

**Course title:** **Calculus of Variations**  
**Institute/Division:** Institute of Mathematics, Faculty of Physics, Mathematics and Computer Science

**Course code:**  
**Erasmus subject code:** 11.1 Mathematics  
**Number of contact hours:** 45 hours  
**Course duration:** 1 semester  
**ECTS credits:** 6  
**Course description:** Integral functionals, weak and strong local extrema. The Euler-Lagrange equation as a necessary condition for a weak local extremum. Higher dimensional problems. Variational problems with higher-order derivatives. Problems with variable endpoints, natural boundary conditions, transversality conditions. Isoperimetric problems, Lagrange multipliers. Jacobi's equation, a sufficient condition for a weak local extremum. Variational problems with integrals involving more than one independent variable. An introduction to the optimal control theory.

**Literature:** L. Komzsik — Applied Calculus of Variations for Engineers, Boca Raton, 2009, CRC Press  
L. Elsgolts — Differential Equations and the Calculus of Variations, Moscow, 1977, Mir Publishers  
H. Sagan — Introduction to the Calculus of Variations, New York, 1992, Dover Publications

**Course type:** Lectures and problems classes  
**Assessment method:** Practical tests (each one will be announced two weeks in advance), the final exam.  
**Prerequisites:** Basic results from calculus of one and several variables, ordinary differential equations.  
**Primary target group:** 2-nd – 4-th year technical university students  
**Lecturer:** Waław Pielichowski, PhD  
**Contact person:** Waław Pielichowski, e-mail: [wpielich@pk.edu.pl](mailto:wpielich@pk.edu.pl)  
**Deadline for application:** 15<sup>th</sup> of January