

Syllabus for Introduction to Fractional Calculus
Non-credit 20 hours of Lectures and Exercises by Prof Francesco MAINARDI
The Division of Applied Mathematics, Brown University
April 14 -May 14, 2015

The 2-hour lectures will be held by Professor F. Mainardi on Tuesdays and Thursdays from 9:00 AM to 11:00 AM in Room 110 at 182 George Street

The course is scheduled for 5 weeks starting on Tuesday April 14 and ending on Thursday May 14, 2015.

The class/home works will be graded by a teaching assistant.

This mini-course is for Graduate students, however, advanced juniors and seniors are welcomed. No registration required.

Hours	Lecture contents	
1-2	Laplace and Fourier transforms	Exercises
3-4	Eulerian and Mittag-Leffler functions	Exercises
5-6	Error, Bessel and Wright functions	Exercises
7-8	Fractional calculus in R^+	Exercises
9-10	Fractional calculus in R	Exercises
11-12	Abel integral equations	Exercises
13-14	Fractional relaxation and oscillations	Exercises
15-16	Time fractional diffusion wave equations	Exercises
17-18	Space fractional diffusion-wave equations	Exercises
19-20	Time-space fractional diffusion-wave equations	Exercises

Suggested texts

1. G. B. Arfken, H. J. Weber and F. E. Harris, *Mathematical Methods for Physicists*, (7-th ed.), Elsevier, Oxford, 2012.
2. D. Baleanu, K. Diethelm, E. Scalas and J. Trujillo, *Fractional Calculus: Models and Numerical Methods* World Scientific, Singapore, 2012.
3. B. Davies, *Integral Transforms and Their Applications*, (3-rd ed.), Springer-Verlag, New York, 2002.
4. R. Gorenflo, A. A Kilbas, F. Mainardi and S. V. Rogosin, *Mittag-Leffler Functions. Related Topics and Applications*, Springer, Berlin, 2014.
5. R. Gorenflo and F. Mainardi, *Fractional calculus, integral and differential equations of fractional order*, in A. Carpinteri and F. Mainardi (Editors), *Fractals and Fractional Calculus in Continuum Mechanics*, Springer Verlag, Wien, 1997, pp. 223-276. [E-print <http://arxiv.org/abs/0805.3823>]

6. A.A Kilbas, H.M. Srivastava, and J.J. Trujillo, J.J. (2006). *Theory and Applications of Fractional Differential Equations*, Elsevier, Amsterdam, 2006
7. F. Mainardi, *Fractional calculus, some basic problems in continuum and statistical mechanics*, in A. Carpinteri and F. Mainardi (Editors), *Fractals and Fractional Calculus in Continuum Mechanics*, Springer Verlag, Wien, 1997, pp. 291-348. [[E-print <http://arxiv.org/abs/1201.0863>]]
8. F. Mainardi, *Methods and Problems in Mathematical Physics*. Lectures Notes, University of Bologna.
9. F. Mainardi, *Fractional Calculus and Waves in Linear Viscoelasticity*, Imperial College Press, London, 2010.
10. I. Podlubny, *Fractional Differential Equations*, Academic Press, San Diego, 1999.