Course Unit Descriptor

Study Programme: Applied Mathematics (MB)		
Course Unit Title: Continuum Mechanics		
Course Unit Code: MB24		
Name of Lecturer(s): Srboljub S. Simić		
Type and Level of Studies: Master Academic Degree		
Course Status (compulsory/elective): Elective		
Semester (winter/summer): Winter		
Language of instruction: English		
Mode of course unit delivery (face-to-face/distance learning): Face-to-face		
Number of ECTS Allocated: 6		
Prerequisites: None		
Course Aims: To present students basic postulates and problems of the Continuum Mechanics, as well as mathematical methods applied in their formulation and analysis.		
Learning Outcomes: *Minimal*: Students are trained to understand basic assumptions and laws of Continuum Mechanics and perceive the role of mathematical methods in their formulation and solution of basic problems. *Expected*: To master the application of mathematical methods to problems of Continuum Mechanics and to establish the correlation between physical phenomena and their description in proper mathematical notions.		
Syllabus: *Theory* Vector and tensor algebra and analysis: vectors, tensors, tensor product; symmetric and skew symmetric tensors, orthogonal tensors, polar decomposition; scalar, vector and tensor fields, integral theorems. Continuum hypothesis. Kinematics: body, configuration, motion; referential and spatial description of motion; deformation, deformation gradient; velocity, velocity gradient, acceleration. Forces in continuous media, stress tensor. Basic equations: Lagrangian and Eulerian description; mass conservation, momentum, angular momentum and energy balance laws. Constitutive relations: models of continuous media, entropy inequality. Elasticity and thermoelasticity. Ideal and viscous fluids. Navier-Stokes equations. Ideal gases, gas dynamics equations, weak solutions, shock waves. Rarefied gases, velocity distribution function, interaction of particles, Boltzmann equation. Collision integral, collision invariants. Equilibrium distribution. Macroscopic equations. *H*-theorem, equilibrium states, local equilibrium. Model equations. Boundary conditions. *Practice* Exercises follow the theoretical part of the course. They illustrate the application of theoretical results to solution of particular problems.		
Required Reading: 1. M.E. Gurtin: *Introduction to Continuum Mechanics*, Academic Press, New York, 1981. 2. J. Jarić: *Mehanika kontinuuma*, Građevinska knjiga, Beograd, 1989. 3. T. Ruggeri; *Introduzione alla termomeccanica dei continui*, Monduzzi Editoriale, Milano, 2013. 4. P. Chadwick: *Continuum Mechanics*, Dover Publications, 1999. 5. R.B. Bird, W.E. Stewart, E.N. Lightfoot: *Transport Phenomena, 2^{nd} Ed.*, John Wiley & Sons, New York, 2002. 6. C. Cercignani: *Rarefied Gas Dynamics*, Cambridge University Press, Cambridge, 2000. 7. C. Villani: *A review of mathematical topics in collisional kinetic theory*, in Handbook of Mathematical Fluid Dynamics, vol. 1, North-Holland, Amsterdam, 2002.		
Weekly Contact Hours:	**Lectures: 3**	**Practical work: 2**

Teaching Methods: Classical lectures adjoined with slides and numerical simulations. Discussion with students. Typical problems are solved which illustrate basic concepts.			
Knowledge Assessment (maximum of 100 points):			
Pre-exam obligations	Points	**Final exam**	points
Preliminary exam(s)	60	Oral exam	40
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			