

Oral Qualifying Exam Syllabus

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1 Algebraic Topology

1. Homology

Singular Homology, Homotopy Invariance, Exact Sequences, Excision, Cellular Homology, Mayer Vietoris Sequence

2. Cohomology

Universal Coefficient Theorem, Cohomology Ring, Kunneth Formula, deRham Cohomology, Poincare Duality

References :

- Allen Hatcher, *Algebraic topology*, Cambridge University Press.
- Raoul Bott and Loring W. Tu *Differential Forms in Algebraic Topology*, Springer-Verlag New York.

2 Symplectic Geometry

1. Symplectic Manifolds

Symplectic Vector Spaces, Symplectic Structure on Manifold, Tautological Symplectic form on Cotangent Bundle, Symplectic Volume, Lagrangian Submanifold, Symplectic and Hamiltonian Isotopies

2. Local Theory of Symplectic Manifolds

Moser's Trick, Weinstein Lagrangian Neighborhood, Darboux Coordinates, Isotopic and Strongly Isotopic Symplectic Structures

3. Almost Complex Structure

Existence of compatible Almost Complex Structure, Complex manifolds, Kähler forms, basics of Dolbeault Theory.

4. Hamiltonian Dynamics and Moment Maps

Hamiltonian Vector fields, Symplectic and Hamiltonian actions, Moment maps, Orbit spaces, Marsden-Weinstein Reduction, Convexity of Moment map

References :

- Ana Cannas da Silva. *Lectures on Symplectic Geometry*. Springer, Lectures notes in mathematics 1764, 2008.
- Dusa McDuff and Dietmar Salamon. *Introduction to Symplectic Topology*. Oxford University Press.