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	Biomechanics of fluids		
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	Dragiša D. Nikodijević, Živojin M. Stamenković		
Teaching Mode	☒ Lectures	☐ Group tutorials	☒ Individual tutorials
	☐ Laboratory work	☒ Project work	☐ Seminar
	☐ Distance learning	☐ Blended learning	☐ Other

Purpose and Overview (max. 5 sentences)

Application of knowledge of fluid mechanics in the generation of biological systems. The development of multidisciplinary research with medical sciences, where the principles of fluid mechanics are of great importance in the study of the origin and development of some diseases. Adoption of contemporary knowledge needed for the study of mathematical and numerical methods used in modeling the flow of blood in the cardio vascular system, as well as the flow of air in the respiratory system.

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

1) Multiphase flow, non-Newtonian non-elastic model, pseudo-plastic fluids, dilatant fluids, Bingham fluids. 2) The linear viscoelastic models. Non-linear viscoelastic model. 3) Composition of blood rheology, constitutive modeling of blood, inelastic models. 4) Heart, anatomy and flow domain, the operation of heart "valve", mechanism of pumping, systole, diastole. 5) Unsteady pulse flow: Womersley solution, Womersley solution and Stokes layer. 6) Small Womersley number limit. Flow rate at unsteady flow. 7) Turbulent flow, the coefficient of friction. 8) Hemodynamic flow, curved vessels, secondary flow, flow separation and recirculation, the wall shear stress, oscillatory shear index. 9) The formation and development of atherosclerosis, the role of hemodynamics, lipid accumulation and changes in the flow pattern. 10) Arteries, Windkessel model, a model of the oscillatory inflow, elastic waves, and the arterial distension waveform, Korteweg-Moens wave speed 11) Microvasculature, two-phase model of blood flow in the capillaries. 12) Fahraeus-Lindqvist effect, the distribution of hematocrit. 13) Fahraeus effect in micro vessel, pressure distribution in micro vessels, blood flow in individual micro vessels, micro vascular bifurcations 14) Auto regulation of blood flow, vasoconstriction and vasodilatation. 15) Air circulation and respiratory system. 16) The mechanism of breathing. Mass transfer and diffusion. Particle transport in the lungs. 17) Numerical methods for complex fluids.

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**			