



Architectural Engineering 464 , Fall 2005
Advanced Architectural Illumination Systems Design

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Sched Number	MeetingDays/ Times	Classroom	ADV ARH ILM SYS&DS
482788	M W 11:15A - 12:05P F 10:10A - 12:05P	367 <u>WILLARD</u> 003 <u>BUSINESS</u>	08/30/2005-12/09/2005 Credits: 3.0 Prerequisite: <u>A E 461</u>

Course Topics:

- Photometry and Lighting Calculations
- Visual Performance and Glare
- Facial appearance and applications in video conferencing
- Light ratios for accent lighting
- Retail and museum lighting
- Flynn atmospheres and your thesis spaces
- Controls and Zoning
- Outdoor Lighting
- Daylighting
- Philadelphia Lighting Design Competition, incl. LEED criteria

Course Goals

This course introduces students to advanced concepts in illumination engineering and lighting design. The goal of this course is to help students develop the vocabulary and skills to become productive lighting designers for building project teams.

Prerequisites: AE 461

Objectives

- Gain a working vocabulary and familiarity with advanced concepts in illumination engineering and daylighting
- Develop and present lighting design concepts for clients
- Be able to perform advanced calculations to assess the quantity and quality of daylight and electric light
- Learn how to apply important lighting design techniques, including accent lighting and facial lighting
- Become familiar with new lighting hardware developments, including controls
- Gain a basic understanding of human factors in lighting

Required Text:

IESNA Lighting Handbook, Reference and Application, 9th edition. The readings in this book are required for all tests. Additional course handouts will be provided as necessary.

Course Format:

This course will combine lectures and laboratory exercises. Students are expected to attend class and be prepared for discussion and measurements.

Submissions:

Neatness counts. Use plain white backgrounds and mention your name, the assignment title, the assignment number, the date and your ID on the first page. Group assignments must be submitted as a single document. Late penalties of 10% per day will be assessed on all submissions. Late work will not be accepted after it has been discussed in class.

On-Line Course Materials

We will be using ANGEL in this course, Penn State's online course management system. All students are required to create and maintain an account on ANGEL for this course.

ANGEL: <https://cms.psu.edu>

Grading

You will be evaluated on your class participation, incl. excursion participation, assignments, one midterm, two group projects, and a final exam.

- Class Participation 5%
- Midterm 25%
- Design Competition 30%
- Assignments 40%

Course Policies:

Lateness in class will result in deductions in class participation.

There are no makeup exams or assignments.

Students are responsible for a seamless set of notes.

Around two hours of reading are required for one hour of lecture.

All exams are open book, open notes. Bring all materials to exams. Midterm and final are cumulative.

1 day late = 1 grade off

Academic Integrity:

<http://www.smeal.psu.edu/smeal/integrity/>

Expenses:

Students will encounter travel expenses for trips to NYC and Washington DC

Excursions:

ARUP Oct 28?

IALD conference Oct 21-22

Photometry and Lighting Calculations 2 weeks	8/31 – 9/14
Visual Performance and Glare 1 week	9/16 – 9/23
Facial appearance and applications in video conferencing 2 weeks	9/26 – 10/7
9/30 GE Lighting trip	
Midterm	10/10
Light ratios for accent lighting 1 week	10/12 – 10/19
10/21 IALD conference	
Retail and museum lighting 1 week	10/24 – 10/28
Flynn atmospheres and your thesis spaces 1 week	10/31 – 11/4
11/3 5-6 pm Rob Leiter HDLC Lighting NYC presentation	
Controls and Zoning 1 week	11/7 – 11/11
Outdoor Lighting 1 week	11/14 – 11/18
Daylighting 1 week	11/21, 11/22 - 11/30
Philadelphia Lighting Design Competition 1 week	12/5 - 12/9
Due date on Final	

Readings

I = IESNA Handbook 9th edition

Photometry: Murdoch pp. 33 – 69, 582 – 591 – see class handout from first day

Visual Performance and Glare

- 1 I 18-2, I 11-3 to 11-5, 12-3 to 12-4
- 2 I 3-1 to 3-33
- 3 I 9-26 to 9-28
- 4 I 3-36

Facial appearance and applications in video conferencing

- 1 I 14-2 to 14-10, 14-12
- 2 I 11-3, 11-5 to 11-6, 11-14, 17-5 to 17-8
- 3 I 15-13 to 15-16
- 4 Handout Mondo article Al Borden on Video Conf. Lighting.
- 5 IIES paper on video conference lighting
- 6 LD+A articles on the topic
- 7 Brightlines web site, Videssence web site pdf documents on video conference lighting

Retail, museum and accent lighting – see the appropriate chapters in the IES Handbook

Philadelphia Lighting Design Competition

- 1 Brandston on Statue of Liberty, “A vision for lighting the lighthouse” LD+A
- 2 Brandston Bulgari “Pretty Persuasion” LD+A
- 3 I 10-1 to 10-12, 11-1 to 11-7, 3-28, 3-32 to 3-33, 3-37 to 3-41, Fig. 3-41, 4-23
- 4 California Title 24 Lighting Section
- 5 LEED v. 2.1, I 7-22, 7-30 to 7-34, 27-14 to 27-15
- 6 Advanced Lighting Guidelines 2003 edition (<http://www.newbuildings.org/lighting.htm>): pp. 3-1 to 3-7, 3-23 to 3-25

Final

Philadelphia Lighting Design Competition

Conceptual lighting design: 5 perspective sketches with color pencil on gray paper, describing a sequence of the most important views and arranged in the order of the walk through. Example: class practice from 9-8-03 and the pdf file “sketching and rendering – color pencils and Photoshop pdf”. See the slides 30 “A hand drawn rendering of a train station” and 31 “Another hand drawn rendering”. See also slides 15, 16 and 20. Meet LEED Requirements.

Assignments

Photometry and Lighting Calculations

Illuminance, luminance, luminous flux. Determine falloff of illuminance of diffuse emitter due to inverse square law calculations and compare to area source calculation. Determine error. Plot. Determine the luminance of an indirectly illuminated ceiling to achieve 500 Lux on the workplane.

Accent Lighting

GAP, Abercrombie & Fitch: photograph the stores from inside and from outside. Label luminance and illuminance values: highlighted vertical and horizontal display and its surrounds, general illuminance in traffic areas, illuminance on shelves, luminance of items on shelves, luminance and illuminance of mannequin visible during daytime from street. Photograph and label all images with luminance and illuminance values. Estimate power density. Clearly identify the illuminance and luminance of a mannequin or other important vertical display visible from the outside during daytime.

Video Conference Lighting

Design video conference lighting room, including all surface reflectance values. Critique Bergman’s solution. Use computer simulations. Determine illuminance and luminance distributions and ratios.

Daylight calculations:

Determine the exterior horizontal illuminance on a clear day in San Francisco for March 21, 10 a.m.. Calculate sunlight and skylight contribution. Repeat for overcast sky. Determine diffuse skylight luminance and spacing for supermarket store to achieve 500 Lux horizontally, and a uniformity of 3:1 or better. Determine the necessary exterior illuminance level. Design skylights to achieve 500 Lux for 60% of all store hours in San Francisco based on weather data (Meteonorm), with a uniformity of 3:1 or better.

Visual Comfort and Glare

Calculate glare UGR for three different lighting systems

Outdoor Lighting

Design the Lighting for a building facade