UNIVERSITY OF NIŠ

Course Unit Descriptor	Faculty	Faculty of Mechanical Engineering

GENERAL INFORMATION			
Study Program	Mechanical Engineering		
Study Module (if applicable)	Energetics and Process Techniques		
Course Title	Numerical simulation of flow in turbomachinery		
Level of Study	☐ Bachelor	☐ Master's	☒ Doctoral
Type of Course	☐ Obligatory	☒ Elective	
Semester	☒ Autumn	☐ Spring	
Year of Study	II		
Number of ECTS Allocated	10		
Name of Lecturer/Lecturers	Dragica R. Milenković, Živan T. Spasić		
Teaching Mode	☒ Lectures	☐ Group tutorials	☒ Individual tutorials
	☐ Laboratory work	☒ Project work	☐ Seminar
	☐ Distance learning	☐ Blended learning	☐ Other

Purpose and Overview (max. 5 sentences)

To gain new knowledge in the field of numerical simulations of fluid flow in turbomachinery. To enable students to independently use some of CFD softwares. To carry on to the students the experience in working with CFD software.

Syllabus (brief outline and summary of topics, max. 10 sentences)

1) Theoretical basis of numerical simulations. Basic equations of fluid flow in turbomachinery. Finite volume method.
2) Softwares for numerical simulations of fluid flow in turbomachinery: Formulation of physical model. Generation of flow domain of axial-flow and radial turbomachinery. CAD software and ICEM CFD software for generating the model of flow domain. Models of rotational and stationary elements of turbomachinery.
3) Numerical simulation of flow in turbomachinery: Generation of numerical mesh, types of control volumes, density criterion and independency of numerical solution and numerical mesh. Defining of physical values, boundary values, numerical parameters, format of output data, defining of rotational and stationary domain. Functional processor elements (choice of flow model, solver, monitoring of convergence, convergence criterion). Stationary and steady flow simulations, initial values, boundary values, time step, dynamics of process). Graphical postpocesing of numerical results (static and turbo mode). Representation of the results using figures and diagrams. Creating animation based on obtained numerical results. 4) Complex problems of numerical simulations of flow in turbomachinery: Changing the flow domain, moving elements, changing the mesh. Numerical simulation of unsteady flow processes, stall, cavitation. Models of two phases flow in simulation of cavitation in turbomachinery. 5) The accuracy of numerical simulations: Optimal choice of model. The choice of solver, discretization schema and algorithm. Defining of additional values. Determination of mesh influence to the numerical solution. Problems of numerical solution convergence. The possibility of solving problems. 6)Advantages and disadvantages of numerical simulations. Research costs.

Language of Instruction

☒Serbian (complete course) ☐ English (complete course) ☐ Other _____ (complete course) ☒Serbian with English mentoring ☐Serbian with other mentoring _____			
Assessment Methods and Criteria			
Pre exam Duties	**Points**	**Final Exam**	**Points**
Lecture (participation)	**5**	**Written Examination**	**0* (50)**
Homework	**5**	**Oral Examination**	**Max. 50**
Project work	**40**	**Overall Sum**	**100**
*** Refers to students who have already gained points by completing pre-exam requirements**			