Course title: Materials Science	**Neptun code: GEMTT500P-a**

Course coordinator: name, position, scientific degree
Prof. Dr. Maria Berkes Maros, Full professor, PhD. Dr. habil.

type and number of lessons: lecture/seminar/practical lesson/consultation … / week or semester
10×2 hours lecture and 4×2 hours seminar / semester

method of accountability (colloquium/practical mark/other): **colloquium**

curriculum location of the subject (autumn/spring): **autumn**

pre-study conditions: –

The task and purpose of the subject:

The aim of the course is to provide doctoral students with a variety of backgrounds in materials with a solid foundation in materials science and an up-to-date knowledge of the most important characteristics of materials used in engineering practice, as well as the most important directions in materials development, with a special focus on meeting the ever-increasing functional and technological requirements.
The task of the course is to provide a general overview of the materials science aspects of engineering practice, to explore the relationships between the structure and properties of the metallic and non-metallic materials most commonly encountered in engineering practice, and to provide a coherent basis for discussing the mechanical behaviour, typical damage modes and performance enhancement options of the different groups of materials.

Course description:

The concept and topics of materials science. General characterisation of groups of materials, mechanical behaviour, influence of micro- and macrostructure of materials and state factors. Structural characterisation of ideal and real crystalline materials. Theoretical background of elastic and plastic deformation, mechanisms of plastic deformation, role of dislocations in deformation. Transport phenomena, diffusion. Type of interfaces and their effect on the transport phenomena. Equilibrium and non-equilibrium crystallization of Fe-C alloys, characteristic microstructures. Methods of strengthening single and multiphase metallic materials. Multiphase material systems and factors affecting their properties. Advanced high strength steels and aluminium alloys. Properties of engineering ceramics, methods of toughening. Visco-elasticity of polymers and consequences for mechanical behaviour. The most important mechanical tests of brittle, ductile and viscoelastic materials.

Required literature:

1. Maros B., Maria: **Materials Science,** Electronic ppt materials of the subject (English and Hungarian) available in the-E-learning system of the University of Miskolc
2. Tisza, M.: **Physical Metallurgy**, ASM International Publisher, Ohio Park, USA, 2001.
3. Tisza, M.: Development **of Lightweight Steels for Automotive Applications,** doi: 10.5772/intechopen.91024 https://www.intechopen.com/books/engineering-steels-and-high-entropy-alloys/development-of-lightweight-steels-for-automotive-applications
4. Callister, *W. D.*: ***Materials Science and Engineering, an introduction****, 7th Ed. John Wiley, New York, 1994, pp1-975. ISBN:13-978-0-471-73696-7, https://abmpk.files.wordpress.com/2014/02/book_material-science-callister.pdf.*

Recommended literature:

1. Porter, D. A., Easterling, K. E., Sherif, M. Y.: **Phase Transformation in Metals and Alloys,** 4th edition, CRC Press 2022, ISBN-13 978-0367430344, p556.
2. Ashby, M.F, Jones, D.R.H.: **Engineering Materials 1 – An introduction to Microstructures, Processing and Design,** 3rd ed., Elsevier Butterwoth-Heinemann, Oxford, 2006. ISBN 0 7506 63804
3. Ashby, M.F, Jones, D.R.H.: **Engineering Materials 2 – An introduction to properties, Applications and Design,** 3rd ed., Elsevier Butterwoth-Heinemann, Oxford, 2006. ISBN-13 978-0-7506-6381-6