COURSE DESCRIPTION CARD - SYLLABUS

Course name

Lighting engineering and electroheat

Course

Field of study	Year/Semester
Electrical Engineering	1/2
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
Second-cycle studies	English
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Małgorzata Zalesińska, Ph. D., Eng.

email: malgorzata.zalesinska@put.poznan.pl

tel. 61 665 2398

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A 60-965 Poznań

Responsible for the course/lecturer:

Przemysław Skrzypczak, Ph. D., Eng

email: przemyslaw.s.skrzypczak@put.poznan.pl

tel. 61 665 2585

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A 60-965 Poznań

Prerequisites

A student starting lectures and laboratory classes on this subject should have basic knowledge of mathematics, physics and electrical engineering. Should have the ability to acquire knowledge in the field of lighting technology and electrothermal. In addition, measuring skills for electrical and non-electrical quantities are necessary.

The student should have the ability to effectively self-study in a field related to the chosen field of study, and be aware of the need to expand their competences, readiness to cooperate as part of a team.

Course objective

Providing students with knowledge on the subject of psychophysiology of vision, lighting equipment, photometric measurements, lighting design. Practical mastery of photometric quantity measurements. In addition, the transfer and extension of knowledge about various electrothermal methods and heating used in various electrothermal technological processes and mastering the ability to measure temperature.

Course-related learning outcomes

Knowledge

The student has knowledge of lighting technology in the field of lighting design, photometric and colorimetric measurements; knows the processes occurring in the life cycle of selected electrical devices. In addition, he has expanded knowledge in the field of measuring electrical quantities and selected non-electrical quantities with particular emphasis on light and heat quantities.

The student has in-depth knowledge on the implementation of various heating methods, construction of electrothermal devices and technological processes carried out with their application.

Skills

The student has the ability to work individually and in a team, is able to lead the team in a way that ensures the implementation of the task within the set deadline of measuring heat and light. In addition, the student is able to determine the directions of further learning and organize the process of self-education.

Studnet is able to formulate and test hypotheses related to light and thermal engineering and scientific problems. In addition, he can design a simple test stand to solve simple research problems.

The student knows how to develop detailed documentation of the results of the experiment related to the determination of light and heat parameters. Is able to interpret the results obtained and draw conclusions based on them regarding the quality of lighting and thermal devices.

Is able to assess and compare design solutions and processes for the production of lighting and thermal elements and systems, due to given operational and economic criteria, i.e. light efficiency, supply system efficiency, quality and uniformity of heating of charges.

The student is able to assess the suitability of lighting and electrothermal construction solutions together with the possibility of using new technical achievements in the field of continuous automated registration of thermal parameters. Is able to design electrical devices with particular emphasis on lighting and thermal devices containing innovative solutions, if necessary, propose their improvements consisting in the selection of more efficient light sources, reduction or intensification of light or heat emissions in specific flow paths.

Social competences

The student understands and is aware that knowledge and the need to develop professional achievements and compliance with the principles of professional ethics, fulfill social obligations, inspire and organize activities for the social environment in the field of lighting and electrothermal themes is necessary.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the lecture will be verified by an examination. The examination is conducted in written form. The exam consists of 25-35 questions (test and open-ended), variously scored. Pass threshold: 51% of the total score. Examination questions based on which questions are developed are sent to students by e-mail using the university e-mail system or posted on the eCourses platform.

Translated with www.DeepL.com/Translator (free version)Skills acquired as part of the laboratory are verified on the basis of a minimum of two reports from laboratory exercises. Assessment threshold: positive assessment of each study.

In addition, laboratory activity is also taken into account. The content of reports is assessed, as well as the ability to develop measurement results and diligence. Additional points are obtained for: the ability to cooperate within a team practically performing a specific task in the laboratory, presenting suggestions related to the improvement of teaching materials, as well as additional knowledge presented and acquired as part of self-study.

Programme content

Lectures: Light environment. Visual performance, visual comfort. Photometry and colorimetry. Photometric properties of materials. Rules for the selection of lighting equipment. Lighting design criteria. Requirements and recommendations for lighting of interior workplaces, road lighting and lighting of sports facilities. Fundamentals of illumination

Heat and electrothermal transformations. Electrothermal methods (resistance, electrode, induction, arc, plasma, capacitive, microwave, electron, photon, fluorescent, ultrasonic) and electrothermal technologies implemented in them. Direct and indirect heating devices. Basic laws of thermokinetics.

During the lecture, direct and indirect heating devices are presented, the basic laws of thermokinetics are explained. The lecture also applies to meters and temperature measurement, from the methods of classic thermometers, through resistance meters on the example of Pt100, ultrasonic meters to the most commonly used thermocouples of various types, including the areas of their application. During the lecture, the information presented is complemented by the possibility of their use in measuring and designing lighting equipment. Emphasis is also placed on the use of modern techniques for modeling heat energy flow in systems (input - environment) using SolidWorksMierniki software.

The laboratories in the lighting technology section deal with the practical determination of lighting equipment parameters, the photometric properties of materials, the assessment of the quality of indoor workplaces and the study of the effects of illumination and object contrast and angular size on visual acuity.

The electrothermal part laboratory is based on:

- resistance heating tests on heating coils, determining the thermal power transferred to the environment through convection and radiation using the proprietary "reference" software. The heating elements are dimensioned using calipers, determination of the twisted pair parameters: twisting and pulling coefficients, determination of the influence of the above mentioned on mutual heating of subsequent coils. Temperature measurements made through thermocouples, measurements of electrical quantities: current, voltage, power with meters with digital displays.

- testing the thermal conductivity of materials used in electrical engineering, including copper, aluminum, composite, steel and brass rods and made as "heatpipes". Temperature measurements are made using a multi-channel temperature recorder with K-type thermocouples connected, data aggregated on a regular basis to the computer. An analysis of temperature increases along the bars is performed and thermal conductivities determined on this basis.

- testing the possibility of using induction and capacitive heating. Steel, aluminum and brass rods of various thickness are heated, determination of their heating efficiency and characteristics of various types of materials.

- testing the parameters of the Peltier module used to cool the electronic component. Determination of the characteristics of the Peltier module, its efficiency and the achieved temperatures of its linings for different thermal power generated by the cooled element.

The lecture also includes information on heat and electrothermal transformations. Electrothermal methods (resistance, electrode, induction, arc, plasma, capacitive, microwave, electron, photon, fluorescent, ultrasonic) are discussed and the electrothermal technologies implemented in them are discussed.

Laboratories - work in teams, discussion on the results obtained for research, detailed reviews of reports by the teacher and discussion on comments, computational experiments, the use of tools enabling students to perform tasks at home.

Teaching methods

Lecture - multimedia presentation (including drawings, photos, animations) supplemented with examples given on the board. The lecture was conducted in an interactive way with the formulation of questions to a group of students or to specific students indicated, the students' activity during classes is given when issuing the final grade, the theory presented in close connection with practice, the theory presented in connection with the current knowledge of students.

During laboratory classes practical tasks are performed. In addition, work is done with the program intended for visualization.

Bibliography

Basic

1. Żagan W.: Podstawy techniki świetlnej. Ofic. Wyd. Pol. Warszawskiej, Warszawa 2005.

2. Dybczyński Wł.: Miernictwo promieniowania optycznego. Wyd. Pol. Białostockiej, Białystok 1996.

3. Materials for laboratory classes available at lumen.iee.put.poznan.pl and Moodle module

4. Żagan W., Krupiński R.: Teoria i praktyka iluminacji obiektów, Oficyna Wydawnicza Politechniki Warszawskiej, 2016.

5. Hauser J.: Elektrotechnika. Podstawy elektrotermii i techniki świetlnej. Wydawnictwo Politechniki Poznańskiej, Poznań 2006.

6. Hering M.: Podstawy elektrotermii cz. I. WNT, Warszawa 1992.

7. Hering M.: Podstawy elektrotermii cz. II. WNT, Warszawa 1998.

8. Hering M.: Termokinetyka dla inżynierów. WNT, Warszawa 1980.

9. Michalski L., Eckersdorf K., Kucharski J.: Termometria. Przyrządy i pomiary. Wydawnictwo Politechniki Łódzkiej, Łódź 1998.

Additional

1. Bąk J., Pabjańczyk W.: Podstawy techniki świetlnej. Wyd. Pol. Łódzkiej, Łódź 1994.

2. Laboratorium z techniki świetlnej. Praca zbiorowa. Wyd. Pol. Poznańskiej, Poznań 1994.

3. Mielicki J.: Zarys wiadomości o barwie. Fundacja Rozwoju Polskiej Kolorystyki. Łódź 1997.

4. Żagan W.: Iluminacja Obiektów. Oficyna Wydawnicza PW, Warszawa 2003.

5. Hauser J., Domke K.: Laboratorium elektrotermii. Wyd. Pol. Pozn. nr 1487, Poznań 1989.

6. Materiały dostępne na stronie: www.licht.de

7. Normy przedmiotowe

8. Hauser J., Skrzypczak P., Czaplicki A., Wesołowski M.: Analogue RC model for temperature controller testing. Poznan University of Technology, Academic Journals, Electrical Engineering, Issue 13, 2015, pp 132-142

9. Hauser J., Skrzypczak P., Wesołowski M.: Adaptacja programów wspomagających projektowanie oświetlenia do symulacji radiacyjnego przekazywania ciepła. PES-10 : X Jubileuszowa Konferencja Naukowo - Techniczna "Postępy w Elektrotechnice Stosowanej", Kościelisko, 15-19 czerwca 2015, s. 195-198.

Breakdown of average student's workload

	Hours	ECTS
Total workload	108	4,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes, preparation for the final tests, preparation of reports or presentations) [1]	48	1,5

[1] delete or add other activities as appropriate