

Oral Qualification Exam Syllabus

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1. Algebraic Topology

(a) Fundamental Group

- i. Basic Constructions
- ii. Seifert van Kampen's Theorem
- iii. Covering Spaces
- iv. Classification of Covering Spaces
- v. Deck Transformations and Group Actions

(b) Homology

- i. Simplicial Homology
- ii. Singular Homology
- iii. Cellular Homology
- iv. Exact Sequences and Excision
- v. Degree of Maps $S^n \rightarrow S^n$
- vi. Mayer-Vietoris Sequence
- vii. Fundamental Group and Homology
- viii. Simplicial Approximation

2. Riemann Surfaces

(a) Basic Definitions

- i. Definition of Riemann Surfaces
- ii. Elementary Properties of Holomorphic Mappings
- iii. Branched and Unbranched Coverings
- iv. Sheaves
- v. Analytic Continuation
- vi. Differential Forms
- vii. Integration of Differential Forms

(b) Compact Riemann Surfaces

- i. Cohomology Groups(Čech)

- ii. Divisors and the Riemann-Roch Theorem
- iii. Serre Duality
- iv. Harmonic Differential Forms
 - v. Abel's Theorem
 - vi. Jacobi Inversion Problem
- (c) Uniformization
 - i. Uniformization Theorem for Simply Connected Surfaces
 - ii. Covering Surfaces, and Uniformization for arbitrary Riemann Surfaces

References

- [1] Allen Hatcher, *Algebraic Topology*
- [2] Otto Forster, *Lectures on Riemann Surfaces*
- [3] Theodore W. Gamelin, *Complex Analysis*