

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Sensor technology and imaging of objects		Code 1010324391010325952
Field of study Electrical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 5 / 9
Elective path/specialty Measurement Systems in Industry and	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: 18 Classes: - Laboratory: 27 Project/seminars: -		No. of credits 5
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
Responsible for subject / lecturer: dr hab. inż. Grzegorz Wiczyński email: grzegorz.wiczynski@put.poznan.pl tel. 616652639 Wydział Elektryczny ul. Piotrowo 3A 60-965 Poznań		Responsible for subject / lecturer: prof. dr hab. inż. Anna Cysewska-Sobusiak email: anna.cysewska@put.poznan.pl tel. 61 665 2633 Wydział Elektryczny ul. Piotrowo 3A 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge in the scope of electrotechnics, electronics, and metrology. Basic knowledge in the scope of electronic analog systems and digital technique.
2	Skills	Ability of the efficient self-education in the area concerned with the sensor technology and object imaging
3	Social competencies	Awareness of the necessity of the competence broadening and ability to show the readiness to cooperate as a team
Assumptions and objectives of the course: - Knowledge of interdisciplinary achievements in the area of application of sensors and measuring systems in industry, everyday life, and biomedical engineering. - Knowledge of the modern systems to measure nonelectrical quantities, including the quantities to be measured in biophysical investigations. - Knowledge of the modern techniques of the acquisition, processing and presentation of measurement data.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. Ability to characterize the importance and application possibilities of the modern measuring systems. - [K_W05 +, K_W14 +] 2. Ability to explain the principles and techniques of the measuring signals acquisition for applications in industry and biomedical engineering. - [K_W03 +]		
Skills: 1. Ability to work independently and as a team in the design and construction companies, research laboratories, industrial centres, and medical facilities - [K_U05 +, K_U23 ++]		
Social competencies: 1. Ability to think and act interprisingly in the area of measuring systems to be used in industry and biomedical engineering - [K_K01 +] 2. Understanding the necessity of broad popularization of the knowledge in the scope of simple and complex measuring systems - [K_K05 +]		

Assessment methods of study outcomes	
<p>Lectures:</p> <ul style="list-style-type: none"> - evaluation of the knowledge with a written exam related to the content of lectures (test, computational and problem questions), awarding marks in laboratory exercises) - continuous estimation in all classes (awarding attendance in lectures, activity and quality of perception). <p>Laboratory exercises:</p> <ul style="list-style-type: none"> - continuous estimating with the tests, - awarding the skill increase, - the evaluation of knowledge and skills connected with the measuring tasks and prepared reports 	
Course description	
<ul style="list-style-type: none"> - Measuring transducer with electrical output signal - basic statical and dynamical properties. - Measurement of electrical signals. - Standard analog signals. - Power supply of measuring transducers. - Attenuation of electromagnetic disturbances. - Determination of the coefficient of the processing of the transducer. - Bridge sternal Measurement of the resistance by the use of a bridge circuit. - Thermography. - Laser and ultrasonic sensor of the distance. - Examples of measuring transducers. - Metrological attributes and testing of the selected equipment for measurements and recording used in physical and biophysical applications. - Modern methods of imaging used in technology and medicine: thermovision, thermography, ultrasonography, computer tomography (CT), magnetic resonance (MRI), X-ray imaging (RTG), fiberoscopy and endoscopy. - Devices for acquiring images with visible radiation (CMOS and CCD cameras). - Configuration of vision systems for image acquisition with analog and digital cameras. - Selecting the camera optical systems. - Formats of graphical files and methods of data compression. - Methods of image digital processing. 	
Basic bibliography:	
<ol style="list-style-type: none"> 1. Biocybernetyka i inżynieria biomedyczna, red. M. Nałęcz, Akademicka Oficyna Wyd. EXIT, Warszawa 2001-2002 S. Bolkowski Elektrotechnika, Wyd. Szkolne i Pedagogiczne, Warszawa 2009 2. A. Cysewska-Sobusiak, Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, Poznań 2010 3. R. Józwicki, Technika laserowa i jej zastosowania, Oficyna Wyd. Politechniki Warszawskiej, Warszawa 2009 4. Z. Kaczmarek, Światłowodowe czujniki i przetworniki pomiarowe, Agenda Wydawnicza PAK, Warszawa 2006 5. M. Rząsa, B. Kiczma, Elektryczne i elektroniczne czujniki temperatury, WKŁ, Warszawa, 2005 6. J. Zakrzewski, Czujniki i przetworniki pomiarowe, Wyd. Politechniki Śląskiej, Gliwice 2004 	
Additional bibliography:	
<ol style="list-style-type: none"> 1. H. Madura, Pomiary termowizyjne w praktyce, Agenda Wyd. PAK, Warszawa, 2004 2. W. Malina, S. Ablameyko, W. Pawlak, Podstawy cyfrowego przetwarzania obrazów, Akademicka Oficyna Wyd. EXIT, Warszawa 2002 3. A. Michalski, S. Tumański, B. Żyła, Laboratorium miernictwa wielkości nieelektrycznych, Oficyna Wyd. Politechniki Warszawskiej, Warszawa 1996 4. J. Moczko, L. Kramer, Cyfrowe metody przetwarzania sygnałów biomedycznych, Wyd. UAM, Poznań 2001 	
Result of average student's workload	
Activity	Time (working hours)
1. Participation in lectures	18
2. Participation in laboratory exercises	27
3. Participation in consulting with lecturers	5
4. Preparation to laboratory exercises and preparation of the reports	41
5. Preparation to the exam	33
Student's workload	

Source of workload	hours	ECTS
Total workload	124	5
Contact hours	50	2
Practical activities	68	3