

Advanced Mathematical Physics - DRAFT

Fall 2019

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References: TBD

Course Outline:

Topic **approx. # lectures**

Probability and Statistics

Probability spaces, random variables 1
Conditional probability, Bayes' Theorem 1
Application: estimation 1
Central limit theorem, (a)typical fluctuations 1
Application: random walks 1
Application: information theory 1

Differential Equations

Ordinary differential equations, linear and non-linear 2
Linear partial differential equations 1
Application: diffusion and the Black-Scholes equation 1
Non-linear partial differential equations 1
Application: non-linear waves, traffic flow, and solitons 2

(Complex) analysis and saddle-point methods

Analytic functions and analytic continuation 1
Contour integrals, residues, and poles 1
Methods of stationary phase and steepest descent 1
Asymptotic expansions and hyperasymptotics 1
Application: instantons 2

Group Theory and Group Representations

Groups and symmetries 1
Matrix representations 1
Representations of the permutation group 1
Lie groups and algebras 1
Representations of Lie groups 1
Application: Representations of the Lorentz group 1
Application: The spectrum of physical particles 1

Total **26**