Course title: Modelling and Simulation in Engineering	**Neptun code: GEGET420-a**
Course coordinator: Prof. Dr. Gabriella Vadászné Bognár, professor, DSc	
type and number of lesson: lecture/seminar 2 / week or 28 /semester	
method of accountability: **colloquium**/practical mark/other	
curriculum location of the subject: **autumn/spring**	
pre-study conditions:	
The task and purpose of the subject:	
The aim is to overview of typical engineering problems, solution methods, and numerical simulations in the engineering sciences. Execute numerical simulations through a specific problem. Creating models for further development and validation of numerical results.	
Course description:	
Typical tasks, modelling in engineering sciences. Description of natural laws with differential equations.The basics of numerical solution of ordinary differential equation systems, stability and accuracy. The most important finite differential methods to solve initial value problems. Boundary value problems of ordinary differential equations.Partial differential equations (electromagnetic field, material transfer, heat transfer, fluid dynamics, structural deformations). The basics of numerical solution of partial differential equations, stability analysis, accuracy.Finite Differential Methods, Spectral Methods. FEM, CFD. Analysis of the simulation results. System Audit Checks Analytical Check.Pilot control. Validation and Verification. Further development of the model. Verification software. White box, black box and grey box models. Empirical modelling. Chaotic phenomena.	
Required literature:	
1. Michael T. Heath: Scientific Computing: An Introductory Survey, 2nd ed. McGraw-Hill, New York. 2002. 2. W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery: Numerical Recipes 3rd ed. The Art of Scientific Computing, Cambridge University Press, 2007.	
Recommended literature:	
1. F. Forrester, A. Sobester, A. Keane. Engineering Design via Surrogate Modelling: A Practical Guide1st ed. Wiley, Chichester, 2008. 2. W. Oberkampf, C.J. Roy. Verification and Validation in Scientific Computing1st ed. Cambridge Univ. Press 2010.	