UNIVERSITY OF NIŠ

Course Unit Descriptor	Faculty	Faculty of Mechanical Engineering

GENERAL INFORMATION

Study Program	**Mechanical Engineering**
Study Module (if applicable)	-
Course Title	Theory of Elasticity and Fracture Mechanics
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	Dragan B. Jovanović
Teaching Mode	☒ Lectures ☐ Group tutorials ☒ Individual tutorials ☐ Laboratory work ☒ Project work ☒ Seminar ☐ Distance learning ☐ Blended learning ☐ Other

Purpose and Overview (max. 5 sentences)

Acquiring knowledge and skills in theoretical and experimental research, in the Theory of Elasticity and Fracture Mechanics of mechanical-engineering systems and structures. Theory of Elasticity is an upgrade of that knowledge, which students listened on the course Strength of Materials, at the undergraduate level. Students will become familiar to the theoretical foundations of Fracture Mechanics and Damage. The aim of the course is to train students for research in the Theory of Elasticity and Fracture Mechanics.

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

Basic concepts of the solid body. Theory of stresses: Cauchy equation. Boundary conditions. Navier's equations of equilibrium. Theory of deformations: Cauchy deformation tensor. Saint-Venant's strain compatibility conditions. Relationships between stresses and strains: General Hooke's law. Elastic constants. Lame's equations. Beltrami-Michell's equations. Deformation work. Methods for solving problems of the theory of elasticity: Saint-Venant's problem. Castigliano's theorem. Betti-Maxwell's theorem. Uniqueness solution of the problem of the theory of elasticity. Saint-Venant's principle. Plane problems of the theory of elasticity: Plane strains. Plane stresses. Contact stresses. Elementary elasticity problems in 3-D space. Thermal stresses.

Development of Fracture and Damage Mechanics in the area of application in engineering. Physical models. Continuity and damage. The structure of materials, damage and fracture. Basic relations of fracture mechanics. Models of the linear-elastic stress state in front of the crack tip. Solutions of basic equations of fracture mechanics by using the potential function. Forms of crack propagation. Griffith's model of crack. Eshelby tensor of energy. Invariant integrals of fracture mechanics. Contour J-integral. Stress state and crack propagation in three-dimensional model. The crack and fracture in elastic-plastic material. Dynamic of propagation and crack arrest. Branching of cracks. Stability of cracks and crack propagation stability criteria. Crack growth due to fatigue. Speed of crack propagation in fatigue of material.

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**
Activity During Lectures	**-**	**Written Examination**	**60**
Practical Teaching	**-**	**Oral Examination**	**Max. 40**
Teaching Colloquia	**60**	**Overall Sum**	**100**
***Final examination mark is formed in accordance with the Institutional documents**			