DOLL Academy 2 day course plan

Who is giving the course?

This course is held by employees at the photonics department at the technical university of Denmark, DTU Fotonik. The course will be held at DTU Campus at Risø, north of Roskilde, where about 50 employees of DTU Fotonik works, and where the DOLL Quality lab, a state of the art lighting lab, is located.

Who should attend?

The course is a continuing education directed to companies and businesses in the lighting industry.

What does the course contain?

The participants will, among other, learn about following topics:

- Photometry (light measurement: lumen, candela, illumination, efficacy if light sources)
- Colorimetry (color perception and measurement: chromatic diagrams and coordinates, correlated color temperature, color rendering)
- Color mixing techniques
- Health aspects of light (circadian sensitivity, etc.)
- Flicker (characterization and measurements techniques)

The participants will also get hands on experience with light measurement equipment.

When?

30 - 31 May 2018

Course material

The presentations and theoretical material will be compiled in handed out compendium.

Course Fee

Registration before 15th April: 9 500 DKK (1270 €). After 15th April: 11 000 DKK (1470 €).
Prices are exclusive VAT.

Contact persons

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Course plan

Day 1

09:00 – 09:15	Welcome and introduction
09:15 – 10:00	Introduction to LED technology
10:00 – 11:00	Photometry
11:00 – 11:15	Coffee break
11:15 – 12:15	Colorimetry
12:15 – 13:00	Lunch
13:00 – 14:00	Demonstration: (Integrating sphere, goniometer)
14:00 – 15:00	Flicker with demonstration (flicker, dimming of LEDs)
15:00 – 15:15	Coffee break
15:15 – 17:00	Practical exercise: Spectrometers, flicker and luminance

Day 2

09:00 – 10:00	Additive color mixing and color perception
10:00 – 11:00	Color Rendering Indices
11:00 – 11:15	Coffee break
11:15 – 12:15	White light generation
12:15 – 13:00	Lunch
13:00 – 14:00	Light and Health
14:00 – 15:00	Guest lecture (lighting design, health, etc)
15:00 – 15:15	Coffee break
15:15 – 16:30	Practical exercise: Integrating spheres and goniometers
16:30 – 17:00	Sum up of the course
17:00	Thanks and goodbye

Topics in more detail

- Introduction to LED technology
  - Electric energy usage for Lighting
  - LED history and future (Nobel Prize 2014)
  - How does LEDs work? (PN-junction)
- Photometry
  - Quantities and definitions
  - Efficiency and efficacy
- Colorimetry
  - Theory of color measurement
  - Color matching functions
  - Color spaces and Chromaticity diagrams (CIE 1931(x,y), Uniform (u,v)-diagram)
  - Correlated Color Temperature
- Additive color mixing
- Color Rendering Indices
  - CIE CRI Ra
  - TM-30
  - CIE Color fidelity for scientific use, Rf
- White light generation
  - RGB mixing
  - Wavelength converters
  - Efficiency/quality trade off
- Color perception
  - Illusions
- Flicker
  - Metrics (Percent Flicker (PF) / Flicker Index (FI) / Visibility Measure (Mv))
  - Standards and recommendations
  - Dimming
- Light and health
  - Circadian sensitivity
  - Temporal Light Artefacts (TLAs) / flicker
- Equipment
  - Spectrometers
  - Integrating Spheres
  - Goniometers
- Guest lectures:
  - E.g. lighting design

Practical exercises

- Spectrometer to measure:
  - Spectra
  - Chromaticity coordinates
  - Correlated color temperature
  - Color rendering
- Integrating spheres to measure:
  - Luminous flux
  - Efficacy
  - Spectra
- Goniometer to measure:
  - Light Intensity Distribution (LID)
- Flicker measurements using:
  - LabVIEW
  - Mobile phone camera
- Luminance measurement using:
  - Luminance camera Techno Team
  - Classical luminance meters

Physical demonstrations

- Inspection of a rack with different light sources using pocket spectroscopes
- Color mixing (Red, green and blue projected on white surface to generate cyan, magenta, yellow and white) and/or (laser pointers into small integrating sphere)
- Integrating sphere (principle and scattering)
- Stroboscopic effects and phantom arrays of flicker
- Dimming of LEDs

Academy Course Coordinator
Johannes Lindén