PENNSTATE

AE 481W AE Senior Project I | Lighting/Electrical Option

Lighting Requirements for Individual Senior Projects

Fall 2013 | 4 credits

Lighting Consultants

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Scope of this Document

This document applies to students that are performing an individual senior project—that is, those being advised by Profs. Good and Houser. For those on an integrated team (i.e., Scott Brown, Katharine Gausseres, Lara Kaiserian, Andrew Levy, Robert Livorio, Rebecca Slocum), please refer to separate requirements from Prof. Mistrick.

All students specializing in lighting or electrical systems are required to perform work in **both** building lighting and electrical systems, as well as complete all general requirements. The general course requirements and electrical deliverables are described in separate documents. The scope of this document is limited to lighting requirements, which may be modified to suit individual projects only through a formal written request. Read this document in its entirety, as later assignments may influence how you approach earlier ones.

Lighting Requirements

There are three major graded categories:

1. 25% (1 of 4 credits) = Project Management assignments as graded by Prof. Parfitt.

2. 25% (1 of 4 credits) = Electrical Assignments as assigned and graded by Prof. Beahm.
3. 50% (2 of 4 credits) = Lighting Assignments as assigned and graded by Prof. Good or Houser.

The table below summarizes each major deliverable (some of which include two items) and lists the grade percentage for each item and due dates. A separate document provides the electrical requirements, including a breakdown of interim deliverables and how they will be scored. The general course syllabus should be referenced to obtain details on the portion of your course grade which has been reserved for project management activities.

Lighting Electrical Grade Composition

	Deliverable	% of Grade	Due
PM	Project management activities as assigned and graded by Prof. Parfitt.	25%	See Prof. Parfitt
1A.	Tech Report 1, Part 1: Lighting Proposal Memo	10% (1A & 1B)	Sep. 9
1B.	Tech Report 1, Part 2: Lighting Existing Conditions and Design Criteria		Sep. 16
2.	Tech Report 2: Electrical System Existing Conditions (see Electrical Handout for deliverables)	25%	Oct. 11
3.	Tech Report 3: Lighting Schematic/Initial Design Development Report – Presentation to AE Faculty (Note: Presentations must be uploaded by 4 PM on Nov. 12. Presentations will be scheduled during the week of Nov. 12)	20%	Nov. 11
4A.	Senior Project Proposal for Spring Semester, Part 1: Revised Lighting Schematic Design/Initial Design Development Presentation to Lighting Designers (at Lutron in Coopersburg, PA) with Plans for Spring Semester	20% (4A & 4B)	Early Dec.
4B.	Senior Project Proposal for Spring Semester, Part 2: Written summary of Lighting Schematic Design/Initial Design Development Presentation, including summary of feedback and suggestions from Lighting Designers		Dec. 13

Specific considerations related to deliverables 1, 3 and 4 above are described below.

1A. Tech Report 1, Part 1: Lighting Proposal Memo

In this brief submission, indicate which spaces you plan to study. The spaces to be analyzed and redesigned should consist of at least one of each of the following (for a minimum of four spaces), and should be spaces of reasonable size and complexity.

- Large work space
- Special purpose space (large conference room, auditorium, cafeteria, etc.)
- Circulation space (such as a lobby or atrium)
- Outdoor space or the building façade
- Any additional spaces that you plan to study.

One space, three schematic design concepts: For one of these spaces (but not the large work space), you will be asked to produce three different design concepts, as described later in this document. Please indicate which space you have selected.

One space, Psychological impressions: For at least one of the spaces you will be asked to produce a lighting solution that provides an appropriate psychological impression, such as one of the following. You do not need to provide a counterpart to the impression that you select.

a. The *Public/Private* counterpart system (re: spatial intimacy)
b. The *Spaciousness/Closure* counterpart system (re: spatial circulation)
c. The *Relaxation/Tension* counterpart system (re: lounge activity)
d. The *Somber/Festive* counterpart system (re: emotional content)

As part of the Lighting Proposal Memo, you only need to identify which of your four spaces you plan to use for psychological reinforcement. You may also incorporate psychological reinforcement into other spaces if appropriate for the design goals.

Consider system integration and breadth issues when selecting your spaces. Daylighting design/analysis may present excellent breadth coordination opportunities.

In the memo, you must describe each space and how they are used—perform a task analysis of the visual and non-visual activities since that will form the basis for your lighting design. For each space include drawings, space dimensions, materials, and a list of activities and/or visual tasks. Everything in your report must be legible when printed; take care with line weights and font sizes.

This memo may be submitted prior to the due date for early approval, thus allowing you to move ahead with the next assignment.

1B. Tech Report 1, Part 2: Lighting Existing Conditions and Design Criteria Report

A. Describe the existing lighting systems, the major lighting hardware, and the spatial environment. Include luminaires, lamps, ballasts, control devices, daylight elements (including glass type & transmittance), as well as space properties such as the geometry and surface materials with their reflectances. Include drawings (plans and sections) for all spaces to be redesigned and show the location of furniture and other relevant items that are present in these spaces (include important details such as artwork, chalkboards, directories, etc.). If you do not have access to actual furnishings, make assumptions regarding these items.

The senior project is open-ended. You will likely need to make inferences and judgments with incomplete information. Do not get overly bogged down attempting to get exact answers to open-ended problems. Make educated decisions, document your assumptions, and move forward.

B. Provide details about all qualitative and quantitative system performance considerations, including such items as aesthetic criteria, illuminance, glare, VDT criteria, energy efficiency, sustainability, controls, accent lighting, luminance ratios, uniformity, luminance limits and ratios, and psychological aspects. Include references for each of your considerations and design criteria, which may be from IES, LEED, ANSI, CIE, and/or other lighting standards organizations. *The most recent edition of any document or standard must be applied*. **Summarize the design considerations with appropriate and complete lighting system design criteria for each of your spaces.**

Justify any deviations in your recommendations from IES documents.

For the space where your focus will be psychological reinforcement, refer to the series of articles by John Flynn from Electrical Consultant, to the article by Craig Bernecker about applying Flynn's work through model studies, to Section 4.5 of Architectural Lighting Design by Gary Steffy, and to the "subjective lighting" presentation that can be found online at http://ald3e.com. These are all good references.

You must include power allowances and control requirements as listed in Standard 90.1 or any more stringent (perhaps state) energy code that is in effect for your building. Sustainability should be an important consideration in all designs.

Your lighting design criteria may be provided in the form of a table, bullet items, and/or short paragraphs, but must include specifics on what your design needs to achieve in each space. **The explanatory descriptions of your criteria—the what's and why's—are the most important part of this report.** Do not simply list design consideration categories and their level of importance. State in your own words what criteria you plan to apply and how they relate to each space **with specific details on the tasks, architectural features, lighting system performance, psychological needs and/or other relevant priorities for each space**. Prioritize the criteria and indicate their relative levels of importance.

Be cognizant of the difference between "design considerations" and "design criteria". An item such as "points of interest" may be a relevant consideration, but how does that translate to a design criterion? What are the points of interest in a particular space and why might it be important to address them with light? Another consideration is psychological reinforcement. These may include design considerations related to mood, comfort, behavior, and/or occupant impressions. How do these considerations translate into criteria for your particular space? What is appropriate for the space? Can light be employed to reinforce the psychology of the space? Your criteria may also include a general lighting concept or an overarching theme that you plan to implement in the building across all spaces. Remember that you are being asked to provide design criteria specific to your spaces; you are not being asked to provide a laundry list of considerations that may or may not be relevant.

The criteria you list for each space must be addressed in your eventual design solution. Think ahead: Do the items you describe have enough specificity that they can be reasonably addressed with a lighting design solution?

You must document the project's applicable energy code and conform to requirements for power consumption and control. If the project was designed to meet LEED criteria, you must clearly state which LEED points the lighting and or lighting controls were designed to meet and whether or not your design goals are to meet or exceed these same criteria. We will permit power densities to be traded between the different spaces studied, but only if the total square footage of each space type within the building permits this to occur. You will be required to show that your final lighting systems comply with all applicable codes, LEED criteria, and other green building design standards. If your building was not originally designed to meet any green building design standards (LEED or other), then you may chose to impose these requirements. You may also choose to impose a more stringent energy code (for example, you may choose to comply with Standard 90.1 2010 even if your building references Standard 90.1 2007).

C. Evaluate and critique the existing lighting conditions in your building (in general), and more significantly in the four spaces you plan to redesign. Address the existing designs relative to the quantitative design criteria you established for each space. Your evaluation must involve a detailed performance analysis of the existing systems in both the work space and the special purpose space using computer software (or any other appropriate method). The performance analysis in the remaining spaces may be made from drawings, photographs, or a site visit. Appropriate light loss factors must be applied and documented in all analyses. In the event that a space or lighting design is overly complex, you may simplify the computer model to approximate the system's performance. Provide summary comments on the aspects of the lighting design that do not lend themselves to a quantitative computer model, including such items as aesthetic integration, architectural reinforcement, appropriateness to space use, and so on. For example, in the circulation space that you selected, does the lighting design solution reinforce the type of circulation that is likely to occur (e.g. random, guided, directional, etc.)? How? Why?

D. Provide a list of the relevant computer files used in any analysis on a CD that you include with your report, or include a link to these files on the title page of your report. Computer models will be checked to ensure proper input and analysis parameters (program settings) were used in the analyses.

2. Tech Report 2: Electrical Systems Existing Conditions
See Electrical handout.

3A. Tech Report 3: Lighting Schematic/Initial Design Development Presentation to AE Lighting Faculty

Submit a PowerPoint[1] presentation that demonstrates schematic design concepts and initial directions of design development for lighting each of the four spaces. The schematic design concepts must address your design criteria. The following are requirements:

One space, three schematic design concepts: For one of the spaces (but not the large work space), you must produce three distinctly different design concepts. This is an opportunity for you to exhibit divergent thinking by demonstrating your ability to conceptualize alternate design solutions for a space.

One space should promote a psychological impression: For one of these spaces you must explicitly demonstrate how you have employed light for psychological reinforcement when illustrating your design concept. This can be achieved with sketches, Photoshop, or with the construction and photography of a scale model.

Your schematic design presentation should focus on conceptually meeting the design criteria. Where aesthetics is important, you should describe patterns of light within your spaces, and relate that to the achievement of design criteria. Consider: How does light reveal the architecture? How does the light reinforce the selected psychological impressions and enhance space appearance? The focus should not be on the lighting hardware. This is why it is necessary to avoid a program such as AGI32 at this stage in the design process; the use of lighting visualization software would require you to select lighting hardware. The focus here is on effects of light, not on effects of a particular product.

For each space, your presentation should summarize the principal design criteria, illustrate your vision for how you want the space to appear, and explicitly describe how your solution will satisfy the design criteria. **It is absolutely critical that you link your proposed lighting design solutions to the design criteria.** Hand sketches, Photoshop illustrations, plans, sections, elevations, model photographs, and/or other graphics that convey your design intent are required. Your approach to the design, the reasons for your proposed design criteria, the desired lighting patterns, and proposed luminance patterns must be clearly articulated in the PowerPoint presentation. Design criteria must be addressed in this presentation with a focus on the key design criteria elements. Don't overwhelm the audience with a laundry list of so-called "design criteria" and then fail to illustrate how they have been addressed. Refer to the previous comments about the difference between design considerations and design criteria.

Sketches of the lighting effects you hope to achieve in a space could (and in most cases should) be used to convey your design concepts.

After explaining your design criteria and describing your design concept, you should provide examples of lighting equipment you propose to use in your design. In real projects, this information would help to convey more information regarding the design to the architect and/or building owner. This can include lamps, luminaires and control

[1] Use of PowerPoint is not a strict requirement. Other software such as Prezi or Sliderocket may be used, as long as you provide your work in a format that is viewable by others without requiring special software.

equipment, as appropriate. Your selections should work with your schematic design concepts and the building's architecture. Initial hardware selection is considered to occur during the initial phases of design development, but will allow you receive valuable feedback on your approach to your proposed design.

You will present Tech Report 3 to your faculty consultant and receive comments that you are then expected to incorporate into your Senior Project Proposal for Spring Semester, Part 1, which will be reviewed by a panel of lighting designers (see 4A below).

In both the fall and spring semester presentations, all lighting hardware must be specified using a *generic description*, with no reference to a manufacturer's name or product appearing on any slides, or in the oral portion of a presentation. This will require special attention, but adds to the overall quality of the presentation. Any written reports and the final summary book may include references to manufacturers.

SUGGESTION: Begin to develop your design concepts and presentation graphics as early as possible during the semester. You do not need to wait until Report 2 has been submitted to begin this work. Material including the Tech 1 report can be placed into a format that can applied in Tech 3 and beyond.

4A. Senior Project Proposal for Spring Semester, Part 1: Revised Lighting Schematic Design/Initial Design Development Presentation to Lighting Designers (at Lutron in Coopersburg, PA) with Plans for Spring Semester (typically a panel of 3)

You will present a revised version (based on your consultant's comments) of your schematic design presentation to a panel of lighting designers at Lutron's corporate headquarters in Coopersburg, PA. The purpose of this presentation is to provide you with feedback on your designs from highly experienced design professionals.

4B. Senior Project Proposal for Spring Semester, Part 2: Written summary of Lighting Schematic Design/Initial Design Development Presentation, including summary of feedback and suggestions from Lighting Designers

1. Describe the work you plan to perform during the Spring Semester in both the lighting and electrical areas. Include a timeline in Gantt Chart format.

2. Summarize the comments you received from the lighting design professionals on your Schematic Design Presentation. Indicate areas you plan to address or revisit based on this feedback. Any proposed changes to the scope of your project should be discussed with your faculty consultant prior to submitting the project proposal, and must be listed in the proposal as a deletion or modification to the standard project requirements. Students are required to perform Spring semester work on both the lighting and electrical systems.

3. Arrange your schedule to accommodate submission of at least one completed lighting space by Feb. 3.

4. **MAE Students**: Describe the additional work that you will do for your MAE degree.

MAE Students

In AE 482 MAE students are required to include a substantive additional component that is related to one of their graduate level courses. In the final AE 482 summary book (spring semester), MAE students will be required to list references for all criteria and literature reviewed. It is important to begin acquiring these during AE 481W (fall semester) as you progress through the assigned tasks.

Students with Disabilities

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: http://equity.psu.edu/ods/dcl. For further information, please visit the Office for Disability Services Web site: http://equity.psu.edu/ods.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: http://equity.psu.edu/ods/doc-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Academic Dishonesty

Talking over your ideas and getting comments on your work from classmates, co-workers and instructors are not examples of plagiarism or cheating. Taking someone else's work and calling it your own is plagiarism, including using another persons' calculations, spreadsheets, computer programs, homework solutions, or ideas. Academic dishonesty includes, but is not limited to, cheating, plagiarism, fabrication of information or citations, facilitation of acts of academic dishonesty by others, unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, and tampering with the academic work of other students. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others. The minimum penalty imposed for academic dishonesty of any type will be a grade of 'F' for the assignment. More serious offenses will result in failure in the course and major offenses may result in suspension or expulsion from the University. You are encouraged to read the University Code of Conduct and Faculty Senate Policy 49-20 and G-9 Procedures.