POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Heat transfer modeling [S2Eltech1E-TŚ>MWC]

Course

Field of study
Electrical Engineering

Year/Semester
1/1

Area of study (specialization)
Lighting Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

dr inż. Przemysław Skrzypczak
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Lecturers

Prerequisites

When starting classes on this subject, the student must have a basic knowledge of the basics of heat generation processes, methods of temperature measurements and heat flow way. Must have knowledge of the physics of phenomena: conduction, convection and radiation. He should be aware of the influence of temperature on aging processes, e.g. electronic components. The student should be able to use the knowledge in the field of electrothermal energy to determine and evaluate the expected values of temperatures in real systems. He must be able to estimate the influence of various external factors on the obtained temperature parameters. The student should be aware of the need to cooperate with others and expand his knowledge. He should also be ready to search for the necessary information about the parameters of the materials used in the literature.

Course objective

Studnet will deepen the knowledge of heat transfer and determining the amount of power generated and transmitted to the environment. He will be introduced to numerical methods and software for modeling heat transfer.

Course-related learning outcomes

Knowledge:
Has extended knowledge in the field of measurements of electrical quantities and selected non-electrical quantities; has in-depth knowledge of the development of the results of the experiment.
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.
Has in-depth knowledge of the implementation of various heating methods, construction of electrothermal devices and the technological processes carried out with their use.

Skills:
He can obtain information from literature, databases and other sources, make their interpretation, evaluation, critical analysis and synthesis, as well as draw conclusions ands formulate opinions.
Can work individually and in a team, can manage a team in a way that ensures the implementation of the task within the set deadline, can define the directions of further learning and organize the process of self-education and other people.
He speaks English at the B2 + level of the European System for the Description of Languages, also in professional matters, reads professional literature with understanding, and is also able to prepare and deliver a presentation on the implementation of a project or research task.

Social competences:
Understands the importance of knowledge in solving cognitive and practical problems and understands that in technology, knowledge and skills quickly become obsolete, and therefore require constant replenishment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lectures is verified through a final test carried out at the end of the semester, moreover, on the basis of individual activity in classes, diligence and accuracy in performing the assigned tasks, and grading on the final test (14th week of classes).
The knowledge and skills acquired during design classes are assessed by assessing the activity and diligence of thermal model design tasks during classes and individual design tasks.

Programme content

LECTURES
During lectures with a multimedia presentation, issues related to the generation and dissipation of thermal energy from various systems are presented. On the basis of the Fourier-Kirchoff equation, the issues of the influence of its individual components for dynamic and steady states are discussed. The significance of the variability of the thermal conductivity coefficient is determined. Presentation for the simple geometry of the system of the analytical method to determine the temperature distribution of the object under the given boundary conditions of I, II, III and IV types. Presentation in the form of an active environment with a feedback of the principles of numerical computation of temperature distribution "by calculation method of solving differential equations" (KM3R). Introduction, presentation and description of heat transfer modeling using MATLAB, QuickField, SolidWorks Simulation. Lecture supported by computational examples on the validity of discretization grid compaction in the context of extended computation time. During the lectures, the presentation of thermograms of thermal objects, whose dimensions of extensions are consistent with those presented in the model approach. Discussion on the economic aspects of improving heat exchange intensification systems.
PROJECT CLASSES
During the course, design for simple system geometries and the occurrence of boundary conditions of various types, analytical calculations and modeling of heat transfer and temperature distributions in the system are carried out for the computer method of solving differential equations (KM3R) implemented in Excel.
- During the classes, design for simple and complex system geometries is carried out with modeling of heat transfer using the QuickField program.
- During the course, the design for simple and complex system geometries is modeled heat transfer using the SolidWorks Simulation program.

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 of heat transfer modeling 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:
- Nagórski Z.: Modelowanie przepływu ciepła metodą KM3R, Oficyna Wydawnicza Politechniki Warszawskiej, 2014
- Domański R., Jaworski M., Rebow M., Kołtyś J.: Wybrane zagadnienia z termodynamiki w ujęciu komputerowym, PWN, 2000
- Hauser J.: Elektrotechnika. Podstawy elektrotermii i techniki świetlnej, Wyd. PP, Poznań, 2006

Additional:
- Magnucka-Blandzi E.:Metody numeryczne w MatLabie. Wybrane zagadnienia, Wyd. PP,Poznań 2013
- QuickField user manual: https://quickfield.com/downloads/quickfield_manual.pdf
- Kurowski P.: Thermal Analysis with SOLIDWORKS Simulation 2022 and Flow Simulation 2022, SDC Publications, 2022

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00