EE2031
Circuits and System Design Lab

Dr. HENG, Chun Huat

Office: E2 03-27

Tel: 6516 1628

Email: elehch@nus.edu.sg

Lecture Outline

- **Module Overview**
- **Lecture Schedule**
- **Lab Schedule**
- **Mid-term Test**
- **Brief Lab Introduction**
- **Mini Project**

Module Overview

- **Prerequisite: EE2021 or equivalent**

- **Modular Credit: 2 MCs**

- **Workload Per Week**

  0.5 hr. Lecture (2 hr lecture for 3 weeks only)

  3 hr. Laboratory Work

  1.5 hr. Preparatory Work by Student
  (Reading manual for LTSPICE, NI ELVIS and Lab. Refresh your knowledge from EE2021)

EE2031 Grading

- **Laboratory Work/Experiment**   **40%**
  Average over 7 experiments

- **Mid-term Lab Test**   **30%**
  Average over 7 experiments

- **Mini-project Report & Presentation**   **30%**

                                         Total   **100%**

Lecture Schedule

Lecture No.	Date	Lecture Description
1	11 Jan 2011 12pm~2pm	General Introduction for This Module
2	15 Feb 2011 12pm~2pm	Understanding of Solar Cell Panel
3	29 Feb 2011 12pm~2pm	Mini-Project – Design Perspective
4	14 Mar 2011 12pm~2pm	Mid-term Lab Test

Lab Schedule

Lab No.	Date	Lab Description
1	16 Jan ~ 20 Jan	Diode Characterization
2	30 Jan ~ 3 Feb	Diode Applications
3	6 Feb ~ 10 Feb	Transistor Characterization
4	13 Feb ~ 17 Feb	Transistor Application: Amplifier
5	27 Feb ~ 2 Mar	Low Pass Filter Design and Implementation
6	5 Mar ~ 9 Mar	Bistable Multivibrator Oscillator Design and Implementation
7	12 Mar ~ 16 Mar	Solar Panel Characterization
8	19 Mar ~ 23 Mar	Brain-storming Mini-project with Given Component List
9	26 Mar ~ 30 Mar	Building Prototype
10	2 Apr ~ 6 Apr	Building Prototype
11	9 Apr ~ 13 Apr	Presentation

Monday: 2pm~5pm,
Tuesday: 9am~12pm,
Wednesday: 2pm~5pm,
Friday: 9am~12pm

Mid-Term Test

- **Held in LT6 during lecture period**

- **Contents of Lab 1 to Lab 7**

- **Equipment knowledge and experiment procedure is also testable**

- **MCQ as well as short questions**

- **30% of the Total Final**

Lab 1: Diode Characterization

- **Learn about NI ELVIS and its SFP**

- **Diode characteristic**

$$I_D = I_S \left(e^{\frac{V_D}{nV_T}} - 1 \right)$$

- **Two unknowns, can we solve simultaneous algebra equations with two sets of (V_D, I_D)?**

- **What method can we use?**

Lab 2: Diode Applications

- **Learn about LTSPICE**

- **How many different kind of diodes are there?**

- **How to design based on datasheet?**

Lab 3: Transistor Characterization

- **What are the important parameters for BJT?**

$$I_C = \beta I_B = I_S e^{\frac{V_{BE}}{V_T}} \left(1 + \frac{V_{CE}}{V_A}\right)$$

- **What are the important parameters for MOSFET?**

$$I_D = K_n(V_{GS} - V_{THN})^2(1 + \lambda V_{DS})$$

- **Do you know how to characterize those parameters?**

Lab 4: Transistor Applications - Amplifier

- **How to bias CS and CG?**

- **What are the gain equations?**

- **What is the difference between CS and CG?**

NUS EE2031 CH Heng

Lab 5: Filter Applications

- **How to design 1st order active filter?**

- **How to design 2nd order Sallen Key filter?**

- **How to figure out the cut-off frequency given certain requirement?**

Lab 6: Bistable Multivibrator Oscillator

- **How to design oscillator with certain oscillation frequency?**

- **What is the use of oscillator?**

Lab 7: Solar Panel Characterization

- **How does the solar panel generate electricity?**

- **What is the electrical circuit model for solar panel?**

- **How to characterize the solar panel?**

- **How to extract the energy efficiently?**

Mini-Project

- **Group of 2 students**

- **Propose and design circuit with only the components specified in a given list**

- **Subject to time and material constraint**

- **Need to demonstrate the whole design flow**

- **Short mandatory presentation during the last week**