[Fall 2021] 4013.314.001 Architectural Lighting Systems and Design

Instructor: Cheol-Soo Park (Office: 39-430, Tel: 02-880-4305, cheolsoo.park@snu.ac.kr)
Place and time: Building #39, Room 427, Tue: 2:00-3:15 p.m., Th: 2:00-3:15 p.m.
Office Hours: Tue. Th. 3:15-3:45 p.m. (by appointment only)

Objectives:

- **Learn lighting fundamentals (**physics of light**,** sight, quantitative and qualitative nature of light) which are required to design architectural lighting systems
- **Understand concepts and basic theories** used in architectural lighting design
- **Be able to design lighting systems** for commercial buildings
- **Be able to evaluate and analyze your lighting design** (performance aspects of energy, initial cost, operation cost, maintenance, control, comfort, etc.)

Textbook:

- Selected chapters. Grondzik, W. and Kwok, A. (2019), Mechanical and electrical equipment for buildings, 13th edition. Wiley (MEEB book), e-book available at the SNU library (https://ebookcentral.proquest.com/lib/snulibrary-ebooks/home.action)
  - Ch.6 Light, vision, and visual comfort
  - Ch.15 Lamps, luminaires, and controls
  - Ch.10 daylighting
  - Ch.16 Electric lighting design
  - Ch.17 Electric lighting applications

References:

- IESNA (2011), The IESNA lighting handbook, 10th Edition.
- Murdoch JB 2003. Illuminating Engineering. 2nd Ed. New York. Visions Communications
- International Energy Agency (2000), Daylight in Buildings, IEA

Homework: Homework will be assigned approximately 4-5 times in the term**.**

Projects:

- Project I: Daylighting Analysis by the CIE method
- Project II: Daylighting Analysis by the IESNA method
- Project III: Lighting System Design Project
- Project IV: Economic Analysis of Lighting System

Exams: There will be a mid-term exam and a final exam.

Grading:
Grades for homework/projects will be based on completeness, accuracy, presentation and understanding of key concepts. All assignments (homework, project) *will be collected at the beginning of class on the stated due date*. No project will be accepted after the scheduled due date and time. A grade of 0 will be assigned for that project. If a homework (project) conflicts with other class' project/exam/site visit, you must inform the instructor at least one class

period before the homework/project is due, if you wish the instructor to consider extending the due date. Grades will be determined as follows.

Attendance + in-class discussion (presentation) (5%), Homework (5%), Project I-IV (10%), mid-term exam (40%), final exam (40%)

Attendance
Arrive on time. You are strongly encouraged to regularly attend class. Missing three classes will reduce your final grade by one letter. Missing four times or more will reduce your final grade by two letters.

Schedule:

- Week 1: Ch.6 Light, vision, and visual comfort
- Week 2: Ch.6 Light, vision, and visual comfort
- Week 3: Ch.6 Light, vision, and visual comfort
- Week 4: Ch.15 Lamps, luminaires, and controls
- Week 5: Ch.15 Lamps, luminaires, and controls
- Week 6: Ch.15 Lamps, luminaires, and controls
- Week 7: Ch.10 daylighting
- Week 8: mid-term exam
- Week 9: Ch.10 daylighting (Project I, II out)
- Week 10: Ch.16 Electric lighting design (Project III out)
- Week 11: Ch.16 Electric lighting design (Project IV out)
- Week 12: Lighting controls and cost analysis / lighting economics / energy management / lighting maintenance
- Week 13: Lighting simulation theories and tools (DIVA, Relux, Desktop Radiance) / Ch.17 Electric lighting applications
- Week 14: Ch.17 Electric lighting applications
- Week 15: final exam

Case studies:
The following buildings will be addressed from the perspective of daylighting and lighting design strategies: Walt Disney concert hall by Frank Gehry, The Centre Georges Pompidou by Renzo Piano & Richard Rogers, The Louvre by IM Pei, La Sagrada Família by Gaudi, High Museum by Richard Meier, etc.

Why is this course required for all Architectural Engineering Students?
(Excerpted from David Di Laura [Editor of Journal of IESNA]'s course syllabus)

All architectural engineers need to know the fundamentals of architectural lighting. Perhaps four of the most important reasons are:

1. **Lighting has a very large effect on how well people can use a building**. Lighting allows people to perform visual work and, in general, the better the lighting the better will be the performance of people. For most commercial buildings the "people costs" (salaries, benefits, and amenities) are TEN times all the operating costs. So money spent on lighting (and other building systems) that increases *occupant productivity*, is money well invested. All architectural engineers need to know what good lighting is, and some architectural engineers need to know how to provide it in a building.

2. **Lighting has a very large effect on how people feel about being in a building.** That

is, lighting has a *psychological influence* on people and, in general, lighting must be carefully designed in order for this influence to be appropriate for the architecture and the intended use of the building. All architectural engineers need to understand the interaction between lighted spaces and people.

3. **Most lighting in buildings in the United States is electric lighting**. Approximately 25% of the nation's electricity is used to provide electric lighting. Thus, lighting is a significant factor in energy conservation and efforts to reduce environmental pollution due to the generation of electricity. Some architectural engineers need to know how to minimize energy required for lighting.

4. **An architectural engineer needs to treat a building as a large system comprised of smaller systems**. Lighting is one of those systems and it affects other building systems, such as HVAC. This system-interaction often determines how well a building works. All architectural engineers need to know enough about lighting to understand its role as a building system and its impact on the entire building.