The Statistical Theory of Turbulence
Carlos III, Spring 2015

1. The Mathematical Formulation of Fully-Developed Turbulence
   (a) The Significance of the Turbulence Theorem
   (b) Navier-Stokes, Fluid Instabilities and Noise
   (c) Probabilistic Background
   (d) The Noise in Fully Developed Turbulence and the Stochastic Navier-Stokes Equation
2. Probability and the Statistical Theory of Turbulence
   (a) Ito Processes, Ito's Diffusion and Kolmogorov's Equation
   (b) Feynmann-Kac, Girsanov's Theorem and Lévy Processes
   (c) The Kolmogorov-Obukhov-She-Leveque Theory
   (d) Computation of the Structure Function of Turbulence
3. The Invariant Measure and the PDF of Turbulence
   (a) Solution of the Stochastic Navier-Stokes Equation and the Kolmogorov-Hopf Equation
   (b) The Invariant Measure of Turbulence
   (c) The PDF of the Velocity Differences
   (d) Comparison with Experiments and Simulations
4. Applications to Boundary Value Problems
   (a) Prandtl-von Kármán Theory
   (b) The Townsend Scaling of the Fluctuations
   (c) Comparison with Simulations

We will use the textbook: *The Kolmogorov-Obukhov Theory of Turbulence* by B. Birnir, Springer Verlag, New York, 2013, ISBN: 978-1-4614-6261-3 (Print) 978-1-4614-6262-0 (Online). http://link.springer.com/book/10.1007/978-1-4614-6262-0