

**Duke University Medical School**

**Duke School of Nursing**



**Thesis Proposal**

**Lighting and Electrical Depth Proposal and Breadth Topics Proposal for  
Spring 2008 Semester**



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## Executive Summary:

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This is a formal proposal for the lighting and electrical depth topics and the two breadth topics for the spring semester of thesis. The overall conceptual lighting design theme is “Lantern of Enlightenment.” The meaning of this theme is that the Duke University Medical School is well known for its prestige and excellence in its researcher and producing high caliber professionals.

The **lighting redesign** will involve four spaces on the first floor: the Gothic Tower Entrance Lobby, the Peter & Ginny Nicholas Auditorium & Learning Center, the Café DUSON student lounge, and the Champagne Courtyard patio. The new lighting designs will follow the fundamental steps of the lighting design process from conceptual design all the way to documentation. The lighting redesign will be completed and documented using a combination of hand sketching and computer software. The final result will be a set of lighting plans for all spaces redesigned and at least two photorealistic renderings of the new lighting design.

The **electrical redesign** will redesign the branch circuit distribution for the four spaces where lighting has been redesigned. A protective device coordination study that addresses a single-path through the distribution system, including short circuit calculations will be conducted. Finally, the electrical redesign will include an investigation of a central transformer system instead of distribution transformers and the use of energy efficient transformers instead of standard transformers. These issues will be addressed by multiple Excel calculations as well as updating the current electrical panel. A cost analysis of implementing these transformer solutions will be conducted.

The **first breadth** topic is an acoustical analysis of the Café DUSON, a large architectural volume with double high glass curtain walls and a large amount of wood finishes on the walls and the ceiling. I propose analyzing the acoustical quality of the Café DUSON and offering solutions to any acoustical problems associated with this study. The analysis will be conducted using acoustical software, EASE, and solutions will be derived from the results.

The **second breadth** topic is a mechanical redesign that involves the integration of the currently exposed mechanical system and my new lighting into the architecture of the space. I plan on creating false beams, which appear to be structurally supporting the ceiling, but in actuality they are hiding the main ambient light fixtures as well as the mechanical equipment. This mechanical integration will entail changing the round ducts to rectangular ducts and modifying diffuser locations if required.

## Building Overview:

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The Duke University Medical School- Duke School of Nursing is a 59,610 SF, three story building that opened for occupation in August 2006. The cost of the building totaled \$14.7 Million. The building is located on the Duke University Campus in Durham, North Carolina. This building is a classroom and administrative building used to train prospective nurses from Duke's nursing program. Additional spaces include conference rooms, large classroom auditoriums, mock-ICU labs, and a large student lounge.

## Depth Proposal: Lighting

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The existing lighting system is mainly a linear and compact fluorescent lighting system that maintains the proper light levels in the building. A variety of fixtures are used which include: direct downlights; linear pendants; pendants; wall-washers; and standard 2x4 lensed troffers. The student lounge receives a large amount of daylight, due to the double high glass curtain walls on the North and East walls of the space. This space as well as most of the spaces in the building are connected to an advanced lighting control and dimming system.

There are two main architectural features that must be addressed in the lighting design. The first element is the large Gothic Tower that houses the main entrance and lobby for the building. The second architectural element that must be addressed is the three large gothic arches in the student lounge.



The lighting redesign will involve four spaces on the first floor: the Gothic Tower Entrance Lobby, the Peter & Ginny Nicholas Auditorium & Learning Center, the Café DUSON student lounge, and the Champagne Courtyard patio.

### **Lighting Designer Comments from Presentation at Lutron (12/13/07)**

#### **Mike Barber**

Clearly defined points

A lot of existing images, good but need more conceptual ideas

Good Prelim renderings

Look at where lighting concept might exist somewhere else to sell/reinforce ideas

#### *Lobby*

- make stronger visual statement – section studies of pendant volume vs. space volume
- what about lighting the beams on the ceiling – 3D effects to continue beam/boxing of beams idea

#### *Auditorium*

- cove in concept design
- controls?
- Kill direct light, just have cove glow – another level of ambient illumination instead of pendant fixture

#### *Lounge/Café*

- show design reduces trespass out
- don't downlight an arch b/c of curvature of the architecture

#### **Sandra Stashik**

- Idea of gothic not really played out in lobby
- Liked lobby fixture glow but the walls are glowing which will be neat but architects don't like holes in beams
- No exterior lighting on the tower? Light gothic tower – it's a huge exterior feature – light it up – key to the building and “gothic” architecture
- What about orientation of spaces in the building and going from one to another?
- Overall images – could have been stronger from tower – more in rendering, auditorium needs more light on seating – clear on what you're going for and how you solved it

#### *Auditorium*

- controls, look at whole space graphically
- seats look really dark – main surface to be lit is not lit – how are you holding the whole space together?

### **Andrea Hartranft**

- Lobby fixture could have huge potential with its presence in the space – gives lots of options for different sources and flexibility
- Define where light is going then look at pendant
- Problem with beams with holes b/c it is no longer a structural-looking beam
- Images too small – can't see them
- Text size inconsistent

#### *Auditorium*

- speaker wall lit but what about speaker modeling?
- Think about how many ceiling planes you're creating – too many? Consider pendant plane at the same plane of the cove

#### *Café*

- says auditorium on slide
- better image – looks like barn
- careful with arch lighting – detracts from multiple layers
- arches already stand out by being in silhouette
- consider small quantity of large pendants instead of no pendants at all
- not very gothic without pendants

#### *Patio*

- second conceptual sketch – excellent sketch!
- Follow through with second idea and sketch
- First concept not good to people on ground but good idea if you could see from above the trees

The overall conceptual lighting design theme is “Lantern of Enlightenment.” The meaning of this theme is that the Duke University Medical School is well known for its prestige and excellence in its researcher and producing high caliber professionals. The building lends itself to become the “Lantern” with its large glass windows and glass curtain walls. The glow, metaphor for the “Enlightenment”, will be the warm light from all the spaces. The lighting will also highlight and accent the Gothic architecture.

The key features of the Tower Entrance Lobby are the gothic tower, the large glass windows, and the double high interior volume. The three double high glass windows allow the lobby to be seen from the West, South and East. This means that this will be a prominent view to passersby. I plan on addressing the issue of creating a pendant fixture that will work with the Gothic theme as well as the shear volume of the space. However, the main light will be focused on the South wall to create this glowing effect. The lighting design intent is to light the tower from within and not place light on the exterior of the tower. This will emphasize the conceptual theme of “Lantern of Enlightenment.”

The key to the Large Classroom Auditorium is to tie the architecture of the other spaces with this space. I plan on creating a coffered/coved ceiling, in order to mimic the large architectural beams of the lobby. Also, these coves will create a glowing effect which fulfills the design metaphor. Daylight control is an important factor in this space since the small ribbon windows are located high on the southern facing wall.

The student lounge is the main space to focus on for my thesis. This space is a large volume that has three large Gothic arches and large glass curtain walls. The goal for the lighting design is to exemplify the design metaphor of the lantern as well as highlight the wonderful Gothic architecture. Passersby are able to see directly into the interior of the space via the two double high glass curtain walls. For this reason, the space must show its design intent from not only the interior but as well as the exterior. I plan on integrating the main lighting system and the mechanical system into the architecture by creating false beams on the ceiling. The size of these false beams must be studied to make sure the scale matches the existing architecture. I also plan on using the same large custom pendant fixture from the Tower Entrance Lobby to tie the spaces together visually. The layering of light is critical in this space and must be thoroughly studied.

The key elements of the courtyard are the arching stacked stone retaining walls and the large existing trees that were carefully saved during the construction of the building. Being that the courtyard borders the large glass walls of the lounge, there is a high level of light in the space from the lounge. However, the retaining walls and the large trees are not currently

lit. I plan on up lighting the trees and the walls to highlight their textures. This plan also will create an indirect luminaire or lantern out of the natural elements.

Overall the three main goals are to create a lighting design that compliments and accents the building's architecture, is flexible in controls for day lighting and various situations, and the appearance of the interior light to the exterior. Please reference Technical Report 3 for the conceptual lighting design.

***Solution Method:***

The new lighting designs will follow the fundamental steps of the lighting design process from conceptual design all the way to documentation. The lighting redesign will be completed and documented using a combination of hand sketching and computer software. The final result will be a set of lighting plans for all spaces redesigned and at least two photorealistic renderings of the new lighting design.

***Tools:***

The lighting redesign will be within the energy requirements of ASHRAE Standard 90.1. The recommended lighting practices and standards of the IESNA Handbook will be followed wherever applicable. Design criteria established in Technical Report 1 will be used to guide and evaluate the new designs.

Conceptual designs will be created using a combination of hand sketches and Photoshop manipulated images. As the designs progress, AGI32 will be used to verify designs and perform necessary calculations. Final photorealistic renderings will be completed using AGI32. A movie walkthrough may be made of the Café out onto the Courtyard and back.

## Depth Proposal: Electrical

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**1. *Redesign branch circuit distribution for the four spaces where lighting is redesigned.***

The four spaces to be redesigned are the exterior courtyard, the first floor tower entrance lobby, the large classroom auditorium, and the student lounge. The redesign will include laying out panelboards and resizing the electrical distribution equipment and feeders.

**2. *Conduct a protective device coordination study that addresses a single-path through the distribution system, including short circuit calculations.***

The path to panel board **RGA** will be analyzed. This path goes from the service entrance to main distribution panel to panel **HGA** to the transformer **TGA** and then finally to panel **RGA**.

**3. *Investigate the use of a central transformer instead of the current distributive transformer system.***

The building is only three stories tall and 59,610 sf. The entire building uses 277V except for the receptacles. With considering this criteria the use of one central transformer may be a better option, especially in considering the electrical losses associated with multiple transformers throughout the building.

**4. *Investigate the use of energy efficient transformers.***

The current building design is trying to obtain a LEED rating. It currently is under evaluation, but the building is using standard transformers. Energy efficient transformers should be investigated to see if the energy savings would be significant enough to justify the higher initial cost and also potentially add a LEED point.

### **Breadth Proposal: Acoustical Analysis**

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Acoustics in a large gathering space, such as a large student study lounge, is of the utmost importance due to the intelligibility of sound as well as maintaining a comfortable and studious environment. The Café DUSON- student lounge is an acoustical concern of the Duke School of Nursing. This space is a large architectural volume with double high glass curtain walls and a large amount of wood finishes on the walls and the ceiling. I propose analyzing the acoustical quality of the Café DUSON and offering solutions to any acoustical problems associated with this study. Acoustical analysis software, EASE, will be utilized to obtain current performances and possible solutions.

### **Breadth Proposal: Mechanical**

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As a compliment to my lighting redesign in the Café DUSON, I am proposing an integration of the currently exposed mechanical system and my new lighting into the architecture of the space. I plan on creating false beams, which appear to be structurally supporting the ceiling, but in actuality they are hiding the main ambient light fixtures as well as the mechanical equipment. This mechanical integration will entail changing the round ducts to rectangular ducts and modifying diffuser locations if required. Mechanical analysis software as well as hand calculations will be utilized to determine the required actions.

**Spring Semester Schedule:**

<b>AE 482 Schedule</b>	
Week	Description of Activities
Winter Break	Begin some modeling of spaces in CAD and revise schematic designs.
Jan 14 <sup>th</sup> to Jan 20 <sup>th</sup>	Continue modeling spaces in CAD
Jan 21 <sup>st</sup> to Jan 27 <sup>th</sup>	Begin electrical coordination study
Jan 28 <sup>th</sup> to Feb 3 <sup>rd</sup>	Start fixture selection and design custom fixture
Feb 4 <sup>th</sup> to Feb 10 <sup>th</sup>	Finish lighting models and start lighting calculations
Feb 11 <sup>th</sup> to Feb 17 <sup>th</sup>	Finish lighting calculations
Feb 18 <sup>th</sup> to Feb 24 <sup>th</sup>	Refine lighting plans based on calculations
Feb 25 <sup>th</sup> to Mar 2 <sup>nd</sup>	Start Research on energy efficient transformers and a central transformer system
Mar 3 <sup>rd</sup> to Mar 9 <sup>th</sup>	Begin short circuit calculations and transformer calculations
<b>Mar 10<sup>th</sup> to Mar 16<sup>th</sup></b>	<b>Spring Break (Start the two photorealistic lighting renderings)</b>
Mar 17 <sup>th</sup> to Mar 23 <sup>rd</sup>	Finish electrical depth requirements and photorealistic renderings
Mar 24 <sup>th</sup> to Mar 30 <sup>th</sup>	Start running acoustical analysis in EASE and start resizing duct sizing for the integration in the Café DUSON space
Mar 31 <sup>st</sup> to Apr 6 <sup>th</sup>	Finish acoustical analysis, and mechanical resizing. Complete final documentation
Apr 7 <sup>th</sup> to Apr 13 <sup>th</sup>	Complete and review Report and finalize Powerpoint presentation
<b>Apr 14<sup>th</sup> to Apr 20<sup>th</sup></b>	<b>Faculty Jury Presentations</b>