| *Name of the subject:* ***Measurements 2.*** | | ***NEPTUN-code:*** KMXMT6ABNE | ***Contact hours/week:*** 2 lectures + 0 practice + 2 lab. practice |
|---|---|---|---|
| ***Credits:*** 4 **Requirement**: Midyear grade | | ***Prerequisite:*** Measurements 1: KMXMT5ABNE | |
| ***Lecturer:*** Zsolt Markella | ***Assignment:*** associate professor | ***Faculty and institute:*** Kandó Kálmán Faculty of Electricity Institute of Instrumentation and Automation | |

**Subject**

*Aim of the course:*
To attain the measuring principles, necessary for measuring basic electrical quantities. Knowledge of construction and handling of most important electrical measuring instruments, interpretation of their technical specification. Knowledge, necessary to select optimal measuring methods and instruments.

| **Thematics:** | **Week** | **Hours** |
|---|---|---|
| Digital methods of frequency, period and time measurement. Sources of errors. | **1.** | **3** |
| Measuring phase shift. Construction of digital counter equipments, time base. DC and AC power basics | **2.** | **3** |
| Power mesurement methods: ammeter-voltmeter method, electrodynamic instrument, electronic power meters. Electric energy measurement, watt-hour meter. | **3.** | **3** |
| Basics of impedance measurement. AC bridges. Electronic impedance measurement methods, digital method. | **4.** | **3** |
| Sampling modes in oscilloscopes. Digital Storage Oscilloscope: operation, blind time problem and solution modes. Logic analyzers: block-diagram, time or state-domain operation, display forms. Spectrum analyzers, operation, block-diagram, applications | **5.** | **3** |
| Basics of DC power supplies: stabilization parameters, output limitation characteristics Construction of DC supplies, coupling methods. Switching mode stabilizers. Power Factor Correction: problem, solution methods. | **6.** | **3** |
| Transducers of non-electrical parameters: standard signal systems, energy distribution methods. Applications of electrical measuring non-electrical quantities. Sensors for temperature measurement. | **7.** | **3** |
| Sensors of rotation speed, force, torque, displacement and light. | **8.** | **3** |
| Trends in instrumentation and measurement. Basics of automatic measuring systems. Data aquisition systems. | **9.** | **3** |
| Special software tools in automatic measurement. | **10.** | **1** |

| **Lab. practice thematics:** | **Week** | **Hours** |
|---|---|---|
| Measuring frequency and time | **1.** | 2 |
| Impedance measurement I (measuring resistance) | **2.** | 2 |
| Use of DSO I. | **3.** | 2 |
| Power measurement | **4.** | 2 |
| Impedance measurement II(measuring C and L) | **5.** | 2 |
| Use of DSO II. | **6.** | 2 |
| Temperature measurement | **7.** | 2 |
| Strain gaus measurement | **8.** | 2 |
| Repalacement | **9.** | 2 |
| Optional measurement | **10.** | 2 |
| Rotation measurement | **11.** | 2 |
| Movement measurement | **12.** | 2 |
| Repalacement | **13.** | 2 |
| Independent measurement | **14.** | 2 |

Visit of the lectures and the laboratory practice is obligatory.

**Laboratory practice part**
Students should write a test every weeks.
There are two type of test:

- „starter test”: questions from new measurements starter question lists
- „test for mark”: questions from the previously measured themas

The laboratory practice result is the mathematical average of the „test for mark” marks.

You should retake every falid tests during the semester

**Lectures part**
During the semester we will write 3 tests.
The test work contains 6 questions. The student get 1 points for every correct answers.
The sum points must be reache at least 7,2 points.

| | |
|---|---|
| 5 - 90% | 16,2 |
| 4 - 70% | 12,6 |
| 3- 60% | 10,8 |
| 2- 40% | 7,2 |

At the end of the semester students should write an retake test from the whole semester.
This test contains 18 questions.
A test work is successful if it reaches at least 7,2 points

**Midyear grade**
Calculation method for the mark: avarage of the laboratory practice result and the lecture result.

**Replacement**
In an examination period students should write an retake test from the faild tests. The maximum number of the retaken tests are 3.

**Literature:**

| | |
|---|---|
| **Compulsory:** | |
| Markella Zsolt | Lecture presentation (pdf and video) |
| Markella Zsolt | Laboratory guides |
| **Optional:** | |
| Kiss Ernő: | Elektronikus műszerek |
| Schnell: | Jelek és rendszerek méréstechnikája |
| Helfrick-Cooper: | Modern Electronic Instrumentation and Measurement Techniques |
| Chin: | Elektronic Instruments and Measurements |