



MECHANICS

- topics for admission to the PhD programme -

A. THEORETICAL MECHANICS

1. The kinematics of a point particle: The motion in the Frenet frame; Absolute and relative motions of a point particle
2. The kinematics of a rigid body: Velocity and acceleration fields; Classes of rigid motions
3. Newton's laws and consequences: Existence of solutions; Conservative forces and the conservation of total energy
4. The equations of motion in curvilinear coordinates
5. The motion of the point particle under the action of particular forces: the motion of the heavy material point, harmonic oscillations, the motion of a point particle under the action of a central force
6. Kepler's laws. The gravitational force
7. Constrained motion of a point particle
8. The equations of motion of a free rigid body

B. ANALYTICAL MECHANICS AND CONTINUUM MECHANICS

1. Dynamics of systems of point masses: Elements of variational calculus, the Euler-Lagrange equations; The motion of point particles in a conservative field, the Hamilton's Principle; Legendre Transformations; Hamilton's equations
2. Dynamics of constrained systems: Possible and virtual (infinitesimal) displacements; The virtual work principle, D'Alembert's principle; Lagrange's equations; The invariance of Lagrange's equations; Natural systems; Hamilton's function
3. The Hamilton-Jacobi method; The determination of the complete integral by the method of separation of variables
4. Continuous body vs. rigid body
5. Deformation tensors
6. The equations of motion of a continuous medium

REFERENCES

1. V. Arnold, *Mathematical Methods of Classical Mechanics*, Springer, 1989.
2. S. Chiriță, *Mecanică rațională. Teorie și probleme*, Editura Matrixrom, Bucuresti, 2014.
3. D. Ieșan, *Mecanică-Medii elastice*, Editura universității Alexandru Ioan Cuza, 2004.
4. Ph. Ciarlet, *Mathematical elasticity, Vol. I: Three-dimensional elasticity*, Elsevier, 1988.
5. B. Dacorogna, *Introduction to the Calculus of Variations*, World Scientific Publishing Company, 2014.
6. L. Dragoș, *Principiile mecanicii analitice*, Ed. Tehnică, București, 1976.
7. Fasano, S. Marmi, *Analytical mechanics: an introduction*, OUP Oxford, 2006.