Assessment and subject description

Óbuda University Kandó Kálmán Faculty of Electrical Engineering			Institute of Microelectronics and Technology	
Subject name and code**: Materials science for engineers, KEEVR5ABNE Credits: 3** **Full-time**				
Course: Electrical Engineering				
Responsible:	Csikóné Dr. Pap Andrea, PhD.	Teaching staff:	László Balázs, PhD. György Meszlényi	
Prerequisites:	none			
Contact hours per week:	Lecture:	Class discussion: 0	Lab hours: 1	Tutorial: 2
Assessment and evaluation:	**exam**			

Subject description / Tutorial

Learning objectives: Introduction to and basic knowledge of materials science. Relations among preparation methods, structure and properties of materials.

Topics to be covered:

Topics	Week	Lessons
Introduction to materials science. Relations between composition, structure, processing and properties of materials.	**1.**	**2**
Structure of atoms. Bohr model and wave mechanics' models. The periodic table. Characteristic parameters. Atomic bonding. Relation between bonding and material behavior.	**2.**	**2**
Crystal structure. Types of crystals, lattice parameters. Packing factors, densities. Real crystals. Types of defects, lattice vibrations.	**3.**	**2**
Methods of investigation of crystal structure. Optical and electron microscopy. Atomic force and scanning tunneling microscopy. X-ray and electron diffraction.	**4.**	**2**
Transport in materials. Equilibrium vs. non-equilibrium. Electrical and heat transport. Material transport: steady-state and non-steady-state diffusion. Oxidation.	**5.**	**2**
Test 1	**6.**	**2**
Alloys. Phase transitions and phase diagrams.	**7.**	**2**
Mechanical properties of materials. Deformation, stress and strain. Ductility, toughness, hardness. Mechanical failures.	**8.**	**2**
Electrical properties of materials. Band theory. Metals, semiconductors, insulators.	**9.**	**2**
Magnetic properties of materials. Types of magnetism. Ferro- and ferrimagnetism. Magnetic storage of information.	**10.**	**2**
Optical properties of materials. Light interaction with solids. Absorption, reflection, transmission, refraction, polarization and their relation to electron structure. Light emission.	**11.**	**2**
New results in Material Sciences	**12.**	**2**
Test 2	**13.**	**2**
Course closure / retake tests	**14.**	**2**

Subject description / Laboratory

Aims: Giving students practical materials science testing knowledge, applicable in the industrial practice. The material covered roughly corresponds to that contained in the course of the Hungarian language B.Sc. programme. Tasks: • Learning theoretical background of measurements • Measure the properties of given materials • Recording and evaluating the measurement data in the laboratory practice report.

Topics to be covered: Spectrophotometry; measuring concentration; Polarization optics; Insulating materials: measuring dielectric parameters; Mechanical properties: tensile strength and hardness; Microscopy basics.

Topics	Week	Lessons
Information about the laboratory works, safety regulations	**1**	**2**
Spectrophotometry; measuring concentration	**2**	**2**
Polarization optics	**3**	**2**
Insulating materials: measuring dielectric parameters	**4**	**2**
Mechanical properties: tensile strength and hardness	**5**	**2**
Microscopy basics, Reports, test	**6**	**2**
Missing lab hours, repeated test	**7**	**2**

Assessment and evaluation / Tutorial

This course continues as e-learning / remote learning via Moodle and MS Teams platforms. The learning material will be uploaded in the Moodle. Questions regarding the learning topics should be posted in the Forum of the course and answers will also be posted on the Forum visible for all students. On-line chat or other form of consultation will also be possible in the time slot predefined to this course.

During the semester students need to fill in 10 on-line quizzes. Students should complete quizzes on time with greater than 50% grade. There will be 3 attempts to complete a practice quiz.

Students will fill in two on-line tests during the course. Duration of tests is 30 minutes and one attempt is allowed with deferred feedback.

Assessment and evaluation / Laboratory

The attendance of laboratory practice is mandatory. Students work in measuring groups of 3 people. At the beginning of each measurement, teacher asks questions controlling the preparation for the tasks. In case of online education students get tasks to solve to be submitted in Moodle by the predefined deadline.

Every student makes his/her own laboratory practice report, and delivers and uploads the report to the associated Moodle task by deadline.
Students get marks both for the lab task and report (Total scores: 5+5 = 10 for each laboratory practice) The maximum lab score for the entire semester: 50, which will contribute to the final mark).

Requirements of the signature:

10 practice quizzes submitted on time with > 50% grade.
2 on-line tests completed within the predefined timeslot with > 50% grade.
5 laboratory reports and tasks accepted (mark ≥2) in Moodle .

Retaking the quizzes, tests or laboratory tasks/report is possible only in week 14 (free of charge) or at the beginning of exam period (Aláíráspótló vizsga. Retaking of only 3 or less quizzes is allowed.

Type of exam: Oral and written by simultaneously using MS Teams and Moodle. At the start of the exam, each student should answer 3 questions. The exam continues in case of 2 or 3 correct answer, otherwise the mark of the exam is 1. Written part of the exam will be a Moodle test, covering the all topics of the course. Total score of the written test: 50.

Evaluation of the mark: Total score will be the sum of the score of laboratory and score of the written exam (100 in total). Mark is calculated from the total score according to the table below:

Mark	Total score
5	85-100 %
4	74-84 %
3	63-73 %
2	50-62 %
1	0-49 %

Suggested material

Fundamentals of Materials Science and Engineering
William D. Callister, Jr.; David G. Rethwisch; 910 pages; John Wiley & Sons; 4 Edition (2013);
ISBN: 978-1-118-32269-7
Semiconductor Devices: Physics and Technology
Simon M. Sze, Ming-Kwei Lee; 592 pages; John Wiley & Sons; 3 Edition (2012);
ISBN-10: 0470537949; ISBN-13: 978-0470537947