Course: Mathematical Methods in Continuum Mechanics

Course instructors: Srboljub Simić, Milana Čolić

**Course type:** 

**Credit points ECTS:** 

Prerequisites:

**Course objectives:** 

Introduction to basic principles of mechanics and thermodynamics of continua, mathematical methods useed in this field and their application in modelling and analysis of diverse processes in continuous media.

## Learning outcomes:

It is expected that student develop the skills of application of basic principles of continuum mechanics in modelling the processes in continuous media, and the use of appropriate mathematical methods in their analysis, especially mathematical analysis and partial differential equations.

#### **Course description (outline):**

Theory

Vector and tensor algebra and analysis. Kinematics of continua. Basic principles and basic equations of continuum mechanics and thermodynamics: conservation laws and balance laws, entropy inequality; integral and local form of basic equations/weak and strong form of the equations. Thermodynamic analysis of shock waves. Constitutive relations: mathematical description material response, mechanical and thermodynamic restrictions.

**Applications** 

Mathematical analysis of particular processes in continuous media: heat conduction in rigid bodies; compressible and incompressible fluid flow; linear and nonlinear elasticity; thermoelasticity; linear viscoelasticity; fluid flow through porous media, diffusion.

#### **References:**

1. M.E. Gurtin, E. Fried, L. Anand: *The Mechanics and Thermodynamics of Continua*, Cambridge University Press, Cambridge 2010.

2. R. Temam, A. Miranville: *Mathematical Modeling in Continuum Mechanics*, Cambridge University Press, Cambridge 2005.

3. C.M. Dafermos: *Hyperbolic Conservation Laws in Continuum Physics*, 4<sup>th</sup> Edition, Springer-Verlag, Berlin 2016.

4. A.C. Fowler: *Mathematical Models in the Applied Sciences*, Cambridge University Press, Cambridge 1997.

Activet eaching hours:Theoretical classes: 5Practice classes: 5

## Methods of teaching:

Teaching is organized in a combined way, in-class lectures and individual student's research. Inclass lectures are devoted to the analysis of theoretical aspects of mathematical models and methods applied in continuum mechanics. Individual student's research is focused on application of theoretical results to the analysis of diverse specific problems. The choice of the problems is based upon student's research preferences.

# Grading structure (100 points)

Предиспитне обавезе/семинар-и: 50 поена

Усмени испит: 50 поена