

Oral Examination Syllabus for Eugene So

Major Topic: Homotopy Theory

Fundamental Groups

Van Kampen Theorem, Covering Spaces

Homology/Cohomology

Singular, Cellular, Simplicial Homology
Excision, Mayer-Vietoris, Cofibrations
Cup and Cap Products, Künneth Formula
Poincaré Duality, Alexander Duality
Universal Coefficient Theorem
Spectral Sequences

Homotopy Groups

Whitehead's Theorem, Hurewicz Theorem, CW-Approximation, Cellular Approximation
Eilenberg-MacLane Spaces, Freudenthal Suspension Theorem, Postnikov Towers
Brown Representability

Fiber Bundles and Fibrations

Replacement by Fibrations, Homotopy Sequence of a Fibration
Homotopy Extension and Lifting Theorem
Classification of Fiber Bundles
Characteristic Classes

Simplicial Theory

Geometric Realization, Singular Simplicial Complex, Kan Complexes
Simplicial Homotopy Groups, Dold-Kan Correspondence, Eilenberg-Zilber Theorem

Model Categories

Definition, Homotopy Category, Fundamental Theorem, Examples, Small Object Argument

Texts

Algebraic Topology (Hatcher)
A Concise Course in Algebraic Topology (May)
An Introduction to Homological Algebra (Weibel)
Simplicial Objects in Algebraic Topology (May)
Model Categories (Hovey)

Minor Topic: Complex Algebraic Geometry

Complex Geometry (Griffiths and Harris, Ch. 0.1-2, 0.4-7, 1.1-4)

Complex, Kähler Manifolds

Hodge, Lefschetz Decomposition

Holomorphic Vector Bundles, Line Bundles

Kodaira Vanishing, Kodaira Embedding

Riemann-Roch, Abel's Theorem (Miranda, Ch. V-VIII)

Divisors, Embeddings, Abel-Jacobi Map

Riemann-Roch, Geometric Riemann-Roch, Abel's Theorem

Cohomology (Griffiths and Harris, Ch. 0.3, 1.1; Miranda, Ch. IX)

De Rham, Dolbeaut, Čech Cohomology

De Rham Theorem, Dolbeaut Theorem

Chern Classes

Texts

Principles of Algebraic Geometry (Griffiths and Harris)

Algebraic Curves and Riemann Surfaces (Miranda)