

# Syllabus for Comprehensive Exam

## MATH 566: Fractional Differential Equations

### Course description

Special functions (Gamma, Mittag-Leffler, and Wright). Riemann fractional integral. Riemann-Liouville and Caputo fractional derivatives. Composition rules. Embeddings. Equivalence with integral equations. Well posedness for Cauchy type problems. Successive approximation method. Laplace and Mellin transform methods.

### Topics

#### Special functions

Gamma function, Mittag-Leffler function of one and two parameters.

#### Fractional calculus

Riemann-Liouville fractional integral and derivative, Caputo derivative, Grünwald-Letnikov derivative.

#### Initial value problem for differential equations with Riemann-Liouville and Caputo derivatives

Initial conditions, existence and uniqueness in the weighted spaces of continuous functions.

#### Methods for solving fractional differential equations

Volterra integral method and successive approximation, composition method, series method, Laplace and Mellin transform methods.

### References

- Kilbas, Srivastava and Trujillo, Theory and Applications of Fractional Differential Equations, 2006.
- Podlubny, Fractional Differential Equations, 1999.
- Shantanu Das, Kindergarten of Fractional Calculus, 2020.
- E. Oliveira, Solved Exercises in Fractional Calculus, 2019.