Course description

Department/Unit /	KET / EM			**Academic Year**	2023/2024	
Title	Electrical Measurement			**Type of completion**	Exam	
Accredited/Credits	Yes, 5 Cred.			**Type of completion**	Combined	
Number of hours	Lecture 2 [Hours/Week] Tutorial 2 [Hours/Week]					
Occ/max	Status A	Status B	Status C	**Course credit prior to**	YES	
Summer semester	0 / -	0 / -	0 / -	**Counted into average**	YES	
Winter semester	0 / -	0 / -	0 / -	**Min. (B+C) students**	10	
Timetable	No			**Repeated registration**	NO	
Language of instruction	Czech			**Semester taught**	Winter, Summer	
Optional course	Yes			**Internship duration**	0	
Evaluation scale	1|2|3|4			**Ev. sc. – cred.**	S|N	
No. of hours of on-premise						
Auto acc. of credit	Yes in the case of a previous evaluation 4 nebo nic.					
Periodicity	K					
Substituted course	KET/+EM					
Preclusive courses	KET/EM1					
Prerequisite courses	N/A					
Informally recommended courses	N/A					
Courses depending on this Course	N/A					

Course objectives:

Methods and instruments for electrical measurements and their application in measurement of basic active and pasive electrical quantities.

Requirements on student

In partial fullfilment: laboratory measurements including corresponding reports, one written test.
Exam: written and oral exam in extent of topics covered in lectures and laboratory exercises.

Content

1. Measurement of AC/DC voltage and current, connection influence, range changes. Zero methods.
   Measurement of AC/DC electrical power in one-phase and 3-phase circuits.
2. Measuremnt of resistances - methods, instruments, bridges, connection influence, errors.
3. Measurement of impedances - methods, instruments, bridges, connection influence. Q-meter.
4. Measurement process. Errors and uncertainties of measurement.
   Static and dynamic characteristics of the transducer.
5. Signals - division. Signal values and factors.
6. Digitalization of analog signals, principle. Ideal and real ADC. Basic types of ADC and DAC.
7. Measurement of magnetic fields magnetic materials.
8. Electromechanic measuring instruments - permanent magnet moving coil meters, iron-vane meters, electrodynamic meters, electricity meters.
9. Digital multimeter.
10. Analog and digital storage oscilloscope, principle, bloc schematic diagram. Oscilloscope probes, errors.
11. Counter, principle, bloc schematic diagram. LF, DDS and RF generators, principles.
12. Multichannel measurements, connection structures.
    Modular solution of the measuring system, PC instrumentation.
13. Measurement systems, GPIB, RS232, USB.

Fields of study

Guarantors and lecturers

- **Guarantors:** Ing. Aleš Voborník, Ph.D. (100%)
- **Lecturer:** Ing. Aleš Voborník, Ph.D. (100%)
- **Tutorial lecturer:** Ing. Stanislav Bouzek (100%), Ing. Petr Kadlec, Ph.D. (100%), Ing. Jan Karel (100%), Ing. Lukáš Kupka, Ph.D. (100%), Ing. Lukáš Mraček, Ph.D. (100%), Ing. Petr Mráz (100%), Ing. Radek Nejdl (100%), Ing. František Steiner (100%), Ing. Martin Sýkora, Ph.D. (100%), Ing. Jiří Ulrych (100%), Ing. Ondřej Veselý (100%), Ing. Aleš Voborník, Ph.D. (100%), Ing. Ladislav Zuzjak, Ph.D. (100%)

Literature

- **Recommended:** Tůmová, Olga. *Elektrická měření : měřící metody*. 2. vyd. Plzeň : Západočeská univerzita, 2005. ISBN 80-7043-412-0.
- **Recommended:** Haasz, Vladimír; Sedláček, Miloš. *Elektrická měření : přístroje a metody*. Vyd. 2. Praha : Vydavatelství ČVUT, 2003. ISBN 80-01-02731-7.
- **Recommended:** Beran, Vlastimil; Girg, Josef; Tůmová, Olga. *Měření neelektrických veličin*. 1.vyd. Plzeň : ZČU, 1994. ISBN 80-7082-158-2.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Contact hours	26
Preparation for laboratory testing; outcome analysis (1-8)	56
Practical training (number of hours)	26
Preparation for formative assessments (2-20)	20
Total:	**128**

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

Test

Combined exam

Skills - skills achieved by taking this course are verified by the following means:

Combined exam

Competences - competence achieved by taking this course are verified by the following means:

Combined exam

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

ovládat základní zásady práce a obsluhy elektrických zařízení v rozsahu kvalifikace dle §4 Vyhlášky č. 50/1987 Sb.

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Lecture

Skills - the following training methods are used to achieve the required skills:

Laboratory work

Competences - the following training methods are used to achieve the required competences:

Lecture

Laboratory work

learning outcomes

Knowledge - knowledge resulting from the course:

explain concept of measurement process, errors and uncertainties in measurements

explain basic measurement methods

explain principles and basic properties of, analogue and digital measurement devices

Skills - skills resulting from the course:

measurement of basic electrical quantities

processing of measured data including errror and uncertainty analysis

Competences - competences resulting from the course:

N/A

Course is included in study programmes:

Study Programme	Type of	Form of	Branch	Stage	St. plan v.	Year	Block	Status	R.year	R.
Applied electrical engineering	Bachelor	Full-time	Applied electrical engineering	1	16	2023	Povinné předměty 2. roč. FEL - obor AEL	A	2	ZS
Applied Electrical Engineering	Bachelor	Combined	Applied Electrical Engineering	1	16	2023	Povinné předměty 2. roč. FEL - obor AELk	A	2	ZS
Electrical Engineering and Informatics	Bachelor	Full-time	Commercial Electrical Engineering	1	16	2023	Povinné předměty 2. roč. FEL - obor KOE	A	2	ZS
Applied Electrical Engineering	Postgraduate Master	Combined	Applied Electrical Engineering	1	16	2023	blok EM	B	1	ZS