**Study programme(s)**:

**Level**:

**Course title:** Mathematical models in engineering

**Lecturer:** Srboljub S. Simić

**Status**:

**ECTS**:

**Requirements**:

**Learning objectives**

Acquaintance with basic principles of mechanics and thermodynamics of continua, mathematical methods used in this field, and their application in modeling and analysis of various processes in continuous media.

**Learning outcomes**

Ability to apply fundamental principles of continuum mechanics in the modeling of processes in continuous media, and ability to exploit appropriate mathematical methods in their analysis.

**Syllabus**

*Theoretical instruction*

Vector and tensor algebra and analysis. Kinematics of continua. Fundamental principles of mechanics and thermodynamics of continua. Thermomechanical analysis of shock waves. Consitutive relations.

*Practical instruction: Student research*

Rigid heat conductors. Compressible and incompressible fluids. Elastic solids. Thermoelasticity. Linear viscoelasticity. Diffusion. Plastic deformations of solids. Groundwater flow. Two-phase flow.

**Literature**

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

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

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

4. C.M. Dafermos: *Hyperbolic Conservation Laws in Continuum Physics*, Springer-Verlag, Berlin 2010.

| **Weekly teaching load** | | | | Other: 0 |
|---|---|---|---|---|
| Lectures: 2 | Exercises: | Other forms of teaching: | Student research: **6** | |

**Teaching methodology**

Teaching comprises lectures which cover theoretical background for development of mathematical models and methods, and individual student's research devoted to application of theoretical results to diverse problems of interest in science and engineering.

**Grading method (maximal number of points 100)**

| **Pre-exam obligations** | **Points** | **Final exam** | **points** |
|---|---|---|---|
| Seminar | 50 | Oral exam | 50 |