



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Thermal imaging diagnostics

### Course

Field of study

Electrical Engineering

Area of study (specialization)

Intelligent Measurement Systems

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

English

Requirements

elective

### Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

1

### Lecturers

Responsible for the course/lecturer:

dr inż. Arkadiusz Hulewicz

email: arkadiusz.hulewicz@put.poznan.pl

tel. 616652546

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

mgr inż. Krzysztof Dziarski

email: krzysztof.dziarski@put.poznan.pl

tel. 616652388

Faculty Of Environmental Engineering And Energy

ul. Piotrowo 3A, 60-965 Poznań

### Prerequisites

The student should know the basic knowledge of electrical engineering, metrology, computer science and electronics.

### Course objective

Understanding the basics of thermovision phenomena, familiarization with modern measurement techniques and awareness of the need to use modern measurement systems working as an IoT node in Industry 4.0 applications in terms of thermovision measurements.

### Course-related learning outcomes

Knowledge

1. Has knowledge of development trends, new achievements and dilemmas of modern engineering.



2. 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.

#### Skills

1. Can obtain information from literature, databases and other sources, make their interpretation, evaluation, critical analysis and synthesis, as well as draw conclusions and formulate and exhaustively justify opinions.
2. Can assess the usefulness and the possibility of using new technical and technological achievements for the design and manufacture of electrical systems and devices containing innovative solutions, and if necessary, propose their improvements.

#### Social competences

1. Recognizes 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:

Lecture: Assessment of the knowledge demonstrated in the written or oral test on the content of the lectures at the last lecture. Passing threshold: 50% of points. Rewarding presence, activity and quality of perception during the lecture.

#### Programme content

Lecture:

Theoretical issues presented in close connection with practice include:

- physical phenomena underlying the thermal imaging technique,
- construction of modern thermal imaging cameras,
- factors affecting the result of thermographic temperature measurement,
- thermal imaging camera processing equation,
- selected parameters of thermal imaging cameras (NEDT, IFOV, FOV),
- practical aspects of thermographic temperature measurements,
- thermovision measurement systems as an IoT node in Industry 4.0 applications.

#### Teaching methods

Lecture: Multimedia presentations supplemented with examples given on the blackboard.

#### Bibliography



Basic

1. Bogusław Więcek, Gilbert De Mey: Termowizja w podczerwieni: podstawy i zastosowania. Wydawnictwo PAK, 2011.
2. Krzysztof Dziarski, Arkadiusz Hulewicz, Grzegorz Dombek, Ryszard Frąckowiak, Grzegorz Wiczyński: Unsharpness of Thermograms in Thermography Diagnostics of Electronic Elements, Sensors, 2020.
3. Krzysztof Dziarski, Arkadiusz Hulewicz, Grzegorz Dombek: Indirect Thermographic Temperature Measurement of a Power-Rectifying Diode Die, Energis, 2021.
4. Arkadiusz Hulewicz, Krzysztof Dziarski, Grzegorz Dombek: The Solution for the Thermographic Measurement of the Temperature of a Small Object, Sensors, 2021.
5. Krzysztof Dziarski, Arkadiusz Hulewicz, Grzegorz Dombek: Thermographic Measurement of the Temperature of Reactive Power Compensation Capacitors, Energis, 2021.

Additional

- 1 Infrared Thermography: Errors and Uncertainties. Waldemar Minkina, Wiley-Blackwell, 2009.
- 2 Normy: JESD 51-4A, JESD 51-12.01, JESD 51-13, JESD 51-14, JESD 51-32, JESD 51-50, JESD 51-51, JESD 51-52, JESD 51-53

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	30	1,0
Classes requiring direct contact with the teacher	15	0,5
Student's own work (literature studies, preparation for test) <sup>1</sup>	15	0,5

<sup>1</sup> delete or add other activities as appropriate