Chloe Urbanski Wawrzyniak Oral Syllabus

1 Complex Analysis

1. The $\overline{\partial}$ equation in one variable
   (a) Cauchy's integral formula in discs and its applications
   (b) The Runge approximation theorem
   (c) The Mittag-Leffler theorem
   (d) The Weierstrass theorem
2. The $\overline{\partial}$ equation in several variables
   (a) Cauchy's integral formula in polydiscs and its applications
   (b) Hartog's extension theorem
3. Domains of holomorphy
   (a) Holomorphic convexity
   (b) Reinhardt Domains and Convergence of Power Series
   (c) Runge Domains and Polynomial Convexity
4. Pseudoconvexity and plurisubharmonic functions
   (a) The plurisubharmonicity of $-\log \delta_\Omega(z)$, Ω a domain of holomorphy
   (b) Plurisubharmonic exhaustion functions
   (c) Plurisubharmonic convexity
   (d) The Levi form
   (e) Analytic discs and the continuity principle
5. L^2 estimates and existence theorems for the $\overline{\partial}$ operator
   (a) Hörmander's solution and the basic estimate
   (b) The Levi problem

Reference: *An Introduction to Complex Analysis in Several Variables*, Hörmander, Chapters 1, 2, and 4

2 Harmonic Analysis

1. The Fourier transform
   (a) The L^1 theory and the inversion problem
   (b) The L^2 theory and the Plancherel theorem
   (c) The class of tempered distributions
   (d) Operators that commute with translations
2. Real-variable theory
   (a) The Hardy-Littlewood maximal function
   (b) The Lebesgue differentiation theorem
   (c) The integral of Marcinkiewicz
   (d) The Calderón-Zygmund decomposition
3. Singular integrals of convolution type
   (a) The gradient condition
   (b) The Hörmander condition
   (c) Homogeneous singular integrals
4. Examples of the theory
   (a) The Hilbert transform
   (b) The Riesz transforms

References: *Introduction to Fourier Analysis on Euclidian Spaces*, Stein and Weiss, Chapter 1, and *Singular Integrals and Differentiability Properties of Functions*, Stein, Chapters 1, 2, and 3