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## A E 311 - Spring 2010

### Fundamentals of Electrical and Illumination Systems for Buildings

#### Faculty Information

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#### Required Text

Mechanical and Electrical Equipment for Buildings (MEEB), 10<sup>th</sup> Edition.  
Advanced Lighting Guidelines ([www.newbuildings.org](http://www.newbuildings.org)), select sections and chapters.  
Other On-line materials that will be posted on Angel.  
Clicker required for in-class questions.

#### Course Description

This course provides an introduction to lighting and electrical system design, providing general information on equipment, design criteria, code requirements, calculation procedures, and basic design for these systems.

#### Course Objectives

For students to become familiar with basic lighting and electrical equipment, as well as the design criteria and analysis procedures that are applied in the design of lighting and electrical systems. At the conclusion of the course, students will be able to design simple layouts for both lighting and electrical systems that meet relevant codes and recommended design criteria.

#### Grading Policy

Course grades will be determined as follows:

Homework	16%
Course Project(s)	2 @ 12% each (1 Lighting, 1 Electrical)
Exams (4 total):	15%, 15%, 15%, 10% (lowest of 4 scores counts 10%)
Clicker Questions:	5%

#### Homework

Homework will be due at the beginning of the class indicated on the assignment. Late work will be accepted within 48 hours with a 10% penalty per day, unless an extension has been requested and provided by the course instructor (Request must be made prior to the assignment deadline).

#### Practicum Sessions

Practicum sessions (Tuesday/Thursday) provide an opportunity for students to gain experience with analysis and design procedures related to lighting and electrical systems. These sessions focus on problems similar to those addressed on homework assignments and exams, and may also include a building tour and equipment demonstrations. Students are expected to attend the practicum session for which they are registered.

#### Office Hours/Appointments/Assistance

Students are encouraged to take advantage of office hours, but may also visit my office or contact the Graduate Teaching Assistant at any time with questions. Email is a fast and convenient way to receive answers to questions (daytime or evening).

### **Academic Integrity Policy**

Each Student is expected to produce his/her **own** solution to each homework assignment. If working in groups to solve the homework problems, each student is expected to work through and calculate his/her own solution and **not copy** the solution of another student. Failure to comply (see Policy 49-20, “Academic Integrity” in Penn State’s “Policies and Rules for Students”) may result in a grade of zero on the exam/assignment, or for the entire course and/or expulsion from the University. Any infractions will be treated in accordance with University policies on academic dishonesty.

### **Professionalism**

Professionalism in this course is as important as in the workplace, and includes such traits as preparation, productivity, timeliness, attendance, participation in discussions, and respect for your fellow classmates. Regular and punctual attendance is your responsibility. In the engineering profession, being late for a meeting, or missing a deadline is a breach of professionalism. A good engineer upholds professional conduct by always being prompt.

### **Angel Website**

AE 311 will make extensive use of an Angel Website. PowerPoint slides, homework assignments, problem solutions, supplementary reading assignments, and course email will be available on Angel.

### **Course Topics**

Light, Vision, Photometric Units, Light Sources, Luminaires, Lighting Quality, Light Loss Factors, Average Illuminance Calcs, Point-by-Point Calcs, Performance Impacts, Ethics.

Basic Electricity, Alternating Current, Distribution Voltages, Overview of a Building Electrical System, Conductors, Protective Devices, Panelboards, Branch Circuits, Feeders, Wire Sizing Issues

### **ABET Expected Outcomes**

Emphasis: 3 – Strong, 2 – Moderate, 1 – Little

<b>Expected Outcome</b>	<b>Emphasis</b>
(a) an ability to apply knowledge of mathematics, science, and engineering.	2
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.	2
(c) an ability to design a system, component, or process to meet desired needs.	3
(d) an ability to function on multi-disciplinary teams.	2
(e) an ability to identify, formulate, and solve engineering problems.	2
(f) an understanding of professional and ethical responsibility.	2
(g) an ability to communicate effectively.	2
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context.	1
(i) a recognition of the need for, and an ability to engage in life-long learning.	1
(j) a knowledge of contemporary issues.	2
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	2

<b>AE 311 - Course Schedule</b>				
	<b>M</b>	<b>W</b>	<b>F</b>	<b>PRACTICUM (T or R)</b>
<b>Week of 1/11</b>	Introduction, Light Spectrum	Lighting Units	Lighting Units	NO CLASS
<b>Week of 1/18</b>	<b>NO CLASS – MLK DAY</b>	Vision	Luminaire Photometry, The Inverse Square Law	LIGHTING UNITS
<b>Week of 1/25</b>	Basic Lighting Calculations: The Inverse Square Law	Light Sources - Incandescent & Fluorescent	<b>NO CLASS – IES STUDENT CHAPTER RETREAT</b>	INVERSE SQUARE LAW
<b>Week of 2/1</b>	Light Sources –Fluorescent & HID	Light Sources, Other	Luminaire Types & Their Application	LAMP DEMOS + OBJECT ILLUMINATION (1 HR EA)
<b>Week of 2/8</b>	Luminaire Types & Their Application	<b>REVIEW for EXAM 1 (Exam is on 2/11)</b>	Light Loss Factors	<b>EXAM – THURSDAY (In practicum or evening)</b>
<b>Week of 2/15</b>	Light Loss Factors	Average Illuminance Calculations	Impacts on Lighting System Performance	LIGHT LOSS FACTORS
<b>Week of 2/22</b>	Impacts on Lighting System Performance	Lighting Quality & Design Criteria	Lighting Quality & Design Criteria	MODELING SOFTWARE
<b>Week of 3/1</b>	The Lighting Design Process	The Lighting Design Process REVIEW FOR EXAM 2	Engineering Ethics	<b>EXAM – THURSDAY (In practicum or evening)</b>
<b>SPRING BREAK</b>				

NOTE – Reading assignments will be posted to the Angel website.

	<b>M</b>	<b>W</b>	<b>F</b>	<b>PRACTICUM (T or R)</b>
<b>Week of 3/15</b>	Basic Electrical Units & Circuits	Basic Electrical Units & Circuits	Branch Circuit & Switching Design	ELECTRICAL CIRCUITS
<b>Week of 3/22</b>	Branch Circuit & Switching Design	Building Electrical Distribution Systems:	<b>** PROJECT #1 DUE **</b> Building Electrical Distribution Systems	BRANCH CIRCUITS & SWITCHING
<b>Week of 3/29</b>	Wire Sizing	Wire Sizing	Wire Sizing	WIRE SIZING
<b>Week of 4/5</b>	Wire Sizing	<b>REVIEW</b> <b>EXAM 3 - Electrical</b> <b>(4/8 IN PRACTICUM)</b>	Panelboards, Feeder Loads & Sizing	<b>EXAM THURSDAY</b> <b>(In practicum or evening)</b>
<b>Week of 4/12</b>	Panelboards, Feeder Loads & Sizing	<b>NO CLASS – 5<sup>th</sup> YEAR</b> <b>THESIS PRESENTATIONS</b>	Panelboards, Feeder Loads & Sizing	SYSTEM LAYOUT CASE STUDY
<b>Week of 4/19</b>	Panelboards, Feeder Loads & Sizing	Voltage Drop Calculations	Voltage Drop & Short Circuit Capacity	PANELBOARD & FEEDER LOAD CALCULATIONS
<b>Week of 4/26</b>	Protective Devices	Protective Devices	<b>REVIEW FOR FINAL EXAM</b>	<b>BUILDING TOUR</b>
	<b>FINAL EXAM DURING FINAL EXAM PERIOD</b>			
	<b>PROJECT #2 DUE</b>			