# Course Outline

## 1. Document Information

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|---|---|
| **Degree Program** | Computer Science |
| **Course Number** | MATH/CS 471 |
| **Course Title** | Optimization Techniques |
| **Semester Hours** | 3 |
| **Course Coordinator** | Math Department |
| **Revision Term** | |
| **Latest Revision** | |

## 2. Catalog Description

Introduction to algorithms for finding extreme values of nonlinear multivariable functions with or without constraints. Topics include: convex sets and functions; the arithmetic-geometric mean inequality; Taylor's theorem for multivariable functions; positive definite, negative definite, and indefinite matrices; iterative methods for unconstrained optimization.

## 3. Textbooks

- *The Mathematics of Nonlinear Programming*. Springer, Perressini, Sullivan and Uhl. 1st Edition, 1993. ISBN: 9780387966144.

## 4. References

## 5. Course Learning Outcomes

- To learn the basic methods of optimization.
- To learn to build mathematical models and develop computer programs for solving the models.

## 6. Assessment of the Contribution to Student Outcomes

| Outcome | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Assessed | X | | | | | | | | | X |

## 7. Prerequisites by Topic

Mathematics 221 and 250 with C or better.

## 8. Major Topics Covered in the Course

1. Dynamic programming: stages, states and decision variables {12 classes}
2. Introduction to linear programming: standard model, graphical solution, simplex method, big M Method, unboundedness, inconsistency, shadow prices lower bounds for finding minimum and sorting, lower bound arguments {6 classes}
3. Graphs and the Transportation Model: the transportation model, rooted spanning tree Noide potentials, pivoting transshipment problem merge sort, quick sort, median selection, polynomial algorithms, matrix algorithms {6 classes}
4. Integer Programming, Why not LP?: formulations with binary variables, branch and bound, binary integer programming, dual simplex method, mixed integer programming {7classes}
5. Game theory introduction: solving simple games, games with mixed strategies, graphical solution procedure, solving by linear programming {5 classes}
6. Network analysis: shortest route problem, minimal spanning {4 classes}