STUDY MODULE DESCRIPTION FORM

Name of the module/subject **(-)**		Code **1010314381010320024**
Field of study **Electrical Engineering**	Profile of study (general academic, practical) **general academic**	Year /Semester **4 / 8**
Elective path/specialty **High Voltage Engineering**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **8** Classes: **-** Laboratory: **13** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in mathematics, physics and electrical engineering
2	**Skills**	Ability of effective self-education in the field connected with the chosen field of study
3	**Social competencies**	He is aware of the need to broaden his competence, readiness to cooperate within the team

Assumptions and objectives of the course:

- Learn about electrothermics, ways of heat transfer, and measuring methods and instruments for measuring temperature.
- Learn about optical radiation, its generation and use.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Knowledge of all electrothermal methods and interactions of optical radiation - [K_W03++]
2. Presentation and interpretation of formula describing of the heat generated by the conduction currents. Knowledge of the construction of various temperature meters. Presentation of basic relationships describing heat transfer. Presentation of effects of optical radiation - [K_W16+++]

Skills:

1. Describe the energy balance of electrothermal devices. Assess the effects of optical radiation - [K_U05++]
2. Calculate the thermal power generated during heating of the charge. Can perform measurements of actinic effects of optical radiation - [K_U14++]

Social competencies:

1. He can work in a group. He can share and coordinate work between team members - [K_K01++, K_K03++]

Assessment methods of study outcomes

Lecture: Assessment of knowledge and skills demonstrated in the written test Laboratory exercises: assessment of knowledge and skills related to the performance of the exercise task, assessment of the report of the exercise Obtaining extra points for activity during classes, especially for: - ability to cooperate within a team practically performing a detailed task in a laboratory; - notes related to the improvement of didactic materials; - the aesthetic diligence of reports and assignments within their own learning
Course description

LECTURES

- Lecture with multimedia presentation presenting the scope of electrothermal topics and its main division.
- Introduction to the topic of electromagnetic transformations in electrical engineering
- Presentation of the division of methods of heat production on slides, discussion on the advantages and disadvantages of flame and electrothermal heat production with particular regard to the disadvantages and advantages of each method.

Determination of the division of electrothermal methods: resistance, electrode, induction, arc, plasma, capacitive, microwave, photon, electron, ionic, ultrasonic with the presentation of the practical implementation of each of them - the connection of presented theoretical content with practice. Discussion on the economic aspects of using each of the aforementioned methods.

- During the lecture in reference to the knowledge of physics students presented the basic law of thermokinetics.

- Presentation in the form of multimedia materials of optical radiation, supported by practical examples, the biological effects of the activity of particular radiation scales on living organisms and inanimate matter.
- Based on current Norms, discuss the risks associated with infrared, ultraviolet radiation.
- Based on the situation in practice, the determination of the risks associated with blue light in LEDs.

LABORATORY CLASSES

- During the laboratory discussion on the accuracy of measurements made using thermocouples, metal thermometers, semiconductor resistors and pyrometers and thermal imaging cameras is initiated.
- Practical students are acquainted with errors that may occur in any of the above methods of measurement.
- A discussion on the performance of various consumer electrothermal devices is made, and features that allow for easy assessment and comparison are drawn. The advantages and disadvantages of particular electromagnetic methods are presented on the basis of the obtained results and the knowledge of the lectures.

-Students make measurements about the wave nature of radiation - with particular regard to microwave radiation, discussion is made about the effects of this flow.

- During the laboratory, discussions about the obtained values ??of measured quantities - radiant power generated in individual sub - bands of optical radiation (UV - VIS - IR)
- The measurements taken during the measurements are compared with the presented data of the manufacturer and the results obtained by the employees of the Department.
- The effect of optical radiation (especially UV) on materials characterized by luminescence is demonstrated.
- Based on the knowledge of the lectures and the measurements taken, students determine the risks associated with blue radiation in LED lamps. at work places
- Experimental calculations of changes in luminous efficacy in cases other than directly investigated in laboratories - changes in filament temperature, fluorescent fluorescence changes, etc.

Applied methods of education: lectures:

- lecture with multimedia presentation (including: drawings, photographs, animations, sound, films) supplemented by examples given on the board
- an interactive lecture with questions to a group of students or to specific students
- Student activity is taken into account during the final assessment
- during the lecture, initiating the discussion
- theory presented in close connection with practice
- theory presented in connection with current knowledge of students
- taking into account various aspects of the presented issues, including: economic ones

Applied methods of education: laboratories:

- laboratories supplemented with multimedia presentations (photos, animations, charts)
- use of tools to enable students to perform tasks at home (author software)
- computational experiments
- work in teams

Update 2017: Discussion and discussion on the introduction of white light-emitting diodes

Presented program content and laboratory activities are based on the results of scientific research conducted at the Institute.

Basic bibliography:

1. Hauser J.: Elektrotechnika. Podstawy elektrotermii i techniki świetlnej. Wydawnictwo Politechniki Poznańskiej, Poznań 2006
2. Wolska A.: Promieniowanie optyczne w środowisku pracy. CIOP PIB, 2013.
3. Michalski L., Eckersdorf K., Kucharski J.: Termometria. Przyrządy i pomiary. Wydawnictwo Politechniki Łódzkiej, Łódź 1998
4. Wiśniewski A.: Źródła światła, Warszawa 2013
5. Materiały do zajęć laboratoryjnych dostępne na stronie lumen.iee.put.poznan.pl

Additional bibliography:

1. Hering M.: Podstawy elektrotermii cz. I. WNT, Warszawa 1992.
2. Hering M.: Podstawy elektrotermii cz. II. WNT, Warszawa 1998

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	8
2. Participation in laboratory classes	13
3. Participation in consultations (lectures)	6
4. Participation in consultations (laboratory classes)	8
5. preparation for laboratory classes (home activites)	15
6. preparation reports to laboratory classes (homework)	10
7. preparation for the exam	10
8. participation in the final exam	2

Student’s workload

Source of workload	hours	ECTS
Total workload	75	3
Contact hours	37	1
Practical activities	41	2