

ELEC 243  
Problem Set 8  
Exam Section  
Due: March 20, 2015

**Exam Cover Sheet**

Exam problems begin on the next page.

There is one problem this week. It has a one hour time limit.

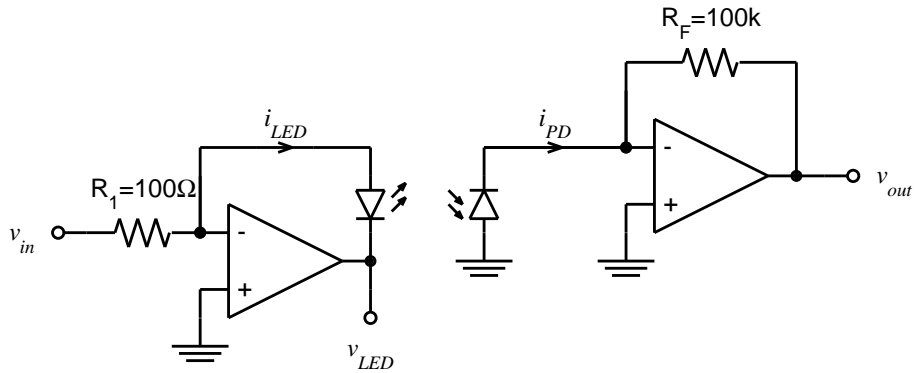
Before beginning you should read the following guidelines:

- All exam problems are pledged work.
- You may not discuss any problem with anyone other than the instructor.
- Unless otherwise specified, you **MAY** utilize:
  - A calculator.
  - Your textbook, class notes, and any material on or *directly* linked to the class web page.
  - A table of integrals.
- Unless otherwise specified, you **MAY NOT** utilize:
  - Matlab or any other computer software.
  - Any reference material other than those listed above.
- “Find” means to determine a numerical value or an algebraic expression for the indicated quantity or function. “Sketch” or “plot” means to draw a graph of the indicated function, not necessarily to accurate scale, but with labeled axes and important values indicated.
- Some problems will have a time limit. This will be indicated at the beginning of the problem itself and on the cover sheet. If no time limit is specified, you may use as much time as desired, subject to the solution being handed in on time.

When you are ready to begin, turn the page.

**E8.1 This problem has a one hour time limit.**

The circuit below is a simplified version of the Emitter-Detector pair from Experiment 6.1.



With a voltage of 2 V DC connected to  $v_{in}$ , and nothing in the path between the LED and the photodiode,  $v_{out}$  has a value of 1 V DC.

- What is  $i_{LED}$ ?
- What is  $i_{PD}$ ?
- If the LED has a reverse saturation current ( $I_0$ ) of  $2.8 \times 10^{-23}$  A, what is  $v_{LED}$ ?
- If an opaque object is placed in the path between the LED and photodiode, what is  $v_{out}$ ?
- If a transparent object which absorbs 80% of the light passing through it is placed in the path between the LED and photodiode, what is  $v_{out}$ ?
- If the 2 V DC source is replaced with  $v_{in} = \cos(100t)$ , what is  $v_{out}$  (with nothing in the path)?