# COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modular : Basics of Electroheat and Optics Radiance:

Basics of Optics Radiance, electroheat and thermokinetics

## Course

| | |
|---|---|
| Field of study | Year/Semester |
| Electrical Engineering | 2/4 |
| Area of study (specialization) | Profile of study |
| - | practical |
| Level of study | Course offered in |
| First-cycle studies | polish |
| Form of study | Requirements |
| full-time | elective |

## Number of hours

| | | |
|---|---|---|
| Lecture | Laboratory classes | Other (e.g. online) |
| 15 | 30 | |
| Tutorials | Projects/seminars | |

## Number of credit points

3

## Lecturers

Responsible for the course/lecturer:
Przemysław Skrzypczak, Ph. D., Eng.

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

tel. 61 6652585

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A 60-965 Poznań

Responsible for the course/lecturer:
Ph.D, D.Sc., Eng. Krzysztof Wandachowicz

email: krzysztof.wandachowicz@put.poznan.pl

tel. 61 665 2397

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 acquired at earlier stages of the first degree studies - semesters 1 to 3. In addition, I should have an in-depth and expanded view of thermodynamics and optics acquired on semesters 1 and 2 - Physics and circuit theory. Should have the ability to effectively self-study in the field related to the chosen field of study and should be able to plan and carry out simulation and measurements of basic quantities characteristic of electrical systems. The ability to present the obtained results in numerical and graphic form is also required. The student should be able

2 to interpret the results obtained and be able to draw the right conclusions. In addition, he should be aware of the need to expand his competences, readiness to cooperate within the team.

## Course objective

Providing students with knowledge about optical radiation, its generation and use.

Provide students with knowledge about the methods and ways of heat transfer, the relationship between material parameters and the possibility of heat transfer. Determination of the use of the presented routes for the generation of heat useful in various electrothermal methods, along with their characteristics and use in both household and industrial electrothermal.

## Course-related learning outcomes

### Knowledge

The student has knowledge of physics in the field of optics, necessary to understand the basic physical phenomena. The student has the knowledge, knows and understands the ways of heat transfer. He has knowledge of electro-thermal transformations occurring in electrical engineering and electrothermal energy.

### Skills

The student has the ability to use literature sources available in printed and electronic versions. The student has the ability to integrate the obtained information, is able to assess its credibility, evaluate it and interpret it. The student has the ability to think independently and draw conclusions, and also has the ability to draw his own original conclusions, has the ability to clearly and correctly formulate sentences expressing opinions about the observed phenomena, as well as formulate and justify opinions, discuss them.

The student has the ability to use his knowledge when selecting the measuring ranges of ammeters, voltmeters and wattmeters. The student has the ability to connect simple measuring systems based on electrical diagrams and without them. The student has the ability to acquire data from connected analog meters (the ability to properly read indications of pointer meters) and digital ones. Has the ability to record the measurement results correctly with the specified accuracy.

### Social competences

The student understands that knowledge is necessary to solve problems in the field of optics and optical radiation. Understands that the knowledge of the transfer of thermal energy is one of the most important in the design of all electrical systems. The student understands that the technologies used to remove unnecessary thermal energy are constantly developed, therefore it is necessary to update their knowledge and professional competences. The student understands that, as a result of the thermal parameters of electrical devices determined by him, he is responsible for the joint task of reliable operation of the designed and operated electrical device.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during lectures - assessment of knowledge and skills demonstrated in the written test. Skills and knowledge acquired during laboratory exercises: assessment of knowledge and skills

related to the implementation of the exercise task, evaluation of the report of the exercise performed or under specific conditions of the size of the group implementation of multimedia presentations conducted by students: description and presentation of measurement results with conclusions. Getting extra points for activity during classes, especially for: - ability to cooperate within a team that practically performs a specific task in a laboratory; - comments related to the improvement of teaching materials; - aesthetic care of reports and tasks prepared as part of self-study

**Programme content**

LECTURES - Presentation in a multimedia form of the range of optical radiation, supported by practical examples, the biological effects of the action of particular ranges of radiation on living organisms and inanimate matter. - On the basis of the applicable Standards, discussion of the risks related to the effects of infrared and ultraviolet radiation. - Identify the hazards of blue radiation in diode (LED) lamps, based on practical situations. Lecture with a multimedia presentation presenting the thematic scope of thermokinetics, ways of transfer of thermal energy and electrothermia and its main division. Introduction to the topic of thermal transformations in electrical engineering - Presentation of the division of heat generation methods on slides, discussion of the advantages and disadvantages of flame and electrothermal heat generation with particular emphasis on the advantages and disadvantages of each method. - Determining the division of electrothermal methods: resistance, electrode, induction, arc, plasma, capacitive, microwave, photon, electron, ion, ultrasonic with a presentation of the practical implementation of each of them - linking the presented theoretical content with practice. Discussion on the economic aspects of applying each of the above-mentioned methods.

LABORATORY CLASSES - During the laboratory, discussions are held on the obtained values of measured quantities - radiant powers generated in individual sub-ranges of optical radiation (UV - VIS - IR). The shares of individual radiation ranges obtained during measurements are compared with the multimedia data of the manufacturer and test results obtained by employees The plant. -The effect of optical radiation (especially UV) on materials characterized by luminescence is demonstrated. Based on the knowledge from the lectures and measurements, students define the dangers of blue radiation in LED lamps, there is a discussion about the dangerous effects of this radiation, e.g. in workplaces. Experimental calculations are made of the change in luminous efficacy in cases other than directly tested in laboratories - the effects of changing the temperature of the filament, changes in the phosphor of a fluorescent lamp, etc.

During the laboratory, a discussion is initiated on the accuracy of measurements made with the use of thermocouples, metal thermometric and semiconductor resistors, as well as pyrometers and a thermal imaging camera. Students are introduced in a practical way to errors that may occur in each of the above-mentioned measurement methods. There is a discussion on the efficiency of various electrothermal devices obtained during measurements of general use, characteristics are drawn up, allowing for their easy assessment and comparison. The advantages and disadvantages of individual electrotemic methods are concluded on the basis of the obtained results and the knowledge of the lectures. -Students make measurements concerning and testifying to the wave nature of radiation - with particular emphasis on microwave radiation, there is a discussion about the consequences of this.

## Teaching methods

The teaching methods used: lectures: - lecture with multimedia presentation (including drawings, photos, animations, sound, films) supplemented with examples given on the board - lecture conducted in an interactive way with the formulation of questions for a group of students or specific students indicated - are included activity of students during classes during the final grade - during the lecture initiating discussions - theory presented in close connection with practice - theory presented in connection with the current knowledge of students - taking into account various aspects of the issues presented, including: economic Educational methods used: laboratories: - laboratories supplemented with multimedia presentations (photos, animations, charts) - the use of tools enabling students to perform tasks at home (proprietary software) - computational experiments - teamwork

## Bibliography

Basic

1. Wolska A.: Promieniowanie optyczne w środowisku pracy. CIOP PIB, 2013. 5

2. Wiśniewski A.: Źródła światła, Warszawa 2013

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

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

5. Materiały do zajęć laboratoryjnych dostępne na stronie lumen.iee.put.poznan.pl oraz w systemie Moodle

Additional

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

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

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 89 | 3,0 |
| Classes requiring direct contact with the teacher | 49 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 40 | 2,0 |

[1] delete or add other activities as appropriate