# Course Outline MCDM

Title: Multiple Criteria Decision Making (MCDM)

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Prerequisite
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Overview Main; Master of Industrial Engineering: Socio-economics System Engineering (e-learning)

Goal
The purpose of this course, is an introduction with the concepts, tools and techniques of decision making under multiple criteria. The course consists of two main parts. In the first part, the multi-attribute decision making techniques and tools are introduced. In particular, the AHP method is discussed in detail. The second part introduces multi-objective operational research models and methods for their solution are explained.

Objectives

Knowledge or Comprehension Objectives
1- Introduction to MCDM Concepts
2- Introduction to Group Decision Making

Skills Objectives
1- Using the Tools and Techniques of MADM
2- Modeling and Solving of MODM problems
3- Using the Structural Modeling
4- Productivity Measurement by DEA

Attitude Objectives
1- Understand the logic of MADM Methods
2- Understand the Optimality Concept in MODM

Materials
Expert Choice
Super Decision
Lingo
MATLAB

| Week | Subject | Table of Contents |
|---|---|---|
| 1 | Basics and Principles of MCDM | Basic Concepts of Decision Making<br>Problem Structuring<br>MCDM Categories |
| 2 | Basics of MADM | Constructing the Decision Model<br>Normalization Method<br>Weight Assignment Methods<br>Preference Modeling<br>Elementary Methods(Maximin,Maximax, …) |
| 3 | MAVT & MAUT | MAVT Method<br>SAW and WP Methods |

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| 4 | MAVT & MAUT | Permutation Ranking Method<br>MAUT Method |
| 5 | AHP Method | Basics and Principles of AHP<br>Design Hierarchy and Make Judgments<br>Methods to Calculate Relative Weights |
| 6 | AHP Method | Calculating Total Weights<br>Measuring Inconsistency<br>Introduction to "Expert Choice" |
| 7 | AHP Method | ANP Method<br>Introduction to "Super Decision" |
| 8 | Distance Based Methods | TOPSIS Method<br>VIKOR Method |
| 9 | Outranking Methods | PROMETHEE Method<br>ELECTRE Method |
| 10 | Group Decision Making | Voting Methods<br>Social Choice Functions |
| 11 | DEA Method | CCR Model<br>BCC Model |
| 12 | Structural Models | ISM<br>DEMATEL<br>FCM |
| 13 | Basics of MODM | MODM Concepts<br>KKT Conditions in MODM |
| 14 | MODM Solving Methods | Multi-objective Simplex Method<br>Categorization:<br>• No Preference Methods: Method of the Global Criterion<br>• A Priori Methods: Goal Programming |
| 15 | MODM Solving Methods | Categorization (Cont.):<br>• A Posteriori Methods: Weighting Method and ε-Constraint<br>• Interactive Methods: ISWT method |
| 16 | MODM Solving Methods | Evolutionary Algorithms for Solving MODM (MOEA) |
| 17 | Other MODM Models | Multi-Stage MODM<br>Multi-Level MODM |

## References

### Primary References


- Tzeng, G-H. & Huang, J-J. Multiple Attribute Decision Making: Methods and Applications, Chapman and Hall/CRC, 2011.
- Tzeng, G-H. & Huang, J-J. Fuzzy Multiple Objective Decision Making, Chapman and Hall/CRC, 2013.
- Cohon, J.L. Multiobjective Programming and Planning, Dover Publications, 2004.
- Saaty, T.L. & Vargas, L.G. Models, Methods, Concepts and Applications of the Analytic Hierarchy Process, 2nd ed., Springer,2012


### Additional References


2. Lai, Y-J. & Hwang,C-L. Fuzzy Multiple Objective Decision Making: Methods and Applications, Springer, 1996.
3. Figueira, J. Greco, S. & Ehrgott, M. Multiple Criteria Decision Analysis: State of the Art Surveys, Springer, 2007.
4. Coello, C.C., Lamont, G.B. & VanVeldhuizen, D. A. Evolutionary Algorithms for Solving Multi-Objective Problems, 2nd ed. Springer, 2007.
5. Miettinen, K. Nonlinear Multi-objective Optimization, Springer, 1998.
6. Saaty, T.L. & Vargas, L.U. Decision Making with the Analytic Network Process, Springer, 2006.
7. Cooper, W.W., Seiford, L.M. & Zhu, J. Handbook on Data Envelopment Analysis, 2nd ed. Springer, 2011.
8. Doumpos, M. & Grigoroudis, E. Multicriteria Decision Aid and Artificial Intelligence: Links, Theory and Applications, Wiley-Blackwell, 2013.

Classroom Methods

1- Research: Present and Analysis an ISI Paper in MCDM Topic
2- Book Present: Present one chapter of the latest books in e-business models

Evaluation

Final Exam: 60%
Quiz & Take-home: 15%
Research: 25%