SFSU – SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

ENG 445 LABORATORY MANUAL

This Manual, downloadable from

http://online.sfsu.edu/~sfranco/CoursesAndLabs/Labs/445Labs.html

contains the pdf handouts for all lab experiments covered in Engr 445 – *Analog IC Design*. Following is a list of the various lab experiments, lasting an average of 3 weeks each:

1. **Effect of Roots on the Time and Frequency Responses**
2. **BJT Characterization and the Differential Pair**
3. **Analog IC Building Blocks**
4. **Testing a Breadboard Op Amp/Voltage Comparator**
5. **Frequency response of BJT Amplifiers**

There is also an **Appendix**, giving tips on proto-board circuit construction, and a folder with the files associated with each of the **PSpice Examples** presented in the Manual – files that students can download to duplicate the examples on their own, if they wish to do so.

Lab #1 uses an op amp to control the pole location in the complex plane for both 1st-order and 2nd-order systems. This lab is designed to offer students an opportunity to review and verify experimentally important systems-theory concepts that will prove useful later in the course as well as in the EE curriculum in general.

Lab #2 deals with the characterization of an IC array of matched BJTs, as well as the investigation of a differential pair.

Lab #3 investigates the basic building blocks of an IC op amp: The input stage, the intermediate stage, the output stage, and the DC biasing network.

In **Lab #5** students put together the blocks investigated thus far to breadboard first an op amp, then a voltage comparator, and to characterize both devices in terms of their most relevant parameters.

Lab #5 deals with the dynamic characterization of a BJT, as well as the investigation of the frequency response of the most common amplifier configurations

In general, a lab experiment is preceded by a detailed and self-contained review of the **theoretical background**. The experiment then proceeds with the **characterization** of the device under scrutiny as well as the investigation of some significant **applications**. The study of applications starts with **theoretical prediction** of circuit behavior using the results of the characterization, followed by **experimental verification**, followed by **computer simulation**, and it concludes with a comparison of the three approaches, with a justification of any discrepancies.

The above approach – characterization, prediction, experimentation, and computer simulation – is designed to prepare students for current industrial practice. A strong laboratory background constitutes an important asset for any student who envisions post-graduation work as a *test engineer*, a *product engineer*, an *applications engineer*, or a *design engineer*.