

A. Agrachev, October 2015 – January 2016.

The course in nonlinear analysis for the 2nd year laurea magistrale
and 1st year Ph.D. students. 48 hours, written exam.

1. Regular and critical point of smooth maps. The notion of transversality.
2. Sard's lemma. Generic properties.
3. Whitney embedding theorem.
4. Topological degree of a continuous map.
5. The Leray–Schauder degree.
6. Intersection number and linking number.
7. Index of a vector field on a smooth manifold.
8. Linearization of a vector field at the equilibrium. Phase portraits of linear systems.
9. Asymptotic stability of the equilibrium and Lyapunov functions.
10. Structural stability of the hyperbolic equilibria; the Grobman–Hartman theorem.
11. Asymptotic behavior of the solutions of two-dimensional systems; the Poincare–Bendixson theorem.
12. Structurally stable two-dimensional phase portraits.
13. Andronov–Hopf bifurcation.