Course title: Engineering Ceramics	**Neptun code: GEMTT505-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
4×2 hours lecture + 10×2 hours consultation / semester

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

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

pre-study conditions: –

The task and purpose of the subject:

The course task is to familiarise students with the advantages, limitations and material-specific characteristics of the technical application of ceramic materials. The aim of the course is to enable PhD students to judge the specific user demands under various operating conditions that can be satisfied by the use of ceramics, to select the appropriate ceramic material and to estimate its expected performance. Further objectives are to familiarise them with the modern manufacturing processes, the investigation methods of the most important mechanical properties, the failure modes, and the prevention methods most frequently used in engineering, in order to enhance the performance and reliability of engineering structures.

Course description:

Micro- and macro-scale material structures of crystalline and non-crystalline ceramics. Phase transformations, crystalline defects in ceramics. Mechanical behaviour and structural background of single crystals, polycrystalline and amorphous ceramics. Deformation and failure behaviour of ceramics at different temperatures. Main mechanical properties of brittle materials, standard test methods. Information content and reliability of metrics. Typical engineering applications (Al_2O_3, AlN, Si_3N_4, SiC, ZrO_2, B4C, BN, TiN, ZrO_2, diamond, SiAlONs, WC, SiO_2, C, Si, Ge). Typical loadings in different applications, damage modes, material properties relevant in different service conditions. Advanced manufacturing techniques for engineering ceramics. Common methods of increasing strength and toughness in monolithic and multiphase structures. Ceramic matrix composites and ceramic reinforcing phases (fibres, whiskers, coatings).

Required literature:

1. KINGERY, W. D., BOWEN, H. K., UHLMANN, D. R.: Introduction to Ceramics, 2nd Edition, John Wiley&Sons, New York Chichester Brisbane Toronto Singapore, ISBN 0-471-47860-1, 1975.
2. RICHERSON, W. D, LEE, W.E.: Modern Ceramic Engineering, Properties, Processing, and Use in Design; CRC Press, Taylor & Francis Group, LLC, 4th ed., ISBN 13: 978-1-4987-1691-8 (Hardback); ISBN 13: 978-1-4987-1693-2 (ePub);(2018) p812
1. RILEY, F.: Structural Ceramics, Fundamentals and Case Studies, Cambridge University Press; 1st ed. ISBN-13: 978-052184586 (2009) p418.

Recommended literature:

1. SOMIYA, S.: Handbook of Advanced Ceramics, Materials, Applications, Processing, and Properties, Academic Press, ISBN 978-0-12-385469-8 (2013) p1258.
2. CHIANG, Y-M., BIRNIE, D. P., KINGERY, W. D.: Physical Ceramics, (Principles for ceramic Science and Engineering) John Wiley & Sons Inc., New York, 1996, ISBN 0-471-59873-9
3. SHELDON, B. W. DANFORTH, S. C.: Silicon-Based Structural Ceramics, 1994. The American Ceramic Society; ISBN 0-944904-76-9
1. LINSMEIER, K-D.: The Manual: "Technical Ceramics – The Material of Choice for extremely demanding Applications", Verlag Moderne Industrie – CeramTec, Süddeutcher Verlag onpact GmbH, letölthető kézikönyv (2011) https://www.ceramtec.com/manual/technical-ceramics/