DESCRIPTION OF THE COURSES

- Course code: ARR 3316
- Course title: Automatization of electrometric measurements.
- Language of the lecturer: polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*1*		*1*		
*Number of hours/semester**	*15*		*15*		
Form of the course completion	*colloquium*		*note*		
ECTS credits					
Total Student's Workload					

- Level of the course (basic/advanced): advanced
- Prerequisites: credit of the courses ARR3302, ARR3303 or ELR3301, ELR3302
- Name, first name and degree of the lecturer/supervisor: Kłos Zbigniew / PhD
- Names, first names and degrees of the team's members: Madej Piotr / PhD
- Year:.....5..... Semester:....3 at II degree....
- Type of the course (obligatory/optional): optional
- Aims of the course (effects of the course):
- Form of the teaching (traditional/e-learning): traditional
- Course description:

Characterization of electrometric source: low internal signal power and very high internal resistance. Methods of measurement high resistances, ultra low DC current, voltage and potentials without current loading. Microprocessors automatically electrometric converters.

- Lecture:

Particular lectures contents	*Number of hours*
1. Introduction. Characteristic of signal sources with extremaly low internal power and extremaly high internal resistance. Influence of disturbances.	*2*
2. Methods of measurement and registration of ultra low DC and low-frequency current. Limitations of accuracy and ranges of such equipment. Methods of measurement of ultra high resistance. Electronic megaohmmeters: ranges, accuracy.	*2*
3. Methods of measurement of electrostatic potentials and DC and low-frequency voltage without current loading. Electrometric amplifiers and voltmeters: internal resistance and current. Electronic electrometer - universal measurement stand: structure, automatic registration of measurement results.	*2*
4. Modern electronic electrometric circuits and elements: operational electrometric amplifiers, high value resistors, cables, connectors, and their parameters. Instrumentation amplifiers with optically-, transformer- and capacitor coupled barrier.	*2*
5. Registration of low DC signals in the presence of high internal and external disturbances with bioelectrical signals an object. Statistical procedures of accuracy improvement of for extreme electrometric measurements: ZERO –	*2*

CHECK, ZERO – CORRECT, SUPPRESS.	
6. Microprocessor i/u and u/u converters for automatic registration of low-frequency bioelectrical signals. Monitoring and long distance transmission of signals coming from electrometric sensors. Current transmitter.	*2*
7. Microprocessor converters for monitoring of sewage parameters: pH, REDOX and O_2.	*2*
8. Test.	*1*

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:

1. Introduction.
2. Differential amplifier. Parameters.
3. Current/voltage conversion.
4. Charge/voltage conversion.
5. Electronic megaohmmeters.
6. Instrumentation amplifier with isolation barrier.
7 Applications of picoammeter and low DC current source.

- Project – the contents:
- Basic literature:

- Kłos Z.: Problematyka wzorcowania aparatury elektrometrycznej. Oficyna Wydawnicza Politechniki Wrocławskiej – seria Monografie, 2004, nr 17.
- Iljukowicz A.M.: Tiechnika elektrometrii. Energija, Moskwa 1976
- Katalogi firm: Burr-Brown, Analog Devices, Keithley.

- Additional literature:

- Kłos. Z.: Wysokoomowe rezystory precyzyjne stosowane w elektrometrii. Normalizacja,1992, nr 7.
- Kłos Z., Mazur J.: Automatyczne stanowisko do badania charakterystyk prądowo-napięciowych rezystorów wysokoomowych. Normalizacja, 1992, nr 8.
- Kłos Z.: Układ analogowy do pomiaru bardzo małych prądów stałych. Pomiary Automatyka Kontrola, 1992, nr 5.
- Kłos Z.: Elektrometryczny wzmacniacz pomiarowy sygnałów bioelektrycznych. Pomiary Automatyka Kontrola, 1993, nr 12.
- Kłos Z., Madej P.: Analogowe metody pomiaru wielkich rezystancji. Normalizacja,1993, nr 3.
- Kłos Z., Madej P.: Elektroniczny megaomomierz analogowy typ EMA-1. Pomiary Automatyka Kontrola, 1994, nr 1.

- Conditions of the course acceptance/credition: Test. Note.

***** - depending on a system of studies