MATH 412 - SUMMARY OF SYLLABUS

1.1 - basic definitions, isomorphism, decomposition, Petersen graph
1.2 - walks/trails, components, cut-edges, bipartite graphs, Eulerian graphs
1.2 - induction, extremality
1.3 - degree-sum formula, k-dimensional cube, large bipartite subgraphs
1.3 - largest triangle-free graphs, induction trap, degree sequences (Havel-Hakimi)
1.4 - digraphs, tournaments

2.1 - Tree properties, distance, diameter
2.2 - Cayley's Formula, recursion to count spanning trees
2.3 - Kruskal's algorithm, Dijkstra's algorithm, Chinese Postman Problem

3.1 - maximum matching vs. augmenting path, Hall's condition, Marriage theorem
3.1 - vertex cover, Konig-Egervary Theorem, independence number vs edge cover
3.2 - augmenting path algorithm, weighted bipartite matching
3.3 - Tutte's Theorem, join, Berge-Tutte Formula, Petersen's Theorems

4.1 - connectivity, k-connected, bonds, blocks
4.2 - expansion lemma, subdivision, ear decomposition,
4.2 - Menger's Theorem(s), line graphs, Fan Lemma
4.3 - network flow problem, augmenting path, labeling algorithm
4.3 - Max Flow-Min Cut Theorem, Integrality Theorem

5.1 - proper coloring, k-colorable, chromatic number, cartesian product
5.1 - greedy coloring, Szekers–Wilf bound, Gallai–Roy Theorem, Brooks' Theorem
5.2 - Mycielski construction, color-critical graph, Turán's Theorem, S-lobe
5.3 - chromatic polynomial, chromatic recurrence
5.3 - chordal graph, simplicial elimination ordering, (perfect graph)

6.1 - planar graphs, dual graphs, euler's formula, maximal planar graphs
6.2 - Kuratowski's Theorem, convex embeddings
6.3 - Five/Four Color Theorem, crossing number

7.1 - edge-coloring, line graph, 1-factorization, Vizing's Theorem
7.2 - Hamiltonian cycles, necessary condition
7.2 - closure, sufficient conditions (Dirac, Ore, Chvátal, Chvátal–Erdős)
7.3 - Tait's Theorem, Grinberg's Theorem