

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Decision-making methods

Academic year: 2019/2020 Code: ZSDA-3-0089-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: Kułakowski Konrad (kkulak@agh.edu.pl)

Module summary

During the course the student will have the opportunity to learn the basic expert decision-making techniques.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Student will learn to think critically and critically evaluate the surrounding reality	SDA3A_K01	
M_K002	The course will allow the student to take an active attitude in the scientific society, assess phenomena and achievements	SDA3A_K02	
Skills: he can			
M_U001	Student would be able to construct simple and complex decision models and use them to solve every day decision problems.	SDA3A_U01	Activity during classes
Knowledge: he knows and understands			
M_W001	Student gets the knowledge on expert based decision-making methods	SDA3A_W06, SDA3A_W01	Activity during classes

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	14	0	0	0	0	16	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Student will learn to think critically and critically evaluate the surrounding reality	+	-	-	-	-	+	-	-	-	-	-
M_K002	The course will allow the student to take an active attitude in the scientific society, assess phenomena and achievements	+	-	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Student would be able to construct simple and complex decision models and use them to solve every day decision problems.	+	-	-	-	-	+	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student gets the knowledge on expert based decision-making methods	+	-	-	-	-	+	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	15 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	30 h
Realization of independently performed tasks	15 h
Summary student workload	90 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

- 1) Decision-making methods panorama; Decision-making methods vs. voting systems, History of decision methods: Lull voting systems, Condorcet, Fechner, Thurstone. Social choice and welfare theory. Pairwise comparisons.
- 2) Introduction to AHP – Analytic Hierarchy Process, principles and basic algorithms
- 3) AHP – deepening I. Various priority deriving methods for complete and incomplete sets of pairwise comparisons
- 4) AHP – deepening II. Inconsistency of data. AHP criticism and open problems.
- 5) HRE – Heuristic Rating Estimation – ranking estimation based on existing ranking data
- 6) Outranking methods: ELECTRE and PROMETHEE. French school of decision-making methods
- 7) MACBETH – better AHP, introduction and principles
- 8) Ordinal pairwise comparisons and inconsistency – Kendall coefficient

Seminar classes

Sample topics covered by the seminars

- 1) BWM – Best Worst Method
- 2) MAUT – Multiattribute Utility Theory
- 3) UTA Methods
- 4) Envelopment analysis
- 5) Uncertainty and MCDM – Fuzzy AHP
- 6) Multiobjective Programming
- 7) Dominance-based Rough Set Approach (DRSA)
- 8) Multiple Criteria Decision Analysis and Sustainable Development
- 9) MCDM in Finance – portfolio optimization problem
- 10) Linear programming and MCDM

Teaching methods and techniques:

Lectures: lectures

Seminar classes: presentations given by students

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

compulsory attendance at seminars, compulsory attendance at all but three lectures

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: compulsory attendance at some number of lectures announced at the beginning of the course

Seminar classes:

- Attendance is mandatory: Yes

- Participation rules in classes: compulsory attendance

Method of calculating the final grade

based on the given presentation during seminars

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

colloquium with the lecture content and compulsory presentation

Prerequisites and additional requirements

basic information in mathematics including linear algebra, mathematical analysis and graph theory.

Recommended literature and teaching resources

- Multiple Criteria Decision Analysis: State of the Art Surveys, Figueira, Greco, Ehrgot

Scientific publications of module course instructors related to the topic of the module

- Konrad Kułakowski, Jiří Mazurek, Jaroslav Ramík, Michael Soltys (2019) When is the condition of order preservation met?. European Journal of Operational Research 277 (1) pp. 248 - 254. doi web BibTeX
- Konrad Kułakowski (2018) Inconsistency in the ordinal pairwise comparisons method with and without ties. European Journal of Operational Research 270 (1) pp. 314 - 327. doi web BibTeX
- Konrad Kułakowski (2016) Notes on the existence of a solution in the pairwise comparisons method using the heuristic rating estimation approach. Annals of Mathematics and Artificial Intelligence 77 (1) pp. 105-121. doi web BibTeX
- Konrad Kułakowski, Anna Kędzior (2016) Some Remarks on the Mean-Based Prioritization Methods in AHP. In Computational Collective Intelligence: 8th International Conference, ICCCI 2016, Halkidiki, Greece, September 28-30, 2016. Proceedings, Part I. pp. 434-443. Springer International Publishing. doi web BibTeX
- 2015
- K. Kułakowski (July 2015) On the Properties of the Priority Deriving Procedure in the Pairwise Comparisons Method. Fundamenta Informaticae 139 (4) pp. 403 - 419. doi BibTeX
- K. Kułakowski (2015) Notes on Order Preservation and Consistency in AHP. European Journal of Operational Research 245 (1) pp. 333-337. Elsevier. doi web BibTeX
- K. Kułakowski, K. Grobler-Dębska, J. Waś (2015) Heuristic rating estimation: geometric approach. Journal of Global Optimization 62 (3) pp. 529-543. Springer US. doi web BibTeX

Additional information

None