(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: SOFT COMPUTING, Optimization theory	**2. Course code SC_OT**
3. Validity of course description: 2018/2019	
4. Level of studies: MSc programme	
5. Mode of studies: intramural studies	
6. Field of study: CONTROL, ELECTRONIC AND INFORMATION ENGINEERING (MACRO)	(FACULTY SYMBOL) RAU-2
7. Profile of studies: ACADEMIC	
8. Programme: DATA SCIENCE	
9. Semester: 1	
10. Faculty teaching the course: Faculty of Automatic Control, Electronics and Computer Science	
11. Course instructor: dr hab. inż. Adam Gałuszka	
12. Course classification: common courses	
13. Course status: compulsory ~~/elective~~	
14. Language of instruction: English	
15. Pre-requisite qualifications: Optimization and Decision Making. It is assumed that students have knowledge of necessary and sufficient conditions for optimality, unconstrained and constrained problems, Lagrange functional, Kuhn-Tucker conditions, Linear programming, Simplex method, gradient methods.	
16. Course objectives: Introduction to advanced mathematical optimization methods and algorithms, optimal control problems. Development of skills necessary to implement and solve complex optimization problems.	
17. Description of learning outcomes:	

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student knows the basic methods of dynamic optimization.	SP	WM	K2A_W01
2.	Student has knowledge of integer programming methods.	SP	WM	K2A_W01
3.	Student has knowledge of multi-criteria optimization methods and evolutionary optimization methods..	SP	WM	K2A_W01
4.	Student has the ability to implement and solve the problem of dynamic optimization.	SP, CL	L	K2A_U07
5.	Student has the ability to implement and solve the problem of multi-criteria optimization.	SP, CL	L	K2A_U21
6.	Student can use the knowledge gained to make optimal decisions in professional practice.	OS	L	K2A_K04
7.				
8.				
9.				

18. Teaching modes and hours

Lecture 30 / ~~BA /MA Seminar / Class / Project~~ / Laboratory 30

19. Syllabus description:

Lecture:

1. duality in linear programming
2. integer and binary integer programming,
3. mixed integer problems,
4. branch and bound method,
5. computational complexity and NP-completeness,
6. non-linear constraints and unconstrained optimization,
7. evolutionary algorithms,
8. multi-criteria optimization, pareto-optimality
9. discrete and continuous dynamical optimization problems,
10. optimal control,
11. maximum principle,
12. examples of optimization problems

Laboratory:

1. Integer and binary integer linear programming
2. Decision trees
3. Genetic algorithms
4. Direct methods of unconstrained dynamic optimization
5. Constrained dynamic optimization (penalty methods)
6. Linear Quadratic problem
7. Optimal control
8. Optimization in graph problems

20. Examination: semester: NO

21. Primary sources:

Świerniak A., A. Gałuszka, Optimization Methods and Decision Making. Lecture Notes. Wyd. Politechniki Śląskiej, Gliwice 2003.
Ogonowski Z., J. Smieja, Optimization Methods and Decision Making. (Handbook for students) Art&Kolor, Gliwice, 2001. (available for download at http://www.platforma.polsl.pl/rau1/)
Figwer J., J. Mościński, Z. Ogonowski. (red. Z.Ogonowski) Laboratorium metod optymalizacji statycznej. Skrypty Uczelniane Politechniki Śląskiej, Nr. 1852, Gliwice.
Duda Z., A. Ordys, A. Świerniak. Laboratorium metod optymalizacji dynamicznej. Skrypty Uczelniane Politechniki Śląskiej, Nr. 1171, Gliwice..

22. Secondary sources:

Cormen, Thomas H.; Leiserson, Charles E.; Rivest, Ronald L.; Stein, Clifford (2009). Introduction to Algorithms (3rd ed.). MIT Press. ISBN 0-262-03384-4
Brian D. O. Anderson, John B. Moore: Linear Optimal Control, Prentice-Hall, Inc., 1971
Luenberger D.: Optimization by vector space methods, John Wiley, 1969 (Polish translation-Teoria optymalizacji, PWN, 1974)
Luenberger D.: Introduction to linear and nonlinear programming, Adison-Wesley, 1973
Helmke U., J. Moore: Optimization and dynamical systems, Springer, 1994
Bryson A., Y.C. Ho: Applied optimal control, Blaisdell, 1969

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/20
2	Classes	0/0
3	Laboratory	30/20
4	Project	0/0
5	BA/ MA Seminar	0/0
6	Other	10/10
	Total number of hours	70/50

24. Total hours: 120

25. Number of ECTS credits: 3

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2

26. Comments:

Approved:

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(date, Instructor's signature)

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(*date , the Director of the Faculty Unit signature)*