**DESL**

Co-funded by the
Erasmus+ Programme
of the European Union

**Developing Energy Efficient and Smart Lighting Education in Vietnam & Myanmar**

# Course Development Workshop

**Agenda**

**Date and time:**        June 15-16, 2020 (CEST 9:00 – 12:00)
**Place:**                Online (Microsoft Teams)

## Day 1

1. Welcome day 1 and introduction rounds

2. Need assessment survey results (Vietnam and Myanmar)

3. Coffee break

4. Brainstorm regarding courses

   - Parallel sessions per institute (TEAMS links for these sessions will be shared during the workshop itself)

5. Summary day 1 and closure

## Day 2

1. Welcome day 2

2. Presentation of proposal list of courses per institute

3. Q&A regarding the proposal (part 1)

4. Coffee break

5. Q&A regarding the proposal (part 2)

6. Verification proposal – come to agreements

7. Next steps

8. Closure day 2
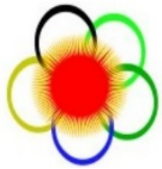
# **Course development workshop**

**June 16, 2020**

# Agenda day 2

- Welcome

- Presentation updated overview courses per institute + action points

- Parallel sessions to finalize overview courses per institute

**±10:45 (CEST)** continue in plenary session:

- Verification overview courses – agreements?

- Next steps

- Summary day 2 and closure

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# Overview courses per institute

- HCMUT

**COURSE A**

| | | |
|---|---|---|
| Name | Lighting Technology | Bachelor level |
| Status | Existing course to be updated | |
| Mandatory/elective | Elective (Category 2) | |
| Study load | 30h lecture + 30 h practice | |
| Estimated # students | 30-60 | |

**Learning objectives**

MAKE SUGGESTIONS

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M1.2.1 | Advanced photometry | 2 | 4 | 8 |
| M1.3 | Colorimetry | 2 | 1 | 4 |
| M1.3.1 | Advanced colorimetry | 2 | 1 | 4 |
| M1.4 | Optic characteristics of materials (absorptance, transmittance, reflectance) | 2 | 2 | 5 |
| M2.2 | Thermal radiators | 1 | 2 | 4 |
| M2.3 | LP discharge lamps | 1 | 2 | 4 |
| M2.4 | HP discharge lamps | 1 | 2 | 4 |
| M2.5 | Electroluminescence (Basics of LED lamps) | 2 | 1 | 4 |
| M2.5.1 | White light from LEDs | 2 | 2 | 6 |
| M2.5.2 | LED luminaires and LED ballasts and drivers | 2 | 2 | 5 |
| M2.6 | Daylight | 4 | 2 | 8 |
| M3.3 | Lighting design through simulations | 1 | 0 | 2 |
| M3.6 | Prevention of design/projection errors | 2 | 0 | 3 |
| M3.7 | Lighting design considerations (advanced lighting design) | 2 | 0 | 3 |
| M4.1 | Introduction to simulation Software | 2 | 10 | 20 |
| M4.2 | Calculations interior lighting (how do simulations work?) | 1 | 7 | 15 |
| M4.3 | Calculations exterior lighting | 1 | 7 | 15 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | **30** | **45** | **114** |
| **Ratio contact hours/self-study** | | 0,657895 | | |
| **Total** | | **189** | | |

**COURSE B**

| | | |
|---|---|---|
| Name | Light and experience | |
| Status | New | |
| Mandatory/elective | Elective (category 1) | |
| Study load | 30h lecture + 30 h practice | |
| Estimated # students | 20-30 | |

**Learning objectives**

MAKE SUGGESTIONS

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M1.1 | Light and Radiation | 2 | 1 | 4 |
| M1.2 | Photometry | 2 | 4 | 8 |
| M2.1 | Introduction to light generation techniques (+ light sources) | 2 | 2 | 5 |
| M6.4 | Energy labelling light sources and certificates | 2 | 2 | 6 |
| M2.7 | Luminaire types and specifications | 2 | 2 | 6 |
| M3.1 | Introduction to lighting design | 2 | 1 | 4 |
| M3.2 | Validation methods of lights designs | 1 | 4 | 6 |
| M5.1 | Introduction to smart lighting | 2 | 2 | 6 |
| M6.1 | Energy efficiency indoor lighting | 2 | 2 | 5 |
| M6.2 | Sustainable (outdoor) lighting | 2 | 2 | 5 |
| M7.1 | Optics (eye lenses and light fraction) | 2 | 2 | 6 |
| M7.2 | Eye and the sensitivity to light | 2 | 2 | 6 |
| M7.3 | Visual effects of light | 2 | 4 | 8 |
| M7.4 | Non-visual effects of light | 2 | 1 | 5 |
| M8.1 | Lighting applications | 2 | 2 | 6 |
| M6.5 | Life cycle analysis (environmental) and life cycle costs (economic) | 2 | 3 | 7 |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | **31** | **36** | **93** |
| **Ratio contact hours/self-study** | | 0,72043 | | |
| **Total** | | **160** | | |

| | | |
|---|---|---|
| Study load | 30h lecture + 30 h practice | |
| Estimated # students | 20-30 | |

**Learning objectives**

MAKE SUGGESTIONS

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M5.1 | Introduction to smart lighting | 2 | 2 | 6 |
| M5.2 | Controls and interaction | 2 | 3 | 7 |
| M5.3 | Hardware and software control of luminaires | 2 | 4 | 8 |
| M5.4 | Business aspects of Intelligent lighting solutions | 2 | 0 | 3 |
| M5.5 | Sensory design | 2 | 7 | 12 |
| M5.6 | Smart urban lighting | 3 | 2 | 6 |
| M7.5 | Light perception and experience | 4 | 2 | 8 |
| M7.6 | Measuring and understanding consumers | 2 | 2 | 5 |
| M7.7 | Visual comfort/discomfort | 2 | 2 | 5 |
| M7.8 | Integrative lighting | 2 | 4 | 8 |
| M3.5 | Daylight applications | 2 | 2 | 6 |
| M8.4 | Office lighting | 2 | 1 | 4 |
| M8.8 | Lighting for agriculture and farming | 2 | 1 | 4 |
| M8.9 | Road and street lighting | 2 | 1 | 4 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | **31** | **33** | **87** |
| **Ratio contact hours/self-study** | | 0,735632 | | |
| **Total** | | **151** | | |

# Overview courses per institute

- TDMU

**Action points:**
- Learning objectives to be confirmed for all 3 courses

**COURSE A**

| | | |
|---|---|---|
| Name | Lighting Engineering | Bachelor level |
| Status | Existing course to be updated | |
| Mandatory/elective | Elective | |
| Study load | 30 lectures + 30 practice + 90 selfstudy | |
| Estimated # students | 50 | |

**Learning objectives** Suggested by TDMU
Broaden your insight in lighting engineering: parameters of light, statistics of light sources, luminaires,
Calculating about indoor lighting, street lighting

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M7.3 | Visual effects of light | 2 | 2 | 8 |
| M7.4 | Non-visual effects of light | 2 | 1 | 5 |
| M1.1 | Light and Radiation | 2 | 1 | 4 |
| M1.2 | Photometry | 2 | 4 | 8 |
| M1.3 | Colorimetry | 2 | 1 | 4 |
| M2.1 | Introduction to light generation techniques (+ light sources) | 2 | 0 | 5 |
| M2.2 | Thermal radiators | 1 | 0 | 4 |
| M2.3 | LP discharge lamps | 1 | 1 | 4 |
| M2.4 | HP discharge lamps | 1 | 1 | 4 |
| M2.4.1 | Gas discharge lamps: Ballasts and drivers | 2 | 0 | 0 |
| M2.5 | Electrolumenescence (Basics of LED lamps) | 2 | 1 | 4 |
| M2.5.2 | LED luminaires and LED ballasts and drivers | 2 | 2 | 5 |
| M2.7 | Luminaire types and specifications | 2 | 2 | 6 |
| M3.1 | Introduction to lighting design | 2 | 9 | 19 |
| M9.1 | Calculation of lighting load | 5 | 5 | 10 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 30 | 30 | 90 |
| **Ratio contact hours/self-study** | | 0,666667 | | |
| **Total** | | 150 | | |

**COURSE B**

| | | |
|---|---|---|
| Name | Lighting Design an... | Preliminary knowl... |
| Status | New | |
| Mandatory/elective | Elective | |
| Study load | 30 lectures + 30 pr... | |
| Estimated # students | 50 | |

**Learning objectives** Suggested by TDMU
Broaden your insight in (day)lighting applications for lighting designs
Get insight into and make use of simulation software for making lightign designs
Learn about methods to validate simulation models

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M3.1 | Introduction to lighting design | 2 | 0 | 2 |
| M3.2 | Validation methods of lights designs | 1 | 0 | 1 |
| M3.3 | Lighting design through simulations | 2 | 0 | 2 |
| M3.4 | Light and architecture | 3 | 2 | 6 |
| M3.5 | Daylight applications | 2 | 2 | 6 |
| M3.6 | Prevention of design/projection errors | 2 | 0 | 3 |
| M3.7 | Lighting design considerations (advanced lighting design) | 2 | 0 | 3 |
| M4.1 | Introduction to simulation Software | 4 | 10 | 16 |
| M4.2 | Calculations interior lighting (how do simulations work?) | 1 | 8 | 16 |
| M8.4 | Office lighting | 2 | 0 | 4 |
| M8.6 | Residential lighting | 2 | 0 | 4 |
| M8a | Lighting for industry and trade | 2 | 0 | 4 |
| M4.3 | Calculations exterior lighting | 1 | 8 | 16 |
| M8.9 | Road and street lighting | 2 | 0 | 4 |
| M6.4 | Energy labelling light sources and certificates | 2 | 0 | 3 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 30 | 30 | 90 |
| **Ratio contact hours/self-study** | | 0,666667 | | |
| **Total** | | 150 | | |

| | | |
|---|---|---|
| Estimated # students | 10 | |

**Learning objectives**
Design a lighting system for office, building, street, factory
Design and implement of intelligent lighting using IoT

| Content modules | | #hours Lecture | Practice | Self-study |
|---|---|---|---|---|
| M9.2 | Determine the problem | 0 | 5 | 5 |
| M9.3 | calculating lighting system | 0 | 15 | 15 |
| M9.4 | Design, simulation, and implement lighting system | 0 | 35 | 35 |
| M9.5 | Report project | 0 | 5 | 5 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 0 | 60 | 60 |
| **Ratio contact hours/self-study** | | 1 | | |
| **Total** | | 120 | | |

# Overview courses per institute

- EIU

**COURSE A**

| | | |
|---|---|---|
| Name | Illumination Engineering | bachelor level |
| Status | Existing course to be updated | |
| Mandatory/elective | Elective | Req.: Electrical circ... |
| Study load | 30h teaching + 30h practice + 75h selfstudy | 30+30+75 |
| Estimated # students | | |

| | |
|---|---|
| Study load | 35h teaching + 85h selfstudy |
| Estimated # students | |

30h teaching + 30h practice + 75h...

**Learning objectives**

After completion of this course, the student will be able to:
1) Understand lighting parameters and terminologies, and characteristics of luminaires;
2) Calculate lighting parameters;
3) Use basic lighting equipment (such as: Lux meter, Luminance meter, Reflectometer…) to measure lighting parameters;
4) Use simulation and software tools (DIALUX, ULYSSE…) to design a lighting system;
5) Develop communication skills and teamwork.

**Learning objectives**

Get insight in the concept of smart lighting and its broad applications
Understand and make use of control systems in practice
Learn to strive for the balance between energy and human oriented lighting control

| Content modules | | Lecture | Practice | Self-study |
|---|---|---|---|---|
| M1.1 | Light and Radiation | 2 | 1 | 4 |
| M1.2 | Photometry | 2 | 4 | 8 |
| M1.3 | Colorimetry | 2 | 1 | 4 |
| M2.1 | Introduction to light generation techniques (+ light sources) | 2 | 2 | 5 |
| M2.7 | Luminaire types and specifications | 2 | 2 | 6 |
| M8.1 | Lighting applications | 2 | 2 | 6 |
| M3.1 | Introduction to lighting design | 4 | 1 | 4 |
| M3.2 | Validation methods of lights designs | 2 | 4 | 6 |
| M3.3 | Lighting design through simulations | 4 | 0 | 2 |
| M4.1 | Introduction to simulation Software | 2 | 1 | 10 |
| M4.2 | Calculations interior lighting (how do simulations work?) | 2 | 6 | 10 |
| M4.3 | Calculations exterior lighting | 2 | 6 | 10 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | **28** | **30** | **75** |
| **Ratio contact hours/self-study** | | **0,773333** | | |
| **Total** | | **133** | | |

| Content modules | | Lecture | Practice | Self-study |
|---|---|---|---|---|
| M1.5 | LIGHT BASICS (recap?) | 1 | | |
| M5.1 | Introduction to smart lighting | 2 | | |
| M5.2 | Controls and interaction | 2 | | |
| M5.3 | Hardware and software control of luminaires | 2 | 4 | 8 |
| M5.4 | Business aspects of Intelligent lighting solutions | 2 | 0 | 3 |
| M5.5 | Sensory design | 2 | 7 | 12 |
| M5.6 | Smart urban lighting | 3 | 2 | 6 |
| M6.1 | Energy efficiency indoor lighting | 2 | 2 | 5 |
| M6.2 | Sustainable (outdoor) lighting | 2 | 2 | 5 |
| M6.3 | Business aspects of Energy efficient lighting solutions | 2 | 0 | 3 |
| M6.4 | Energy labelling light sources and certificates | 2 | 2 | 6 |
| M6.5 | Life cycle analysis (environmental) and life cycle costs (economic) | 2 | 3 | 6 |
| M7.1 | Optics (eye lenses and light fraction) | 2 | 2 | 6 |
| M7.2 | Eye and the sensitivity to light | 2 | 2 | 6 |
| M7.3 | Visual effects of light | 2 | 4 | 8 |
| M7.4 | Non-visual effects of light | 2 | 1 | 5 |
| M7.5 | Light perception and experience | 4 | 2 | 8 |
| M7.6 | Measuring and understanding consumers | 2 | 2 | 6 |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | **38** | **41** | **110** |
| **Ratio contact hours/self-study** | | **0,718182** | | |
| **Total** | | **189** | | |

Matej B. Kobav:
2 or 4 hours

DESL

# Overview courses per institute

- VGU

**Action points:**
- Hours need to be confirmed (practice hours)

## COURSE A

| | |
|---|---|
| Name | Illumination Engineering |
| Status | New |
| Mandatory/elective | elective - Bachelor - 3 ECTS |
| Study load | 84 hrs (18 lectures + 18 practise + 48 self-study)? |
| Estimated # students | 15 |

**Learning objectives**

(Get knowledge of the fundamentals of lighting technology: from wave to energy).
Understand parameters of lighting. (Understand commonly used photometric and colorimetric quantities to descri
Gain skill to do lab experiments and learn how to measure light.
(Learn about (day)light effects on human and the applications).

| Content modules | | #hours | | |
|---|---|---|---|---|
| | | Lecture | Practice | Self-study |
| M1.1 | Light and Radiation | 2 | 1 | 4 |
| M1.2 | Photometry | 2 | 4 | 8 |
| M1.2.1 | Advanced photometry | 2 | 4 | 8 |
| M1.3 | Colorimetry | 2 | 1 | 4 |
| M1.3.1 | Advanced colorimetry | 2 | 1 | 4 |
| M1.4 | Optic characteristics of materials (absorptance, transmittance, reflectance) | 2 | 2 | 5 |
| M2.1 | Introduction to light generation techniques (+ light sources) | 2 | 2 | 5 |
| M2.2 | Thermal radiators | 1 | 2 | 4 |
| M2.6 | Daylight | 4 | 2 | 8 |
| M7.1 | Optics (eye lenses and light fraction) | 2 | 2 | 6 |
| M7.2 | Eye and the sensitivity to light | 2 | 2 | 6 |
| M7.3 | Visual effects of light | 2 | 4 | 8 |
| M7.4 | Non-visual effects of light | 2 | 1 | 5 |
| M7.5 | Light perception and experience | 4 | 2 | 8 |
| M7.6 | Measuring and understanding consumers | 2 | 2 | 6 |
| M8.1 | Lighting applications | 2 | 2 | 6 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 35 | 34 | 95 |
| **Ratio contact hours/self-study** | | 0,726316 | | |
| **Total** | | 164 | | |

## COURSE B

| | |
|---|---|
| Name | Lighting Design |
| Status | New |
| Mandatory/elective | elective - Bache |
| Study load | 140 hrs (30 lectu |
| Estimated # students | 15 |

**Learning objectives**

Ability to apply methods to design lighting for indoor and outdoor applications.
Get insight in - and make use of different simulation softwares for making lighting designs
(Learn about methods to validate simulation models)
(Broaden your insight in (day)lighting applications for lighting designs.)

| Content modules | | #hours | | |
|---|---|---|---|---|
| | | Lecture | Practice | Self-study |
| M3.1 | Introduction to lighting design | 2 | 1 | 4 |
| M3.2 | Validation methods of lights designs | 1 | 4 | 6 |
| M3.3 | Lighting design through simulations | 1 | 0 | 2 |
| M3.4 | Light and architecture | 2 | 2 | 6 |
| M3.5 | Daylight applications | 2 | 2 | 6 |
| M3.6 | Prevention of design/projection errors | 2 | 0 | 3 |
| M3.7 | Lighting design considerations (advanced lighting design) | 2 | 0 | 3 |
| M4.1 | Introduction to simulation Software | 2 | 10 | 20 |
| M4.2 | Calculations interior lighting (how do simulations work?) | 1 | 7 | 15 |
| M4.3 | Calculations exterior lighting | 1 | 7 | 15 |
| M8.4 | Office lighting | 2 | 1 | 4 |
| M8.6 | Residential lighting | 2 | 1 | 4 |
| M8.8 | Lighting for agriculture and farming | 2 | 1 | 4 |
| M8.9 | Road and street lighting | 2 | 1 | 4 |
| M8c | Shop lighting | 2 | 1 | 4 |
| M8e | Lighting for hotels and restaurants | 2 | 1 | 4 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 28 | 39 | 104 |
| **Ratio contact hours/self-study** | | 0,644231 | | |
| **Total** | | 171 | | |

| | |
|---|---|
| Estimated # students | 15 |

**Learning objectives**

Knowledge of LED lighting technology.
(Get insight in the concept of smart lighting and its broad applications)
Student project (+presentation). (Understand and make use of control systems in practice)
Learn how to strive for the balance between energy and human oriented lighting control

| Content modules | | #hours | | |
|---|---|---|---|---|
| | | Lecture | Practice | Self-study |
| M2.3 | LP discharge lamps | 1 | 2 | 4 |
| M2.4 | HP discharge lamps | 1 | 2 | 4 |
| M2.4.1 | Gas discharge lamps: Ballasts and drivers | 2 | 1 | 4 |
| M2.5 | Electroluminescence (Basics of LED lamps) | 2 | 1 | 4 |
| M2.5.1 | White light from LEDs | 2 | 2 | 6 |
| M2.5.2 | LED luminaires and LED ballasts and drivers | 2 | 2 | 6 |
| M5.1 | Introduction to smart lighting | 2 | 2 | 6 |
| M5.2 | Controls and interaction | 2 | 3 | 7 |
| M5.3 | Hardware and software control of luminaires | 2 | 4 | 8 |
| M5.4 | Business aspects of Intelligent lighting solutions | 2 | 0 | 3 |
| M5.5 | Sensory design | 2 | 7 | 12 |
| M5.6 | Smart urban lighting | 3 | 2 | 6 |
| M6.1 | Energy efficiency indoor lighting | 2 | 2 | 5 |
| M6.2 | Sustainable (outdoor) lighting | 2 | 2 | 5 |
| M6.3 | Business aspects of Energy efficient lighting solutions | 2 | 0 | 3 |
| M6.4 | Energy labelling light sources and certificates | 2 | 2 | 6 |
| M6.5 | Life cycle analysis (environmental) and life cycle costs (economic) | 2 | 3 | 7 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 33 | 37 | 95 |
| **Ratio contact hours/self-study** | | 0,736842 | | |
| **Total** | | 165 | | |

# Overview courses per institute

- MTU

**Action points:**
- Did we interpret this correctly?
- Agree on the content?
- Check study load hours (l/p/s)
- Learning objectives check

**COURSE A**

| | |
|---|---|
| Name | Lighting Engineering |
| Status | New |
| Mandatory/elective | |
| Study load | 140 |
| Estimated # students | |

**Learning objectives**
Get knowledge of the fundamentals of lighting technology: from wave to energy
Understand commonly used photometric and colourimetric light quantities to describe light
Learn about (day)light effects on human and the applications

Re-design excisting courses

| Content modules | | Lecture | Practice | Self-study | |
|---|---|---|---|---|---|
| | #N/B | #N/B | #N/B | #N/B | |
| M1.2 | Photometry | 2 | 4 | 8 | EP 42012, Light ECE-21012 |
| M1.2.1 | Advanced photometry | 2 | 4 | 8 | EP 42012, Light ECE-32012 |
| M1.3 | Colorimetry | 2 | 1 | 4 | EP 42012, Light ECE-22012 |
| M1.3.1 | Advanced colorimetry | 2 | 1 | 4 | EP 42012, Light ECE 81001 |
| M1.4 | Optic characteristics of materials (absorptance, transmittance, reflectance) | 2 | 2 | 5 | EP 42012, Light ECE-31012  ME 51053, Sustainable Energy Technology |
| M2.1 | Introduction to light generation techniques (+light sources) | 2 | 2 | 5 | EP 42012, Light ECE-22012 |
| M2.6 | Daylight | 4 | 2 | 8 | EP 42012, Light ECE 82001 |
| M8.1 | Lighting applications | 2 | 2 | 6 | EP 42012, Lighting and optical properties of materials |
| M2.2 | Thermal radiators | 1 | 2 | 4 | ECE 81001 |
| M2.5 | Electroluminescence (Basics of LED lamps) | 2 | 2 | 5 | ECE 82001 |
| M2.5.1 | White light from LEDs | 2 | 2 | 6 | ECE 82001 |
| M2.5.2 | LED luminaires and LED ballasts and drivers | 2 | 2 | 5 | ECE 82001 |
| | #N/B | #N/B | #N/B | #N/B | |
| | #N/B | #N/B | #N/B | #N/B | |
| | #N/B | #N/B | #N/B | #N/B | |
| **Sub total** | | 25 | 25 | 67 | |
| **Ratio contact hours/self-study** | | 0,746269 | | | |
| **Total** | | 117 | | | |

**COURSE B**

| | |
|---|---|
| Name | Lighting Design |
| Status | New |
| Mandatory/elective | |
| Study load | 140 |
| Estimated # students | |

**Learning objectives**
Broaden your insight in (day)lighting applications for lighting designs
Get insight into and make use of simulation software for making lighting designs
Learn about methods to validate simualion models

Re-design excisting courses

| Content modules | | Lecture | Practice | Self-study | |
|---|---|---|---|---|---|
| M3.1 | Introduction to lighting design | 2 | 1 | 4 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.2 | Validation methods of lights designs | 1 | 4 | 5 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.3 | Lighting design through simulations | 1 | 2 | 0 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.4 | Light and architecture | 2 | 2 | 5 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.5 | Daylight applications | 2 | 2 | 6 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.6 | Prevention of design/projection errors | 2 | 0 | 3 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M3.7 | Lighting design considerations (advanced lighting design) | 2 | 2 | 3 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M4.1 | Introduction to simulation Software | 2 | 10 | 20 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M4.2 | Calculations interior lighting (how do simulations work?) | 1 | 7 | 15 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| M4.3 | Calculations exterior lighting | 1 | 7 | 15 | EP 21012, Lighting EP 31015, Lighting Design and illumination |
| | #N/B | #N/B | #N/B | #N/B | Choice of Applic Choice of control modules e.g. |
| M8.4 | Office lighting | 2 | 1 | 4 | EP 21012, Lighting Design and Illumination |
| M8.5 | Exterior workplaces | 2 | 1 | 4 | EP 21012, Lighting Design and Illumination |
| M8.7 | Tunnel lighting | 2 | | | EP 21012, Lighting Design and Illumination |
| M2.7 | Luminaire types and specifications | 2 | 2 | 6 | EP 31015, Lighting Design and illumination |
| M2.4 | HP discharge lamps | 1 | 2 | 4 | EP 31015, Lighting Design and illumination |
| M2.4.1 | Gas discharge lamps: Ballasts and drivers | 2 | 1 | 4 | EP 31015, Lighting Design and illumination |
| | #N/B | #N/B | #N/B | #N/B | |
| **Sub total** | | 27 | 41 | 106 | |
| **Ratio contact hours/self-study** | | 0,641509 | | | |
| **Total** | | 174 | | | |

**COURSE C**

| | |
|---|---|
| Name | Smart Lighting Solutions |
| Status | New |
| Mandatory/elective | |
| Study load | 140 |
| Estimated # students | |

**Learning objectives**
Get insight in the concept of smart lighting and its broad applications
Understand and make use of control systems in practice
Learn to strive for the balance between energy and human oriented lighting control

Re-design excisting courses

| Content modules | | Lecture | Practice | Self-study | |
|---|---|---|---|---|---|
| M5.1 | Introduction to smart lighting | 2 | 2 | 6 | EP S2015, Energy, Environment and Smart L |
| M5.2 | Controls and interaction | 2 | 3 | 7 | EP S2015, Energy, Environment and Smart L |
| M5.3 | Hardware and software control of luminaires | 2 | 4 | 8 | EP S2015, Energy, Environment and Smart L |
| M5.4 | Business aspects of intelligent lighting solutions | 2 | 0 | 3 | EP S2042, Energy, Storage and lighting Busin |
| M5.5 | Sensory design | 2 | 7 | 12 | EP S2015, Energy, Environment and Smart L |
| M5.6 | Smart urban lighting | 3 | 3 | 6 | EP S2015, Energy, Environment and Smart L |
| M6.1 | Energy efficiency indoor lighting | 2 | 2 | 5 | EP S2015, Energy, Environment and Smart L |
| M6.2 | Sustainable (outdoor) lighting | 2 | 2 | 5 | EPS2015, Energy, Environment a ME 51053, |
| M6.3 | Business aspects of Energy efficient lighting solutions | 2 | 0 | 3 | EP S2042, Energy, Storage and lighting Busin |
| M6.4 | Energy labelling light sources and certificates | 2 | 2 | 6 | EP S2042, Energy, Storage and lighting Busin |
| M6.5 | Life cycle analysis (enviromental) and life cycle costs (economic) | 2 | 3 | 7 | EP S2042, Energy, Storage and lighting Busin |
| | #N/B | #N/B | #N/B | | |
| | #N/B | #N/B | #N/B | | |
| | #N/B | #N/B | #N/B | | |
| **Sub total** | | 23 | 27 | 68 | |
| **Ratio contact hours/self-study** | | 0,735294 | | | |
| **Total** | | 118 | | | |

# Overview courses

- YTU

**COURSE A** — DEP: ARCHITECTURE

| | |
|---|---|
| Name | Illumination Engineering (for architecture) |
| Status | Existing course to be updated |
| Mandatory/elective | Mandatory |
| Study load | 1 semester (4months) - 120 hours |
| Estimated # students | |

Learning objectives

| Content modules | | Lecture | Practice | Self-study |
|---|---|---|---|---|
| | | #hours | | |
| M1.1 | Light and Radiation | 2 | 1 | 4 |
| M1.2 | Photometry | 2 | 4 | 8 |
| M1.2.1 | Advanced photometry | 2 | 4 | 8 |
| M1.3 | Colorimetry | 2 | 1 | 4 |
| M1.3.1 | Advanced colorimetry | 2 | 1 | 4 |
| M1.4 | Optic characteristics of materials (absorptance, transmittance, reflectance) | 2 | 2 | 5 |
| M3.1 | Introduction to lighting design | 2 | 1 | 4 |
| M4.1 | Introduction to simulation Software | 2 | 10 | 20 |
| M7.1 | Optics (eye lenses and light fraction) | 2 | 2 | 6 |
| M7.2 | Eye and the sensitivity to light | 2 | 2 | 6 |
| M7.3 | Visual effects of light | 2 | 4 | 8 |
| M7.4 | Non-visual effects of light | 2 | 1 | 5 |
| M7.5 | Light perception and experience | 4 | 2 | 8 |
| M7.6 | Measuring and understanding consumers | 2 | 2 | 6 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 30 | 37 | 96 |
| **Ratio contact hours/self-study** | | 0,697917 | | |
| **Total** | | 163 | | |

**COURSE B** — DEP: EE

| | |
|---|---|
| Name | Illumination Engineering I |
| Status | New |
| Mandatory/elective | Mandatory |
| Study load | 1 semester (4 months) |
| Estimated # students | |

Learning objectives

| Content modules | | Lecture | Practice | Self-study |
|---|---|---|---|---|
| | | #hours | | |
| M2.1 | Introduction to light generation techniques (+ light sources) | 2 | 2 | 5 |
| M2.2 | Thermal radiators | 1 | 2 | 4 |
| M2.3 | LP discharge lamps | 1 | 2 | 4 |
| M2.4 | HP discharge lamps | 1 | 2 | 4 |
| M2.4.1 | Gas discharge lamps: Ballasts and drivers | 2 | 1 | 4 |
| M2.5 | Electrolumenescence (Basics of LED lamps) | 2 | 1 | 4 |
| M2.5.1 | White light from LEDs | 2 | 2 | 6 |
| M2.5.2 | LED luminaires and LED ballasts and drivers | 2 | 2 | 5 |
| M2.6 | Daylight | 4 | 2 | 8 |
| M2.7 | Luminaire types and specifications | 2 | 2 | 6 |
| M2.8 | Recycling of lamps | 2 | 0 | 3 |
| M8.1 | Lighting applications | 2 | 2 | 6 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 23 | 20 | 59 |
| **Ratio contact hours/self-study** | | 0,728814 | | |
| **Total** | | 102 | | |

**COURSE C** — DEP: EE

| | |
|---|---|
| Name | Illumination Engineering II |
| Status | New |
| Mandatory/elective | Mandatory (follow-up) |
| Study load | 1 semester (4 months) |
| Estimated # students | |

Learning objectives

| Content modules | | Lecture | Practice | Self-study |
|---|---|---|---|---|
| | | #hours | | |
| M5.1 | Introduction to smart lighting | 2 | 2 | 6 |
| M5.2 | Controls and interaction | 2 | 3 | 7 |
| M5.3 | Hardware and software control of luminaires | 2 | 4 | 8 |
| M5.4 | Business aspects of Intelligent lighting solutions | 2 | 0 | 3 |
| M5.5 | Sensory design | 2 | 7 | 12 |
| M5.6 | Smart urban lighting | 3 | 2 | 6 |
| M6.1 | Energy efficiency indoor lighting | 2 | 2 | 5 |
| M6.2 | Sustainable (outdoor) lighting | 2 | 2 | 5 |
| M6.3 | Business aspects of Energy efficient lighting solutions | 2 | 0 | 3 |
| M6.4 | Energy labelling light sources and certificates | 2 | 2 | 6 |
| M6.5 | Life cycle analysis (environmental) and life cycle costs (economic) | 2 | 3 | 7 |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| | #N/B | #N/B | #N/B | #N/B |
| **Sub total** | | 23 | 27 | 68 |
| **Ratio contact hours/self-study** | | 0,735294 | | |
| **Total** | | 118 | | |

# Parallel sessions: Overview courses per institute

Same TEAMS links as yesterday:
HCMUT ([TEAMS link](#)) | Pramod
TDMU ([TEAMS link](#)) | Grega
EIU ([TEAMS link](#)) | Matej
VGU ([TEAMS link](#)) | Evert
MTU ([TEAMS link](#)) | Mariëlle
YTU ([TEAMS link](#)) | Juliëtte

# Conclusions parallel sessions: Overview courses per institute

- HCMUT

  **Action points:**
  - Reduce (practice) hours in all 3 courses
  - Define learning objectives for all 3 courses
  - % change existing courses

- TDMU

  **Action points:**
  - Learning objectives to be confirmed for all 3 courses
  - % change existing courses

- EIU

  **Action points:**
  - Course B to be confirmed (content, learning objectives, hours)
  - One reference book per course (!)
  - % change existing courses

# Conclusions parallel sessions: Overview courses per institute

- VGU

**Action points:**
- Hours need to be confirmed (practice hours)

- MTU

**Action points:**
- Did we interpret this correctly?
- Agree on the content?
- Check study load hours (l/p/s)
- Learning objectives check
- % change existing courses

- YTU

**Action points:**
- Check number of hours study load
- Learning objectives to be confirmed for all 3 courses
- % change existing courses

# Verification overview courses per institute: Agreements?

- HCMUT
- TDMU
- EIU
- VGU
- MTU
- YTU

# Next steps for course development

- Confirmations from all partner institutes (Vietnam and Myanmar) on course overview (coming 2-4 weeks?)
- Dividing tasks for course development process between European partners (after agreements)

- Content and teaching method development for new courses (soon)
- Establishment of lighting laboratories (soon)
- Guidelines for measurements and testing (Nov 2020)
- Training of staff on use laboratory equipment (Dec 2021)
- Testing of course, feedback, and training of teaching staff (Apr 2021)
- Enhancement of courses and running in partner countries (May 2021)

# Summary day 2 and closure

- Summaries
  - Agreements on overview courses
  - Working on the next steps in the course development

- Closure day 2
  - Thank you!