# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Intelligent management support systems

## Course

Field of study
Engineering management
Area of study (specialization)

Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/6
Profile of study
general academic
Course offered in
English
Requirements
elective

## Number of hours

Lecture
15
Tutorials
15
Laboratory classes

Projects/seminars

Other (e.g. online)

## Number of credit points

2

## Lecturers

Responsible for the course/lecturer:
Ph.D., D.Sc., Grzegorz Pawłowski

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Responsible for the course/lecturer:
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## Prerequisites

Student has knowledge of the foundations of management and information technology carried out at

first-cycle studies. In addition, he should also be able to use the acquired knowledge in practice and is ready to work within team structures.

## Course objective

To interest the students of Engineering Management course of the future of the application of expert systems and methods and techniques of artificial intelligence for the requirements of decision-making processes and management of the design, implementation and operation of systems: human communities - a technological and organizational component.

## Course-related learning outcomes

### Knowledge

The student identifies various types of data and technologies used in intelligent management support systems, including artificial intelligence algorithms and cyber-physical systems [P6S_WG_01].

The student describes how the life cycle of socio-technical systems affects the implementation and operation of intelligent management support systems [P6S_WG_13].

The student lists and characterizes the basic principles and methods of quality management used in the context of intelligent management support systems [P6S_WK_02].

### Skills

The student analyzes the results of experiments and computer simulations related to intelligent management support systems, drawing conclusions about their effectiveness and applications [P6S_UW_09].

The student designs and implements solutions based on intelligent management support systems, using analytical methods and simulation tools [P6S_UW_10].

The student applies strategies and techniques to analyze and solve problems related to the implementation of intelligent management support systems in various organizational contexts [P6S_UW_11].

### Social competences

The student creates plans and strategies for the implementation of intelligent management support systems, taking into account various technical and organizational aspects [P6S_KO_02].

The student prepares recommendations on the ethical use of intelligent management support systems, considering their impact on the environment and society [P6S_KR_01].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by a test carried out after the last lecture. The test consists of 20 closed questions. Assessment threshold: 50% of the points (satisfactory).

Knowledge acquired as part of the exercises is verified on the basis of solving individual tasks covered by the curriculum. The student receives points for each task. Assessment threshold: 50% of the points (satisfactory).

## Programme content

Lecture: The course consists of three main thematic modules. The first concerns the issues of processing and searching: data, information, knowledge and wisdom, and in this context it introduces the concept of artificial intelligence in the context of applications in the economy based on intelligent digital technologies and in supporting management information systems. Familiarize students with concepts such as: Business Intelligence System in company management. It also addresses the issue of a modern enterprise as a cyberattack object and the issue of the so-called "intelligent dilemma" of the sixth business cycle. The second module covers the issue of knowledge acquisition, methods of knowledge representation, creation and reconstruction of professional knowledge databases as well as expert strategies and intelligent solution of management decision-making problems. This module concerns methodological nature and deals, among others, with heuristics and strategies of graph searching as well as classic and fuzzy inference methods in intelligent systems supporting decision-making processes of design management, implementation and operation of systems: human communities - a technological and organizational component. The third module is descriptive and methodological in nature and concerns two types of selected artificial intelligence tools (artificial neural networks and evolutionary algorithms) supporting decision-making management processes. Expert Systems are presented in variants of decision solutions based on bivalent fuzzy logic systems. Among the solutions of Artificial Intelligence classified as based on Computational Intelligence, Artificial Neural Networks (in variants: Self Organizing Maps and Learning Vector Quantization) and Evolutionary Algorithms (in variants: Genetic Algorithms, Evolutionary Strategies, Evolutionary Programming) are presented. The so-called hybrid systems and elements of chaos theory.

Exercises: This type of classes is implemented in a joint form with the tutor of student analysis exercises, team practical studies for the issues: a), b), c) and d) and jointly with the tutor concerning the analysis of an example of problem prepared by student e) The list of exercise issues includes: a) selected methods of symbolic knowledge representation in the field of engineering management for the purposes of creating and rebuilding professional knowledge bases b) methods of building and searching knowledge graphs in the field of engineering management , c) operation on triangular and trapezoidal forms of membership functions for the purpose of inference in a fuzzy expert system of a selected issue of engineering management, d) preparation of training programs in the field of business engineering management in cyber threat conditions, e) generating in MATLAB an Artificial Neural Network with multilayer feedback and one hidden layer with 15 input nodes and one node in output layer (as a network learning algorithm - Levenberg-Marquardt gradient back propagation, as a transfer function in both the input and output layers - hyperbolic tangent; the number of neurons in a hidden wa layer determined by trial and error, changing the number of neurons from the set: {7, 10, 13, 16, 19, 22, 25, 27, 29, 31}).

## Teaching methods

Information lecture in the form of a multimedia presentation, with elements of a conversational lecture.

Classes: auditorium exercises, task solving and case study.

## Bibliography

Basic

1. Pacholski L., Systemy ekspertowe i sztuczna inteligencja, Wydawnictwo Politechniki Poznańskiej, Poznań 2011,

2. Flasiński M., Wstęp do sztucznej inteligencji, PWN, Warszawa 2011,

3. Zieliński J.S., (red.), Inteligentne systemy w zarządzaniu, PWN, Warszawa 2000,

4. Mulawka J.J., Systemy ekspertowe, WNT, Warszawa 1996.

5. Cytowski J., Algorytmy genetyczne. Podstawy i zastosowania, Akademicka Oficyna Wydawnicza, Warszawa 1996.

6. Anandarajan M., Anandarajan A., Srinivasan C.A. Business Intelligence Techniques, Springer Verlag Berlin Heidelberg 2004,

7. Medsker L.M., Hybryd Neural Networks and Expert Systems, Kluwer Academic Publisher, Boston 1994. Walczak S.,

8. Artificial Neural Network s , Information Resources Management Association 2019

Additional

1. Rutkowska D., Piliński M., Rutkowski L., Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, Warszawa 1997,

2. Striving for excellence in AI implementation : AI maturity model framework and preliminary research results, Tanajura Ellefsen A.P., Joanna Oleśków-Szłapka J., Pawłowski G., Toboła A., LogForum 2019

3. Medsker L.M., Hybryd Neural Networks and Expert Systems, Kluwer Academic Publisher, Boston 1994.

4. Żurada J.M., Barski M., Jędruch W., Sztuczne sieci neuronowe, PWN, Warszawa 1996.

5. Budrewicz J., Fraktale i chaos, WNT, Warszawa 1993.

6. Chambers L.D.,Practical Handbook of Genetic Algorithms, CRC Press 1999, 2. Striving for excellence in AI implementation : AI maturity model framework and preliminary research results, Tanajura Ellefsen A.P., Joanna Oleśków-Szłapka J., Pawłowski G., Toboła A., LogForum 2019

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 50 | 2,0 |
| Classes requiring direct contact with the teacher | 30 | 1,0 |
| Student's own work (literature studies, preparation for classes/tutorials, preparation for tests) [1] | 20 | 1,0 |

[1] delete or add other activities as appropriate