, Schmitt trigger
3	***09/03***	***No Class - Labor Day***
3	09/05	Op-Amp: Applications
4	09/10	Experimental Lab on Op-Amp
4	09/12	Data Conversion: Sampling, Quantization
5	09/17	Data Conversion: Performance Metrics (ENOB, INL, DNL)
5	09/19	Data Conversion: Architectures (Flash, Pipeline, SAR, Oversampling)
6	09/24	Data Conversion: Signal Reconstructions (DAC)
6	09/26	Data Conversion: Experimental Lab on ADC
7	10/01	DC-DC Conversion: Concept, Charge based and Switching Regulator
7	10/03	DC-DC Conversion: Efficiency and Loading
8	10/08	Midterm 1
8	10/10	DC-DC Conversion: Experimental Lab
9	10/15	Energy Harvesting: Introduction, Basic Concepts
9	10/17	Energy Harvesting: Energy Storage, Solar Cells
10	10/22	Energy Harvesting: Experimental Lab
10	10/24	Short Range Communications: Concepts and Needs
11	10/29	Short Range Communications: RF-ID, NFC, IEEE Standards on NFC
11	10/31	Short Range Communications: Experimental Lab
12	11/05	Phase Locking: Introduction to PLL
12	11/07	Phase Locking: Synthesizer and Clock Generators (Crystal)
13	11/12	No Class – Veteran ‘s Day
13	11/14	Phase Locking: Clock and Data Recovery
14	11/19	Midterm 2
14	***11/21***	***No Class – Thanksgivings***
15	11/26	Phase Locking: Performance Metrics (Jitter, Skew, eye-diagram opening, …)
15	11/28	Phase Locking: Experimental Lab
16	12/03	Display & Touch Screen: Image Sensors: LCD Display, Touch Sensor, Touch Screen
16	12/05	Display and Touch Screen: Image Sensors (CCD/CMOS)
17	12/10	Project Demo and Presentation

Week	Date	Topics, Readings, Assignments, Deadlines
17	12/12	***Final Exam (2 hours 15 minutes) 19:45-22:00***