

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Czujniki i przetworniki**
 Name in English: **Sensors and Transducers**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ARR043304**
 Group of courses: **NO**

| | Lecture | Classes | Laboratory | Project | Seminar |
|--|-------------|---------|----------------------|---------|---------|
| Number of hours of organized classes in University (ZZU): | 15 | | 15 | | |
| Number of hours of total student workload (CNPS): | 60 | | 30 | | |
| Form of crediting: | examination | | crediting with grade | | |
| For group of courses mark (X) final course: | | | | | |
| Number of ECTS points: | 2 | | 1 | | |
| including number of ECTS points for practical (P) classes : | | | 1 | | |
| including number of ECTS points for direct teacher-student contact (BK) classes: | 1.40 | | 0.70 | | |

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He has basic knowledge in the field of linear circuits with sinusoidal signal. He knows the rules of the modelling of electrical circuits and their mathematical description.
2. He has basic knowledge of metrology.
3. He Has a basic skills in the implementation, analysis and design of electrical measurements

SUBJECT OBJECTIVES

- C1. Knowledge of static and dynamic properties of sensors, transducers,
 C2. Learning practical metrological characteristics of sensors and measuring transducers
 C3. Knowledge of mathematical models of transducers
 C4. ability to optimize and enhance the dynamic properties of transducers
 C5. Acquisition and consolidation of social skills including emotional intelligence skills involving the cooperation of a group of students with a view to effective problem solving. Responsibility, honesty and fairness in the procedure observance force in academia and society.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 He or she knows rules for processing physical quantities on the electrical parameters.
 PEK_W02 He or She has a basic knowledge of the dynamic properties of sensors and transducers.
 PEK_W03 Know the mathematical models of sensors and transducers

relating to skills:

- PEK_U01 Can take measurements of static and dynamic characteristics of sensors and transmitters.
 PEK_U02 Can present the results in numerical and graphical form.
 PEK_U03 He has ability to assess the impact of external factors on the result.

relating to social competences:

- PEK_K01 He or she is aware of their own responsibility for their work and a willingness to comply with the principles of teamwork. He searches information and its critical analysis, properly identifies and resolves the dilemmas of working in the profession

PROGRAMME CONTENT

| Form of classes - lecture | | Number of hours: |
|---------------------------|---|------------------|
| Lec 1 | Sensors and transducers in measurement chain. Types of sensors | 2 |
| Lec 2 | Models of real transducers, transducers zero, first and second order. | 1 |
| Lec 3 | Static and dynamic properties of sensors.. | 2 |
| Lec 4 | The measurement systems of passive and active sensors | 2 |
| Lec 5 | Basic blocks of measuring transducers | 2 |
| Lec 6 | Voltage and current measuring transducers | 2 |
| Lec 7 | Power and energy transducers | 2 |
| Lec 8 | Displacement transducers | 2 |
| Total hours: | | 15 |

| Form of classes - laboratory | | Number of hours: |
|------------------------------|---|------------------|
| Lab 1 | Presentation of the safety rules and principles of assessment laboratory. Presentation of laboratory test stand | 1 |
| Lab 2 | Investigation of dynamic transducers - response to unity step | 2 |
| Lab 3 | Determination of amplitude and phase characteristics for input circuit of transducer. | 2 |
| Lab 4 | Determination of the frequency characteristics of current transducers | 2 |
| Lab 5 | Rms converter | 2 |
| Lab 6 | Determination of the characteristics of the light sensor | 2 |
| Lab 7 | Determination of the characteristics of proximity (distance). | 2 |
| Lab 8 | Discussion of Report. The reserve term | 2 |
| Total hours: | | 15 |

TEACHING TOOLS USED

- N1. Traditional Lecture with audio-visual techniques
 N2. Laboratory run in the traditional manner of exercises + student groups, a report

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

| Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i> | Educational effect number | Way of evaluating educational effect achievement |
|---|---|--|
| F1(W) | PEK_W01 PEK_W02 PEK_W03 | Exam |
| P(W) | P=F1 | |
| F1(L) | PEK_U01 PEK_U02 PEK_U03 PEK_K01 | Assessment of reports done laboratory activities |
| P(L) | P=F1 Average value of laboratory evaluation | |

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Zajda Z., Żebrowski L., Urządzenia i układy automatyki PWr. Wrocław, 1993
- [2] Miłek M., Metrologia elektryczna wielkości nieelektrycznych, Uniwersytet Zielonogórski 2006.
- [3] Janiczek R., Elektryczne miernictwo przemysłowe, Wydawnictwo Politechniki Częstochowskiej 2006.
- [4] Rząsa M., Kiczma B., Elektryczne i elektroniczne czujniki temperatury, WKŁ Warszawa 2005.
- [5] Romer R., Miernictwo przemysłowe, PWN, Warszawa, 1970

SECONDARY LITERATURE:

- [1] Stryburski W. Przetworniki tensometryczne - konstrukcja, projektowanie, użytkowanie, WNT, Warszawa 1971.
- [2] www.czujniki.pl
- [3] Editors: Erika Kress-Rogers and Christopher J. B. Brimelow - Instrumentation and sensors for the food industry, second edition, CRC Press 2001
- [4] Nestor O. Shpak, Vadim P. Deynaga Nikolay V. Kirianaki and Sergey Y. Yurish - Data Acquisition And Signal Processing For Smart Sensors, John Wiley & Sons 2002

SUBJECT SUPERVISOR

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR043304 - Sensors and Transducers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics****

| Subject educational effect | Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable) | Subject objectives | Programme content | Teaching tool number |
|-----------------------------------|--|---------------------------|--|-----------------------------|
| PEK_W01 | K1AiR_W21 | C.1 C.2 C.3 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 | N.1 |
| PEK_W02 | K1AiR_W21 | C.1 C.2 C.3 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 | N.1 |
| PEK_W03 | K1AiR_W21 | C.1 C.2 C.3 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 | N.1 |
| PEK_U01 | K1AiR_U19 | C.4 C.5 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 | N.2 |
| PEK_U02 | K1AiR_U19 | C.4 C.5 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 | N.2 |
| PEK_U03 | K1AiR_U19 | C.4 C.5 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 | N.2 |
| PEK_K01 | K1AiR_K03 | C.5 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 | N.1 N.2 |