UNIVERSITY OF NIŠ

Course Unit Descriptor	Faculty	Faculty of Mechanical Engineering

GENERAL INFORMATION			
Study Program	Mechanical Engineering		
Study Module (if applicable)	-		
Course Title	OPTIMIZATION OF TRANSPORTATION SYSTEM		
Level of Study	☐Bachelor	☐ Master's	☒ Doctoral
Type of Course	☐ Obligatory	☒ Elective	
Semester	☐ Autumn	☒ Spring	
Year of Study	I		
Number of ECTS Allocated	10		
Name of Lecturer/Lecturers	Miomir Lj. Jovanović		
Teaching Mode	☒ Lectures ☒ Laboratory work ☐ Distance learning	☐ Group tutorials ☒ Project work ☐ Blended learning	☐ Individual tutorials ☐ Seminar ☐ Other

Purpose and Overview (max. 5 sentences)

Introduction of PhD students with optimizations methods of transport machines and supporting structures. Education students in the techniques and methods of mathematical minimization. Direct implementation of the application software. The ability of students to apply optimization methods on sc. research. Knowledge of techniques for studies of transport systems and support structures based on mathematical minimization. Acquisition of own programming experience in modern techniques of minimization. Ability to formulate and solve optimization tasks of some classes of basic research. Knowledge of application software for optimization. Creating own work and verification of knowledge through publications.

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

Theory classes

- Introduction to Optimization: Engineering applications of optimization. Rules, variables, constraints, objective function. Classification tasks, the type and nature of the technical problem. Multi-target decision.
- Classical optimization techniques: Technical minimization with multiple variables. Optimization with the constraints. The method of Lagrange multipliers.
- Linear Programming: Simplex Method. Revised Simplex Method. Post - optimal analysis.
- Sequential approximate quadratic programming of technical optimization task (SQP).
- Formal searches procedures: Example of the optimal choice of box - girders. Software solution. Application of structural problems with a complex objective function.
- Nonlinear Programming: Methods for one-dimensional minimization. Fibonacci method, golden section method. Newton's method. Practical example. Gradient method. Application of gradient method to minimize the Westinghouse objective function.
- Nonlinear minimization techniques: Random-search method, GRG method, Penalty function method.
- Dynamic Programming: Concepts. Sub-optimality. Procedures. Continuous dynamical programming.
- Stochastic Programming: Theory of probability. Stochastic linear programming. Example.
- Topology optimization: Application to the problems of dynamic stability, load pressure, stiffness of the supporting structure of optimization. Topology design of bar structures. The Simplex method of optimization. SDP interior point method. Power (Stress) criteria of buckling.
- Optimization using sensitivity analysis: Structural design . Variational formulation of the FEM. Transient analysis.
- Other fields of optimization: multi-objective function of optimization. The optimization method using the polyhedrons.

Guided independent research

Research through the development of Seminar work, which is in direct correlation with the selected mathematical and mechanical model of the doctoral dissertation. Application to the supporting structures of machines.

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**
		Final (oral) Presentation	**50**
The requirement for the exam is defended individually term paper - or published paper.	**50**	**Overall Sum**	**100**

*** Final examination mark is formed in accordance with the Institutional documents**