List of topics

Basic course of discrete mathematics

I. Combinatorial topology

1. Graphs. Incidence matrix. Graph spectrum.
2. Trees. Generating tree. Circuits and cuts
3. Planar Graphs. Euler Theorem.
4. Perfect Pairing and factorization
5. Eulerian and Hamiltonian paths
6. Graph coloring. Chromatic Polynomial
7. Tutte Polynomial. Contraction and Deletion. Minors
8. Graph automorphism. Cayley Graphs. Strongly Regular Graphs.
9. Simplicial complex. Triangulation, Cellular fits, fit algorithm

II. Combinatorial Algebra

1. Counting techniques. Elementary Quotients on counting, number of subspaces in a vector space. Recursion and inversion. Stirling numbers, Generating Functions.

III. Combinatorial Optimization

1. Linear inequalities, introduction to cones, polyhedrals and polytopes. Farkas' Lemma. Caratheodory Theorem.
2. Linear programming Basics. Duality.
3. Digraphs. Networks and flows. Max-Min theorem. Algorithms.
4. Polyhedral Structure. Facets, faces and vertex. Decomposition. Paring Polyhedral
5. Integer Programming Basics
6. Unimodularity and optimization
7. Computational complexity

Reference

Aigner, M.	Combinatorial theory
Archideacon, D.	Topological graph theory
Biggs, N.	Discrete mathematics
Bondy, J.A., Murty, U.S.R.	Graph theory with applications
Gross, J., Tucker, T.	Topological graph theory
Johnson, D.	Computers and intractability
Lovaz, L., Plummer, M.	Matching theory
Newhauser, G.	Integer and combinatorial optimization
Oxley, J.	Matroid theory
Schrijver, A.	Theory of linear and integer programming
Stanley, R.	Enumerative combinatorics
van Lint, J.H., Wilson R.M.	A course in combinatorics
Welsh, D.	Complexity: knots, colorings and counting
Ziegler, G.	Lectures on polytopes