

NONLINEAR FUNCTIONAL ANALYSIS - MATH 784
Spring 2021



Instructor: Dr. Carlos N. Rautenberg	Time: Tuesday 7:20 PM-10:00 PM
Email: crautenb@gmu.edu	Place: EXPL 4106

Office Hours: Tuesday 11:00 AM – 2:00 PM or by appointment

Notes and material: The classnotes and material will be provided weekly.

Objectives: To develop the ability to solve and analyze basic problems in nonlinear analysis involving fixed points of nonlinear maps in infinite dimensional spaces. To understand and apply the fixed point theorems of Banach, Brouwer, and Schauder. To understand differentiability properties for maps between infinite dimensional spaces (Gateaux, Fréchet and Newton derivatives) and its application to optimization problems in function spaces. To be able to apply solution algorithms of the type of Newton-Kuratowski and Semismooth Newton for the identification of zeros of nonlinear maps. To acquire knowledge of monotone operator theory, its connection to convex analysis, and its application to optimization, variational inequalities, and complex evolutionary problems.

Prerequisites: MATH 675: Linear Analysis (MATH 776: Measure and Integration recommended but not necessary)

Homework and Projects: Problems will be assigned regularly throughout the semester. Students are expected to solve all the assigned problems, and submit them to be graded. Students are allowed (and encouraged) to discuss assigned problems with classmates, but solutions should be written individually. *If you work in group, every member must disclose the names of all other group members in the first page of your homework.*

Tests: One final exam.

Grading Policy: The graded homework and projects counts for 50%, and the final exam for 50%. Equivalence between scores and letters will follow GMU standards.

Course Policy: Students are expected to attend class and/or follow the class online, and study the class notes posted on Blackboard and/or handed in person.

Changing the date of the final exam for unusual circumstances, or because three or more finals are scheduled in one day, requires the approval from the professor at least a week prior to the last day of classes. If absence from the final exam is unexcused, the grade for the course is F.

GMU Policies: The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies in university academic affairs. Further policies are available at <http://universitypolicy.gmu.edu/>. All members of the university community are responsible for knowing and following established policies.

Honor code: Students are expected to follow the honor code <https://oai.gmu.edu/mason-honor-code/>. Lack of knowledge of the honor code is not a reasonable excuse for its violation.

Email Communication: When you email me, please use “MATH 784” as subject.