COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Electrical and Electronic Engineering</td><td colspan="2">Degree level and programme type</td><td>bachelor's degree, full time programme</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Optoelectronics - Sources and Detectors of Optical Radiation</td><td colspan="2">Course code</td><td>IS-FEE-10052W</td></tr>
<tr><td colspan="2">Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>winter</td></tr>
<tr><td>15</td><td></td><td>30</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>4</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">To acquaint students with the main theme of sources and detectors of optical radiation. Identification of areas of sources and detectors of optical radiation applications including respectively: industry, medicine, telecommunication, military technology, visual effects. To Acquaint students with the current state of development and research in the field of modern sources and detectors of optical radiation. To acquaint students with the classification and properties of sources and detectors of optical radiation. To overview selected problems: optical phenomena in semiconductors, the analysis of structures of semiconductor detectors and emitters. To familiarize students with the parameters of sources and detectors of optical radiation used in telecommunications and optoelectronics. To teach the principles of operation and measurement of the sources and detectors of optical radiation: electro-optical, spectral characteristics of LEDs and lasers, static, control and frequency characteristics of photonic and thermal radiation detectors. To teach the ability to use semiconductor sources and radiation detectors. To teach the skills of selecting sources and detectors' parameters for selected applications.</td></tr>
<tr><td>Course content</td><td colspan="9">Methods of producing optical radiation. Classical light sources and their applications in optoelectronics (radiation patterns). The phenomenon of radiation in semiconductors. Methods of analysis of semiconductor structures. Structure, principle of operation, operating systems of emitters and detectors of optical radiation. LEDs, semiconductor lasers, photoluminescence, emission of radiation in organic materials. Electro-optical and spectral parameters of thermal and semiconductor sources. Photon and thermal radiation detectors. Electro-optical, spectral, frequency parameters of optical radiation detectors. Construction and operation of the detector arrays (CCD, CMOS, thermal) in visible or infrared light. The use of sources and detectors of radiation. Selected applications and measurement teqchniques.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">classic lecture with elements of inverted lecture, demonstration of basics phenomena, problem solving and problem-based learning, laboratory experiments, practical work and reports,</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture – written exam, laboratory classes – evaluation of reports, verification of preparation for classes,</td></tr>
<tr><td>Symbol of learning</td><td colspan="7">Learning outcomes</td><td colspan="2">Reference to the learning outcomes for</td></tr>
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outcome		the field of study	
LO1	student has detailed knowledge of sources and detectors of optical radiation		
LO2	student explains optical phenomena occurring in semiconductors		
LO3	student discusses and characterizes the construction of sources and detectors of optical radiation		
LO4	student measures and analyzes the properties of semiconductor radiation emitters		
LO5	student measures and analyzes the properties of optical radiation detectors		
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed	
LO1	written exam	L	
LO2	written exam	L	
LO3	written exam	L	
LO4	evaluation of reports, verification of preparation for classes,	LC	
LO5	evaluation of reports, verification of preparation for classes,	LC	
Student workload (in hours)		No. of hours	
	lecture attendance	15	
Calculation	participation in the laboratory	30	
	preparation for the laboratory	20	
	working and description of laboratory reports	20	
	participation in lecture / student - teacher consultations	5	
	participation in student-teacher sessions related to the laboratory classes	5	
	preparing to pass the exam	20	
	TOTAL:	115	
Quantitative indicators		HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation		55	2
Student workload – practical activities		75	3
Basic references	1. Deen J.A., Basu P.K.: Silicon photonics : fundamentals and devices, Chichester : John Wiley a. Sons, 2012. 2. Kasap F.: Optoelectronics and photonics, Cambridge University Press, Cambridge, 2012 3. Hu Wenping: Organic optoelectronics, Wiley-VCH, Weinheim, 2013		
Supplementary references	1. Kingston R. H., Detection of optical and infrared radiation (Vol. 10). Springer, 2013. 2. Keyes, R. J., Optical and infrared detectors (Vol. 19). Springer Science & Business Media, 2013. 3. Rogalski, A., Infrared detectors. CRC press, 2010. 4. Schubert E. F., Gessmann T., Kim J. K., Light emitting diodes. John Wiley & Sons, Inc., 2005.		

	5. Agrawal G. P., Dutta N. K., Semiconductor lasers. Springer Science & Business Media, 2013.	
Organisational unit conducting the course	Department of Photonics, Electronics and Light Technique	Date of issuing the programme
Author of the programme	Urszula Błaszczak, Ph.D. Eng., Łukasz Gryko, PhD. Eng.	30.01.2020

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar