EASTERN MEDITERRANEAN UNIVERSITY

DEPARTMENT OF INDUSTRIAL ENGINEERING

IENG521 MULTI-CRITERIA DECISION MAKING

COURSE OUTLINE

COURSE CODE	IENG521	**COURSE LEVEL**	MS and PhD Degree
COURSE TITLE	Multi-Criteria Decision Making	**COURSE TYPE**	Approved Elective
CREDIT VALUE	(3,0) 3	**ECTS Credit Value**	3
PRE-REQUISITE(S)	None	**CO-REQUISITE(S)**	None
LECTURER	Asst.Prof.Dr. Oğuzhan KIRILMAZ	**SEMESTER / ACADEMIC YEAR**	Spring 2022-2023
e-mail	oguzhan.kirilmaz@emu.edu.tr	**OFFICE**	IE-B105

CATALOG DESCRIPTION

In practice Multi-Criteria Decision Making (MCDM) methods are very popular in addressing complex problems involving multiple and typically conflicting criteria as well as several stakeholders or decision makers with different preferences with respect to the evaluation criteria. This course aims at training students in the field of MCDM with emphasis on rating, ranking and classification problems and methods with applications in business. Quantitative decision analysis. Multi-criteria benefit and utility theories. Decision making under uncertainty. Decision tree. Structuring of objectives and value hierarchies, and determination of value functions. Multi-objective decision making with mutually exclusive alternatives. Multi-objective ranking and classification. Multi-objective mathematical programming. Interactive methods and applications.

COURSE AIMS AND OBJECTIVES

This course is designed to introduce various multiple criteria decision making techniques and their applications to complex real life problems. The aim of the course is to enable students to use the multi-criteria decision making methods (MCDM) by employing quantitative methods. Accordingly, in order to make business decisions using ranking irregularities, ELECTRE methods, the Analytic Hierarchy Process (AHP), decision-making applications are used to identify the variables and their suitability ratings for decisions. Students will be able to use Multi-criteria decision making techniques, partially or completely be able to rank the alternatives, and make decisions under conditions of uncertainty and high risk.

1. Knowledge or Comprehension Objectives
    a. Introduction to MCDM Concepts
    b. Introduction to Group Decision Making
2. Skills Objectives
    a. Using the Tools and Techniques of MCDM
    b. Modeling and Solving of MODM problems
    c. Using the Structural Modeling
3. Attitude Objectives
    a. Understand the logic of MCDM Methods
    b. Understand the Optimality Concept in MODM

WEEKLY PLAN

WEEK	TOPICS
1	MCDM Basic Concepts. Simple Additive Weightage
2	Decision Making Under Uncertainty, Utility Theory, Utility Function
3	Decision Tree
4	Multi Attribute Utility Theory
5	Analytic Hierarchy Process
6	Analytic Network Process
7	Measuring Attractiveness by a Categorical Based Evaluation Technique; MACBETH,
8	Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Method
9	Elimination and Choice Translating Reality (ELECTRE) Method

10	Preference Ranking Organization Method for Enrichment of Evaluations (PROMETE)
11	Introduction to Multi-Objective Decision Making, Goal Programming
12	Multi-Objective Optimization on The Basis of Ratio Analysis Method (MOORA)

COURSE LEARNING OUTCOMES	Program Learning Outcomes	Teaching Methods	Assessment Methods
Can define multi criteria decision making problems and describe basic properties of these problems.	2,7	1,2	A
Can propose appropriate solution techniques to real life multi criteria decision making problems and can collect the necessary data properly.	1,2,3	1,2,4	A
Can solve multi criteria decision making problems by using one of the AHP, TOPSIS, ELECTRE, PROMETHEE and similar methods or a hybrid approach.	1,2,4,6	1,2,4	A,B
Can understand, interpret and present new multi criteria decision making approaches and applications in literature.	1,2,5,7	1,2	A,B
Can develop new solution techniques.	6,7	1,2	A

TEACHING METHODS	1: Lecture	2: Paper Discussion	3. Case Study
ASSESSMENT METHODS	A: Testing	B: Homework	

RECOMMENDED SOURCES

TEXTBOOK	1. Alessio Ishizaka, Philippe Nemery. Multi-Criteria Decision Analysis: Methods and Software 1st ed. 2013 Edition 2. Multi-Criteria Decision Making 1st ed. 2021 Edition Jitesh J. Thakkar
ADDITIONAL REFERENCES	1. Lai, Y-J. & Hwang,C-L. Fuzzy Multiple Objective Decision Making: Methods and Applications, Springer, 1996. 2. Figueira, J. Greco, S. & Ehrgott, M. Multiple Criteria Decision Analysis: State of the Art Surveys, Springer, 2007. 3. Coello, C.C., Lamont, G.B. & VanVeldhuizen, D. A. Evolutionary Algorithms for Solving Multi-Objective Problems, 2nd ed. Springer, 2007.

	4. Miettinen, K. Nonlinear Multi-objective Optimization, Springer, 1998. 5. Saaty, T.L. & Vargas, L.U. Decision Making with the Analytic Network Process, Springer, 2006. 6. Cooper, W.W., Seiford, L.M. & Zhu, J. Handbook on Data Envelopment Analysis, 2nd ed. Springer, 2011.

COURSE'S CONTRIBUTION TO PROGRAM

NO	PROGRAM LEARNING OUTCOMES	NO	MODERATE	HIGH
1	Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics			X
2	Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors			X
3	Ability to communicate effectively with a range of audiences	X		
4	Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		X	
5	Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	X		
6	Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions		X	
7	Ability to acquire and apply new knowledge as needed, using appropriate learning strategies			X

ASSESSMENT

MIDTERM	30 %
FINAL	40 %
HOMEWORK	10 %
PRESENTATION	15 %
ATTENDANCE	5 %

GRADING CRITERIA

Exams: All examinations will be based on lectures, tutorials, assigned readings or other works performed in the classes. To pass these exams, students will need to have studied the material well in advance in order to understand the concepts, procedures and techniques. Exam results will be announced online as soon as the exam papers have been evaluated. Descriptions of these examinations are as follows:

Midterm Exam:	There will be one midterm examination that covers all the material up to the date of the examination.
Final Exam:	The final examination will cover all the material studied throughout the semester and has the same structure as in the midterm examination. Like the midterm exam, the final exam will be scheduled for a day in the designated final exams week.
Make-up Exam:	Make-up examination will only be offered to students who missed the **final or midterm exam** and provided **adequate documents for the reason** for their absence within three working days at the latest after the examination date. A student's illness will only be accepted as a valid excuse if it is supported by a **written report** of a medical doctor.
Presentation:	Each student will be given a research area by the instructor and the students are to find, study and present an article regarding his/her area. It will be presented to whole class using presentation slides. Students are supposed to have full knowledge of the paper they are going to present.
Homework:	Homework(s) must be submitted at the due date. Late submission will not be accepted unless there is valid excuse.

ATTENDANCE

- Attendance will be taken on every lecture. Note that EMU regulations allow instructors to give a grade of NG to a student whose absenteeism is more than 30% of the lecture hours and/or who do not complete sufficient work that are included in the assessment of the course.
- Students missing an examination should provide a valid excuse and report within three days following the examination they missed. One make-up examination will be given.