

Study program / course: Mechanical Engineering			
Type and level of study: Master academic studies			
Course: Virtual Engineering			
Lecturers: Vesna M Mandić			
Status of course: Elective for module M ₁ , III semester			
Number of ECTS: 6			
Precondition: none			
The objective of course • present basic principles of innovative product, process and tool development by using VE technologies • demonstrate application the above technologies, in our country and worldwide • explain basic principles FE simulations • point out on significance virtual development product and processes, through using CAx, RP/RT/RE and VR tech. • learn about virtual reality systems, visualization techniques and simulation practices • learn how the above can be incorporated into product, process and tools design • learn about significance of validation in product and process development, focuses on application of CAE (Finite element), RP and VR techniques			
The outcome of course At the end of this course the student will be expected to be able to: • demonstrate knowledge and understanding of VE technologies • explain modern trends on innovative development and design of product, process and tools • design and construct a basic virtual/visual/simulated environment • using VR equipment • using modern product and tool modelling software, as well as FE software for numerical simulation of processes • examine effects and consequences of design modifications, as well as the influences of prototypes (virtual and physical), models and simulations in achieving innovation • describe obtaining good model of product and tools, applying RP/RT/RE technologies • discuss the problems associated with implementing VE technologies in industrial practice			
Syllabus Theoretical study: Principles of virtual integrated product and process development, Concurrent Engineering, Successful engineering design, Significance and application of innovative computer technologies in product, process and tool design, Integration CAD/CAM/CAE technologies in VE system, FE simulation of materials processing technologies, FE estimation of microstructure and product quality, Basic principles and application of RP/RT techniques, Product re-modeling using RE techniques, Virtual reality, visualization and simulation techniques, Virtual reality equipment and software, Integration of VE technologies into modern product, process and tool development, with retrospective view on the best EU industrial practice Practical Studies: CAD/CAM modelling product and tools, Application CAx technology in industrial environments (visits to local factories), Demonstration of product re-modelling using RE equipment, Demonstration of RP/RT technologies and equipment, VR systems, equipment and software, Production I project task, FE simulation materials processing using software for non-linear FE analysis, FE tool analysis (elastic stresses, tool life estimation...), Virtual reality for 3D validation product, process and tool design, Production II project task			
Recommended reading V. Mandić: "Modelling and simulation in metal forming", Mechanical Engineering Faculty, WUS, Kragujevac, 2005. V. Mandić: "Virtual engineering", Mechanical Engineering Faculty, WUS, Kragujevac, 2007. G. Devedžić: "CAD/CAM technologies", Mechanical Engineering Faculty, WUS, Kragujevac, 2006. M. Plančak, O. Lužanin: „Introduction in virtual reality“, WUS, Novi Sad 2005 N. Grujović: „Rapid prototyping“, WUS, Kragujevac 2005			
The number of hours of active teaching:			Other classes: 1
Theory: 3	Practical classes: 1.4	Other forms: 0.6	
Research study: 0			
Methods of teaching Teaching approach through lessons, exercises, independent work of students. Available CAD/CAM software (CATIA, ProEngineer), software for FE/FV numerical process simulation (CAMPform2D, MSC.SuperForm, MSC.SuperForge, PAK) equipment for RP/RE (ZCorp 3D printer, Roland MDX-20, Roland LPX-250, Immersion Microscribe G2LX) and VR equipment (5DT Data Glove 5, 3D projector InFocus DepthQ) are used.			
Evaluation of knowledge			
Pre-final exam obligations	points	Final exam	points
Activities during the classes:	10		
Practical classes:		Oral exam	30
Colloquiums(s) :	30		
Seminar(s) :	30		