



Course Syllabus

ENEE 159b: Start-Up 101, Electric Guitar Design
Prof. Bruce Jacob

Basic Information

Time & Place

Lecture/Lab: Wed 4:00–6:00 pm, AVW-1366

Professor

Bruce L. Jacob: AVW-1325, blj@ece.umd.edu
 Office hours: *Open-door policy (for now ...)*

Class Home Page

<http://www.ece.umd.edu/courses/enee159b>

Class Email List

enee159b-0101-spr09@coursemail.umd.edu

Class Schedule

This is a weekly schedule of my hours, including class time and scheduled office hours, but also including other things that make me unavailable. It is subject to change.

	MON	TUE	WED	THU	FRI
9–9:30					
9:30–10					
10–10:30					
10:30–11					
11–1:30					
11:30–12					ENEE 459J Disc. CSI-3118
12–12:30		ENES 100 Lecture JMP-1215		ENES 100 Lecture JMP-1215	Meetings with graduate students
12:30–1					
1–1:30					
1:30–2					
2–2:30			ENEE 459J Lab AVW-1366		
2:30–3					
3–3:30					
3:30–4					
4–4:30			ENEE 159B Lab AVW-1366		
4:30–5					
5–5:30					
5:30–6					

Course Overview

This class will teach the skills necessary for good product design and development in the real world, using as a motivating example the electric guitar.

The class will be structured as a start-up company's research & development department: students will be given design specs and some latitude in the choice of implementation. Students will be taught the fundamentals of sound, audio signals, amplification and equalization, wiring, soldering, circuit-board design and assembly, and, perhaps most importantly, good design principles. Students will design circuits and circuit boards; they will have those boards manufactured; they will assemble the boards, solder the parts, and wire them into prototype guitars.

Class projects will explore different aspects of guitar design; the final project will build upon the earlier projects in a student-defined direction.

Prerequisites

There are no official prerequisites, though a familiarity with the operation and physical structure of an electric guitar is essential. Students will be taught how to wire the guitar; a student need not have wired up a guitar before coming into the class (though, of course, that would help).

Course Materials

The required text for the course:

Hackers & Painters, by Paul Graham. A book about developing code and starting up companies. It is especially powerful because it goes deep into the thinking that is required (on the technical side) to create a successful start-up company. It is written by one of the two founders of Viaweb, the company that built the engine that now powers Yahoo! Stores.

Class Projects

Several projects will be assigned during the term, which form the bulk of the course grade and each of which will require a substantial time commitment on your part.

- Project 1: *Soldering and wiring basics*
Students will solder together a set of wires and components. Primary goals: learn how to solder correctly; learn how to read a schematic; learn how to debug an audio circuit.
- Project 2: *Switching between coils*
Students will design and implement a circuit that switches between a set of circuit components, putting the various components in series, parallel, in-phase, and out-of-phase.
- Project 3: *Full electric guitar*
Students will build the rest of the electric guitar wiring: a volume and tone-control circuit that uses bypass caps to ensure frequency response and also reduce audio hum. Students will take measurements to compare frequency response of circuit with pickups wired directly to output jack.

- Project 4: *Student design*
Students will propose an idea and implement it. The project can be theory-based (e.g., characterization of materials, components, or techniques), or it could be engineering-based (e.g., implementation of a new idea and comparison with previous implementations).

Grading Policy

Final grades will be based on the total of points earned on the projects and exams. The tentative point breakdown is as follows:

- Project 1: 10%
- Project 2: 10%
- Project 3: 20%
- Project 4: 50%
- Participation: 10%

Tentative Lecture Schedule

Week of	Subject/s	Lab
Jan. 26	Intro to course, The physics of sound	Waves, volts, amps
Feb. 2	Electric guitar fundamentals, Circuit fundamentals, Audio fidelity	Soldering project
Feb. 9	Advanced switching, Reverse engineering	<i>Soldering project, cont'd</i>
Feb. 16	Really advanced switching	Switch project
Feb. 23	Resistors and capacitors, Volume and tone	Full-on guitar project
Mar. 2	More advanced tone circuits	<i>Full-on guitar project, cont'd</i>
Mar. 9	Pickup construction, Thoughts on student projects	Winding machine
Mar. 16	SPRING BREAK	
Mar. 23	Related issues: PCB-design tools	Student-defined project
Mar. 30	Related issues: Woods	<i>Student-defined project, cont'd</i>
Apr. 6	Related issues: Characterization of materials	<i>Student-defined project, cont'd</i>
Apr. 13	Related issues	<i>Student-defined project, cont'd</i>
Apr. 20	Related issues	<i>Student-defined project, cont'd</i>
Apr. 27	Related issues	<i>Student-defined project, cont'd</i>
May 4	Final Presentations (Mon May 19 1:30)	Student project due
May 11	No class (last day of classes is Tuesday, May 12)	
Exams	No class	

Special Needs

If you have a documented disability that requires special needs, please see me as soon as possible, and certainly no later than the third week of classes.