MIE 686 Course Description

TITLE: Multi–Criteria Decision Making & Decision Analysis
INSTRUCTOR: James MacGregor Smith

1. DESCRIPTION:

One of the most important, exciting and influential topics in Industrial and Systems Engineering has emerged as the field of Multi–Criteria Decision Making (MCDM). Both from a theoretical and practical perspective, MCDM influences all aspects of engineering design and analysis. We will survey and examine in some detail the following issues, topics and algorithmic techniques of MCDM:

- Values, Objectives, Attributes and Criteria
- Elementary Decision Analysis/Decision Trees
- Deterministic and Expected Utility Theory
- Vector Optimization Theory
- Multi-Attribute Value Systems
- Attribute Ranking Methods
- Solution Generating Methods
- Global Preference Methods
- Goal Programming Methods
- Interactive Trade-Off Methods
- Group Decision Making Methods

All of the above will be demonstrated in class and coupled with available personal computer programs when appropriate.

2. REQUIREMENTS:

Homeworks, midterm, final exam, and term project are required by all students. Homework will account for 25% of your grade, the midterm and final exam and term project will each be worth 25% to round out your total grade.

3. PREREQUISITES:

Graduate standing or consent of the instructor. Knowledge of linear algebra and linear programming (MIE 379 or 620 or equivalent) and probability and statistics (MIE 273 Math 520) is highly recommended.

4. TEXT and REFERENCES:

I. Introduction
- MCDM Overview
- Basic Foundations and Pareto Optimality
- Elementary Decision Analysis
- Decision Trees & Influence Diagrams

II. Multi–Attribute Decision Making (MADM)
- Deterministic Utility Theory
- Value Decomposition
- Additive Value Decomposition
- Multi–Facility Location Analysis
- Expected Utility Theory
- Single Attribute Utility Functions
- Multi–Attribute Overview
- Two–Attribute Utility Models
- Multi–Attribute Computer Programs
- Multi–Attribute Assessment

III. Multi–Objective Decision Making (MODM)
- Vector Optimization Theory
- Weighting Methods
- Weighting Example
- Linear Vector Optimization (LVOP)
- Parametric Decomposition
- LVOP Algorithm
- LVOP Example

IV. Noninteractive and Interactive Methods
- Geoffrion’s Bi–Criterion Method
- Linear Goal Programming
- Nonlinear and Integer Goal Programming

V. Interactive Trade–Off Methods
- Zionts–Wallenius
- Surrogate Worth
- Group Decision Making Methods


---

* Required as a reference in the Text Book annex
** Required as a reference in the Text Book annex