STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Electrothermal processes		**1010322331010324893**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**general academic**	**2 / 3**

Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Lighting Engineering	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours					No. of credits
Lecture: **15**	Classes: **-**	Laboratory: **15**	Project/seminars: **-**		**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

dr inż. Przemysław Skrzypczak
email: przemyslaw.s.skrzypczak@put.poznan.pl
tel. 61 6652585
Faculty of Electrical Engineering
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of the basics of heat generation processes, methods of measuring temperature and ways of heat transfer. Knowledge of the physics of phenomena: Conduction, Convection and Radiation. Knowledge of the influence of temperature on aging processes electronic components.
2	**Skills**	Ability to use knowledge in the field of electrothermics to identify and evaluate expected temperatures in real systems. Ability to estimate the influence of individual external factors on the obtained temperature parameters
3	**Social competencies**	Is aware of the need to broaden their competence, willingness to work together as a team.

Assumptions and objectives of the course:

- Identify the amount of heat generated by individual light sources
- Understand the flow of heat and determine the amount of power generated and transmitted to the environment
- Identify the methods used in real systems to dissipate heat generated by light sources

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

Knowledge:

1. It knows the elements of the luminaires important from the point of view of heat transfer - [K_W14+++]
2. Know the main flow paths for each light source and luminaire - [K_W11++]
3. Has knowledge of the possibility of improving the cooling system's thermal parameters - [K_W13+++]

Skills:

1. On the basis of physical dependencies and material parameters obtained from the literature it is possible to calculate the thermal parameters of the system light source - luminaire - ambient - [K_U01++, K_U05++]
2. Can distinguish components of the heat dissipation system and decide to intensify one of the ways of heat flow - [K_U02++]

Social competencies:

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

Assessment methods of study outcomes

On the basis of individual activity in the classes, diligence and accuracy in the performance of assigned tasks, scoring on the final test (14 weeks of teaching), individual grades are assessed on the reports.

Course description

LECTURES

- lecture with multimedia presentation on the generation of heat and energy balance in various light sources,
- lecture conducted in the form of discussion on the influence of temperature on electrical parameters and photometric light sources,
- presentation in the form of a multimedia presentation with the preceding content related to the subjects of light technology, including the content of bulldozing of the construction of high power LEDs with particular emphasis on the ways of heat flow,
- a lecture based on computational examples of the thermal parameters of diodes cooling systems, thermal parameters of luminaires using light-emitting diodes, calculations performed in connection with actual cooling systems and thus with practice, discussion on economic aspects of improving cooling systems at the expense of complicated luminaire construction,
- multimedia presentation with animations - films from the thermal imaging camera on thermal parameters of modern light sources used as substitutes for classical light sources, lecture based on the results of research conducted in the Department
- presentation in tabular form with a verbal commentary on the thermal requirements for the electrical components used in the construction of the lighting fixture.

LABORATORY CLASSES

- During the lab, students will be able to make use of the "luminaire" home program to evaluate the temperature of the luminaire under given ambient conditions,
- computational experiments performed in the program luminaire confirmed by temperature results obtained in real conditions during laboratory classes
- discussion of the results obtained and the reasons for differences in their values ??with the computer simulations.
- Demonstration of changes in temperature values ??in systems in different outdoor conditions (use of temperature chambers)
- based on real-time characteristics of temperature changes, discussion on their course, time constants and monotonousness

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

Updated 2017:

- presentation of the possibility of using Peltier modules in diode cooling systems
- heat calculations using Peltier modules
- make available to students using virtual lab software created in LabView.

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, Wyd. PP, Poznań, 2006
2. Filin S.: Termoelektryczne urządzenia chłodnicze, IPPU MASTA 2002
3. Wesołowski M, Skrzypczak P, Hauser J.: Thermal resistance of LED diodes. Precission of catalogue data. Elektronika 12/2015 s.45-49
4. Materiały do zajęć laboratoryjnych dostępne na stronie lumen.iee.put.poznan.pl

Additional bibliography:

1. Skrzypczak P.: Badania parametrów cieplnych diodowych zamienników lamp tradycyjnych, VI Konferencja Naukowo-Techniczna: Energooszczędność w oświetleniu, Poznań 26.05.2015 s.: 31-36
2. Skrzypczak P.: Analiza układów chłodzenia diod elektroluminescencyjnych dużej mocy z wykorzystaniem ogniw Peltiera ; Politechnika Poznańska. Wydział Elektryczny.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Participation in laboratory classes	15
3. Participation in consultations	10
4. preparation for laboratory classes and reports	10
5. preparation for the exam	10
6. participation in the final exam	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	70	3
Contact hours	42	2
Practical activities	25	1