EELE482 INTRODUCTION TO ELECTRO-OPTICAL SYSTEMS

Final Paper

The final paper for this course will be in the format of a formal design review of an electro-optical system, consisting of both a written and an oral presentation. You will have considerable latitude in choosing the system you will review. It can be derived from a commercial instrument or system, manufacturer's application notes, the scientific literature, or a system of your own design. Optical systems you may already be using as part of a research project may be suitable as well.

The objective of this design review will be a detailed analysis of the system function and intended application, operating principles and performance specifications. *The review paper should be written as if you were proposing to build the system you are describing, for instance as a subsystem of a commercial instrument.* The purpose of such a review is to inform your colleagues about how the design works, specify the performance with respect to the intended application, specify any interface to other parts of the instrument, and provide an opportunity for other experts to identify potential pitfalls or possible improvements. Special attention should be given to those elements of the design that are critical to the system operation, limit system performance or are especially novel in the way they are used in the system. The intended audience for the review document would be other scientists or engineers with a basic understanding of electro-optical devices and systems, but who may not be up to speed on the particulars of your design.

The written review should consist of the following parts.

1) **Abstract** (or "Executive Summary"). In 250 words or less, describe the overall function or application of your design, key performance measures and a general description of the implementation.
2) **Introduction**. Describe the application, and why you are building this optical system. Describe the proposed system in terms of the overall function it will provide. Remember that in a design review, most of the audience will already know the application, but there may also be executives or engineers from other departments who are not familiar with the application, so you need to provide some context for them to understand the proposed system.
3) **Design Description**.
    a) **Overview**. Should include a *block diagram* description of the system. If the complete optical system is easily represented on a single page "schematic" (most are), include the *detailed schematic* here as well, and identify the functional blocks on the schematic. Describe how the various functional blocks work together to achieve the system function.
    b) **Detailed discussion**. For each functional block, describe the optical components used and how they achieve the desired function. If there is something clever or novel about the way a particular component is used, give enough detail, including background theory if necessary, so that the reader can understand the implementation. If an adequate explanation requires a lengthy digression, you should refer the reader to an appendix for the full treatment. There may be system wide details that require further discussion as well, such as a complicated feedback scheme. If a particular component is critical to system performance, tell why and what level of performance is achieved.

4) **Performance Summary**. Enumerate key performance measures. This section might look like a "specification sheet" for your design. (for extra credit, include tolerances on performance specifications) Examples of important performance measures might be *output optical power, minimum detectable signal, dynamic range, electronic bandwidth, optical bandwidth, spatial resolution, spectral resolution,* etc. Which parameters are important depends upon the nature of the optical system and the purpose for which it is being designed.
5) **Interface specifications**, if any.
6) **Equipment and components list**. Include all electrical and optical hardware necessary to implement the design. (for extra credit provide cost to build, and if for a commercial instrument, estimate costs for volume production).
7) **References.** If any. Please provide for this paper at least the primary reference from which the design was obtained, unless the design is your own and not based on another's work.
8) **Appendices.** Reserve any detailed theoretical development or justification for appendices at the end of the review document.

There is no set limit to the length of a review document. However, remember that you are asking your colleagues to give of their time to review your design. Therefore you should provide enough detail for a thorough understanding of the design, but keep to the point and avoid rambling on about subjects you may find fascinating but are not germane to the present design. Many designs can be adequately covered in **8 pages of single spaced text**, excluding appendices, and many can be described in fewer pages. Use your best judgement.

Oral Presentation

A formal design review typically consists of a written document, distributed ahead of time to allow the audience time to become familiar with the design, and an oral presentation of the design. Although a real design review might require a few hours of interactive discussion, our presentations will be limited to **15 minutes**, followed by 5 minutes of questions from the audience. Because of the limited time, you should focus on conveying the overall function of the design and the system "architecture". Select a few **key points** that you want your audience to go away with, and be sure to convey these points well. Be sure to include some introduction to the application of your optical system, to give us the context in which to understand the design.

Be professional. Prepare slides using Powerpoint or similar. Avoid using fonts smaller than 14 points, as they are impossible to read from the back of the room. 18 point type for bulleted items on a slide is a reasonable choice. At a **minimum**, devote one slide to :

- Target application for the optical system
- Key elements of the proposed solution
- Block diagram of system
- Detailed schematic of the design
- Each subsection of the design which you have chosen to review in detail
- Summary of the performance specifications for the design