POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Current issues of lighting technology [S2Eltech2-TŚ>AZTŚ]

## Course

Field of study
Electrical Engineering

Year/Semester
2/3

Area of study (specialization)
Lighting Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

## Number of credit points

3,00

## Coordinators

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## Lecturers

## Prerequisites

When starting this course, the student should have an established knowledge of the basics of lighting technology in the field of: calculating and measuring basic lighting quantities, lighting equipment, requirements for lighting design and heat transfer. The ability to effectively self-educate in a field related to the chosen field of study.

## Course objective

The objective of the course is to teach the student with the current issues discussed in the lighting technology community. Moreover, attention to need to follow trends in the industry, analyze and evaluation of new technology and changing legislative conditions.

## Course-related learning outcomes

Knowledge:
Through the lectures, the student has an orderly and theoretically founded knowledge in the field of

designing electrical devices and systems, taking into account their impact on the environment.
The analysis of the latest technological solutions will result in the fact that the stuent has in-depth knowledge of lighting technology in the field of lighting design, photometric and colorimetric measurements, knows the processes taking place in the life cycle of selected electrical devices.
As a result of laboratory and design classes, the student has an extended knowledge of computer-aided design in electrical engineering

Skills:
As a result of the implementation of project tasks and laboratory classes, the student is able to work individually and in a team, is able to lead a team in a way that ensures the implementation of the task within the set deadline, is able to define the directions of further learning and organize the process of self-education and other people.
Through discussions on measurement results and project effects, the student is able to formulate and - using appropriate analytical, simulation and experimental tools - test hypotheses related to engineering issues and simple research problems of electrical engineering.

Social competences:
Information discussed during classes changes in industry trends the student is aware of the need to develop professional achievements and observe the rules of professional ethics, fulfill social obligations, inspire and organize activities for the benefit of the social environment.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lectures is checked through an exam, moreover, on the basis of individual activity in classes, diligence and accuracy in carrying out the assigned tasks.
The knowledge and skills acquired during design and laboratory classes are assessed by assessing the activity, design and measurement tasks, along with analysis during classes and individual design and laboratory tasks.

## Programme content

Current trends in the development of lighting engineering. Energy and economic efficiency of lighting. Visual and non-visual effects of optical radiation. Daylighting.
Classical, phase-change and thermoelectric systems for dissipating thermal energy in luminaires. Modeling of temperature fields and thermal calculations using computer methods for luminaires.

## Course topics

During the lectures with a multimedia presentation, current issues in the field of lighting technology are presented in the context of the introduced or planned to be introduced legal conditions and recommendations. All issues will be presented on the basis of current technological and research trends, and based on articles and research results, literature of lighting technology and thermal precess.
Laboratory and design classes will be supported by computational examples of real objects and measurements in real conditions along with the assessment of the effects and accuracy of measurements and calculations.
They will concern about:
- visual, workplace and driving skills,
- research on the lighting parameters of active and passive evacuation signs in the context of laboratory and field measurements,
- psychophysiology of vision in the context of the speed of perception,
- the human circadian rhythm and its effect on functioning, related to the melanopsin intensity
- daylight lighting with an assessment of the energy consumption of the installation and the possibility of its reduction,
- new methods of glare,
- subjective estimation parameters of color rendering,
- estimation of the accuracy of calculations of lighting softwares,
- methods for assessing and estimating the durability of light-emitting diodes,
- quality assessment of thermal energy dissipation systems used in luminaires,
- the possibility and justification of using thermoelectric systems in luminaires to force the flow of

thermal energy,
- design and parameters of heat flow systems operating on the basis of phase change used in luminaires.
- possibilities and quality of modeling temperature fields with the use of computer methods,
- thermal calculations in luminaires and light sources.
The above topics will cover the economic aspect and technological trends based on the latest patent solutions.

## Teaching methods

Teaching methods used: 1) a lecture with a multimedia presentation (including: drawings, photos, animations, sound, films) supplemented with examples of live modeling 2) an interactive lecture with the formulation of questions to a group of students or to the indicated specific students 3) includes students' activity during classes when assigning the final grade 4) initiating a discussion during the lecture 5) theory presented in close connection with the practical aspects current legislative and economic conditions 6) theory presented in connection with the current knowledge of students 7) taking into account various aspects of the issues presented, including : economic

## Bibliography


Basic:
1. Light Pollution Handbook, Astrophysics and Space Science Library, 2004th Edition, Springer, The Netherlands 2004, ISBN-13: 978-9401570589,
2. Lighting Handbook, Reference & Application. IES of North America, New York 2010
3. Boyce P.R.: Human factors in lighting, 2th Edition, Taylor $ Francis, London 2003
4. EN 1838:2013: Zastosowania oświetlenia -- Oświetlenie awaryjne
5. ISO 30061:2007(E)/CIE S 020/E:2007 Emergency lighting
6. ISO 17398:2004 Safety colours and safety signs – Classification, performance and durability of safety signs
7. ISO 16069:2017 Graphical symbols – Safety signs – Safety way guidance systems (SWGS)
8. ISO 3864-4:2011 Graphical symbols – Safety colours and safety signs – Part 4: Colorimetric and photometric properties of safety sign materials
9. ANSI/IES TM-21-19 - Technical Memorandum: Projecting Long Term Lumen, Photon and Radiant Flux Maintenance of LED Light Sources
10. ANSI/IES LM-80-20 - Approved Method: Measuring Luminous Flux And Color Maintenance Of LED Packages, Arrays, And Modules
11. PN-EN 62717:2017-11 - Moduły LED do ogólnych celów oświetleniowych -- Wymagania funkcjonalne
12. Baran K.: Temperatura panelu oświetleniowego ze źródłami LED i jej wpływ na wybrane parametry świetlne, Rzeszów 2019
13. Budzyński Ł.: Kształtowanie parametrów fotometrycznych i kolorymetrycznych modułów oświetleniowych ze źródłami LED, Oficyna Wydawnicza Politechniki Białostockiej, Białystok 2021

Additional:
1. Wandachowicz K., Zalesińska M.: „Badanie własności pasów fotoluminescencyjnyc”. Przegląd Elektrotechniczny , ISSN 1731-6106, R.5 NR 1/2007 s.59-62
2. Wandachowicz K., Zalesińska M.: „Analysis of the excitation parameters of photoluminescent low-location lighting materials”. Przegląd elektrotechniczny 8/2008 s. 118-121, ISSN 0033-2097
3. Wandachowicz, K, Zalesińska, M.; Otomański, P.: “Analysis of LLL System Properties for Different Excitation Parameters”. Energies 2021, 14, 7723. https:// doi.org/10.3390/en14227723
4. Zalesinska M.: The impact of the luminance, size and location of LED billboards on drivers' visual performance - laboratory tests, Accident Analysis & Prevention, Volume 117, August 2018, Pages 439-448, doi.org/j.aap.2018.02.005
5. Zalesińska M.: Pilot study of visibility level with the use of a driving simulator – 7th International Conference on Comparing Design in Nature with Science and Engineering „Design and Nature 2014”, 9 - 11 July, Opatija, Croatia. Conference Proceedings on USB Flashdrive
6. Zalesińska M.: Study of visual performance of drivers in laboratory conditions. Computer Applications in Electrical Engineering , ed. by Ryszard Nawrowski. Vol 12, 2014. Poznań 2014 pp. 560-571
7. Zalesińska M.: Pilot study of visibility level with the use of a driving simulator, International Journal of Design & Nature and Ecodynamics, Volume 10 (2015), Issue 1, pp 50-59, ISSN: 1755-7437 (paper format), ISSN: 1755-7445 (online)Gawędzki W.: Pomiary elektryczne wielkości nieelektrycznych, Wydawnictwo AGH, Kraków 2010

8. Zakrzewski J.: Czujniki i przetworniki pomiarowe. Podręcznik problemowy, Wydawnictwo Politechniki Śląskiej, Gliwice 2004
9. Różowicz A, Baran K.: Rozkład temperatury wieloźródłowej oprawy oświetleniowej w technologii LED, Instytut Naukowo-Wydawniczy TTS , Radom 2015
10. Pyrża A.: Poradnik wynalazcy: procedury zgłoszeniowe w systemi krajowym, europejskim, międzynarodowym, Urząd Patentowy Rzeczpospolitej Polskiej, Warszawa 2009

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 88 | 3,00 |
| Classes requiring direct contact with the teacher | 45 | 1,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 43 | 1,50 |