



COURSE CARD

1. Basic information

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| Course name in English: | Optimisation and its applications | |
| Course name in Polish: | Optymalizacja i jej zastosowania | |
| Number of hours: | 30 | |
| Type of course: | Elective course | |
| Form of course: | mixed forms (combination of lecture, seminar and laboratory) | |
| Code of course: | NZQ100141W | |
| Course leader: | prof. dr hab. inż. Dorota Kuchta | |
| Faculty of the course leader: | W8 Faculty of Management | |
| Email address of the course leader: | Dorota.kuchta@pwr.edu.pl | |
| Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course): | Architecture and urban planning | <input type="checkbox"/> |
| | Automation, electronic, and electrical engineering | <input type="checkbox"/> |
| | Information and communication technology | <input type="checkbox"/> |
| | Biomedical engineering | <input type="checkbox"/> |
| | Chemical engineering | <input type="checkbox"/> |
| | Civil engineering and transport | <input type="checkbox"/> |
| | Mechanical engineering | <input type="checkbox"/> |
| | Environmental engineering, mining, and energy | <input type="checkbox"/> |
| | Mathematics | <input type="checkbox"/> |
| | Chemical sciences | <input type="checkbox"/> |
| | Physical sciences | <input type="checkbox"/> |
| | Management and quality studies | <input checked="" type="checkbox"/> |

2. Objectives

C1 to familiarise listeners with selected concepts and optimisation problems

C2 getting the listeners acquainted with selected methods of solving optimization problems

C3 to familiarise the audience with selected optimisation applications

3. Content

Detailed information about the course content, including topics and form of classes.

| No. | Topic | Number of hours | Form of classes |
|-----|-----------------------------|-----------------|-----------------|
| 1 | Problems of graph colouring | 1 | Lecture |
| 2 | Knapsack problems | 2 | Lecture |



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| 3 | Problems of optimal paths | 2 | Lecture |
| 4 | The Travelling Salesman Problem | 1 | Lecture |
| 5 | Scheduling problems | 2 | Lecture |
| 6 | The problem of maximum and cheapest flows | 1 | Lecture |
| 7 | Fuzzy optimization | 2 | Lecture |
| 8 | Test | 2 | Lecture |
| 9 | | | |
| 10 | Organisational issues and choice of presentation topics | 1 | seminar |
| 11 | Students presentations and discussion | 2 | seminar |
| 12 | Students presentations and discussion | 2 | seminar |
| 13 | Students presentations and discussion | 2 | seminar |
| 14 | Students presentations and discussion | 2 | seminar |
| 15 | Students presentations and discussion | 2 | seminar |
| 16 | Students presentations and discussion | 2 | seminar |
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4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

none

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

| Symbol | Learning outcome | |
|--------|--|-------------------------------------|
| | <i>KNOWLEDGE. Doctoral student knows and understands:</i> | |
| SzD_W3 | the main trends in the development of the scientific or artistic disciplines covered in the curricula; | <input checked="" type="checkbox"/> |
| SzD_W4 | research methodology; | <input checked="" type="checkbox"/> |
| SzD_W5 | the rules for the dissemination of scientific results, including in open access mode; | <input type="checkbox"/> |
| SzD_W6 | the fundamental dilemmas of modern civilization; | <input type="checkbox"/> |
| SzD_W7 | the legal and ethical conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W8 | the economic and other relevant conditions of scientific activity; | <input type="checkbox"/> |
| SzD_W9 | basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results. | <input type="checkbox"/> |
| | <i>SKILLS. Doctoral student is able to:</i> | |
| SzD_U2 | use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, | <input checked="" type="checkbox"/> |



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| | - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres; | |
| SzD_U3 | communicate on specialised topics to the extent that they enable an active participation in the international scientific community; | <input checked="" type="checkbox"/> |
| SzD_U4 | disseminate research results, including in popular forms; | <input checked="" type="checkbox"/> |
| SzD_U5 | initiate debates and participate in a scientific discourse; | <input checked="" type="checkbox"/> |
| SzD_U6 | be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment; | <input checked="" type="checkbox"/> |
| SzD_U7 | plan and implement an individual or collective research or creative activity, including in an international environment; | <input type="checkbox"/> |
| SzD_U8 | independently plan and act for one's own development and inspire and organize the development of others; | <input checked="" type="checkbox"/> |
| SzD_U9 | plan classes or groups of classes and implement them using modern methods and tools. | <input type="checkbox"/> |
| <i>SOCIAL COMPETENCES. Doctoral student is ready to:</i> | | |
| SzD_K3 | fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way; | <input checked="" type="checkbox"/> |
| SzD_K4 | maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection. | <input checked="" type="checkbox"/> |

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Test (lecture), Oral presentations (seminar)

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

N1. Traditional lecture

N2. Multimedia presentations

N3. Case studies presentations

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.



- [1] Roseaux, Exercices et problèmes résolus de recherche opérationnelle, tome 1, Dunod 2005;
- [2] Roseaux, Exercices et problèmes résolus de recherche opérationnelle, tome 2, Dunod 2004;
- [3] Michalewicz Z., Fogel D.B., How to solve it: modern heuristics, Springer 2010
- [4] Smith D.K, Network optimization practice: A Computational Guide, John Wiley, 1982,

SECONDARY LITERATURE:

- [5] Michalewicz Z , Genetic Algorithms + Data Structures = Evolution Programs, Springer 1996
- [6] Kuchta D., Soft Mathematics in Management, Wrocław 2001

9. Other remarks

Additional remarks, comments, (e.g., language of the course)