



### MAT 653 – Combinatorial Optimization

Course Code & Number	Course Name	Credit Hours	Lec.	Lab.	Tut.	Prerequisites
MAT 653	Combinatorial Optimization	4	3	0	1	

**Syllabus:**

**Problems and Algorithms:** Optimal Trees and Paths: Measuring Running Times, Minimum Spanning Trees, Shortest Paths, Maximum Flow Problems: Network Flows Problems, Maximum Flow Problems, Minimum Cut Problem, Multicommodity Flows, Minimum Cost Flow Problems.

**Optimal Matchings:** Matchings and Alternating Paths, Maximum Matchings, Minimum Weight Perfect Matchings, T-joins and Postman Problem.

**Integral Polyhedra:** Convex Hulls, Polytopes, Facets, Integral Polytopes, Total Unimodularity, Total Dual Integrality, Cutting Planes, Separation and Optimization.

**The Traveling Salesman Problem:** Introduction, Heuristics for the TSP, Lower Bounds, Cutting Planes, Branch and Bound.

**Matroids:** The Greedy Algorithm, Matroids: Properties, Axioms, Constructions, Matroids Intersection, and Applications.

**NP and NP-completeness:** Introduction, Words, Problems, Algorithms and Running Time, The Class NP.

**References:**

1. W. Cook, W. Cunningham, W. Pulleyblank, and A. Schrijver; *Combinatorial Optimization*; 1<sup>st</sup> Edition, Wiley-Interscience, 1997. **(Main Reference)**
2. C. Papadimitriou and K. Steiglitz; *Combinatorial Optimization: Algorithms and Complexity*; 1<sup>st</sup> Edition, Dover Publications Inc., 2000.

