Course Unit Descriptor

Study Programme: Physics

Course Unit Title: Thermal and mechanical properties of materials

Course Unit Code: M18TMOM

Name of Lecturer(s): dr Goran Štrbac

Type and Level of Studies: Master Academic Degree

Course Status (compulsory/elective): elective

Semester (winter/summer): summer

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): face-to-face

Number of ECTS Allocated: 8

Prerequisites:

Course Aims:

Introducing students to the field of investigating of thermal and mechanical properties of materials.

Learning Outcomes:

After completing the course, a student should have developed:
- ability to monitor the scientific literature and prepare scientific publications;
-ability to realize certain technical solutions
- ability to perform independent measurements and experiments in order to characterize materials;
- knowledge of the characteristics of particular types of materials in condensed state and tendencies in their behavior under thermal and mechanical treatment

Syllabus:

Theory

Macroscopic and microscopic properties of materials. Specific heat and influence of the structure. Thermal dilatation. Thermal conductivity. Mechanisms of heat conduction. Free electron Fermi gas. Heat capacity of the electron gas. Lattice vibrations. Phonons. Determination of coefficient of thermal conductivity.
Differential thermal analysis. Differential scanning calorimetry. Thermogravimetric analysis and derivative thermogravimetric analysis. Simultaneous thermal analysis. Dilatometric analysis.

The behaviour of materials under the influence of stress. Elastic and plastic deformation. Tensile properties. Shear and torsional deformation. Examination of material strength by pressure and bending. Examinations of fracture toughness. Static and dynamic methods for testing the hardness and microhardness.

Practice

Experimental exercises and problem solving that follow the content of lectures, implementation and evaluation of oral presentations and seminars.

Required Reading:

1. W. D. Callister, Jr., *Materials Science and Engineering/An Introduction*, John Wiley and Sons, Inc. , USA, 2007.
2. P. Hofmann, *Solid state physics/An Introduction*, Wiley-VCH Verlag GmbH and Co. KGaA, Morlenbach, Germany, 2008.
3. M. P. Marder, *Condensed matter physics*, John Wiley & Sons,Inc.,USA, 2000.
4. P. Gabbott, *Principles and applications of thermal analysis*, Blackwell, Oxford, 2008.
5. W.W. M. Wendlandt, *Thermal Methods of Analysis*, John Wiley & Sons,Inc., New York & London,1974.

C. Kittel, *Introduction to solid state physics*, John Wiley & Sons, USA, 1971.

Weekly Contact Hours:	**Lectures:**3	**Practical work:**2

Teaching Methods:			
Knowledge Assessment (maximum of 100 points):			
Pre-exam obligations	points	**Final exam**	points
Active class participation		written exam	
Practical work	10	oral exam	70
Preliminary exam(s)		…….	
Seminar(s)	20		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			