COURSE DESCRIPTION CARD - SYLLABUS

Course name
Scheduling production tasks

Course

Field of study
Computing

Year/Semester
2/3

Area of study (specialization)
Informatyka w procesach biznesowych

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
16	16	
Tutorials	Projects/seminars	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
Arkadiusz Zimniak, PhD

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Responsible for the course/lecturer:
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Prerequisites

A student starting this course should have basic knowledge of algorithms and data structures, operational research and the organization of business processes.

Should be able to program in any high-level language

A student starting this course should have the ability to obtain information from the indicated sources.

He should also understand the need to expand his competences. Moreover, in terms of social competences, the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. Expanding knowledge in the field of operational research and production planning. In particular, familiarizing students with selected methods of solving problems of scheduling tasks in production systems, taking into account the parameters and criteria specific to these systems.

2. Developing in students the skills of solving problems occurring when scheduling production tasks in enterprises. Skills are developed by analyzing practical scheduling problems and matching specific models (including non-classical) and algorithms to them. .

3. Shaping students' ability to implement scheduling algorithms in an example ERP system environment

Course-related learning outcomes

Knowledge

has a structured, theoretically founded general knowledge of task scheduling algorithms and their complexity. (K2st_W2)

has a theoretically founded detailed knowledge related to selected issues in the field of computer science, such as selected scheduling algorithms (K2st_W3)

has knowledge about development trends and the most important new achievements in computer science and in selected related scientific disciplines, in particular operations research (K2st_W4)

knows advanced metaheuristic approaches used in solving complex engineering tasks in the field of production process optimization (K2st_W6)

Skills

can obtain information from literature, databases and other sources (in the mother tongue and in English), integrate them, interpret and critically evaluate them, draw conclusions and formulate and exhaustively justify opinions (K2st_U1)

can assess the usefulness and possibility of using new heuristic optimization methods (K2st_U6)

can make a critical analysis of existing technical solutions and propose their improvements in terms of optimizing the use of available resources (K2st_U8)

is able to assess the usefulness of methods and tools for solving an engineering task, consisting in the search for approximate solutions, without a guarantee of finding the optimum (K2st_U9)

can - in accordance with the given specification, taking into account non-technical aspects - design a complex metaheuristic algorithm and implement this project - at least in part - by adapting the existing or developing new software for this purpose (K2st_U11)

is able to interact in a team, assuming various roles (K2st_U15)

Social competences

understands that in the field of IT the knowledge and skills quickly become obsolete (K2st_K1)

understands the importance of using the latest knowledge in the field of computer science in solving research and practical problems (K2st_K2)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) in the field of lectures:

- on the basis of answers to questions about the material discussed in previous lectures and discussed during the current lecture

b) in the field of laboratories / exercises:

- on the basis of an assessment of the current progress in the implementation of tasks.

Summative assessment:

a) the knowledge and skills acquired during the lectures are assessed on the basis of a test containing multiple choice questions, tasks and open-ended questions. To pass the test it is necessary to get at least half of the points.

b) in the field of laboratories, verification of the assumed learning outcomes is carried out by:

- assessment of the student's preparation for individual sessions of laboratory classes, by assessing the efficiency of performing specific tasks

- evaluation of the simulation report of the operation of the selected task scheduling algorithm (it is possible to use non-classical task models), partially prepared during the course;

Obtaining additional points for activity during classes, especially for:

- discussion of additional aspects of the issue,

- remarks related to the improvement of teaching materials,

Programme content

Lecture: Introduction to the problems of scheduling production tasks. Classic and non-classical task models. Classification of scheduling problems. Ranking criteria. Job scheduling on a single machine. Task scheduling on parallel machines. Scheduling tasks in the flow system. Job scheduling in a socket system. General resource allocation problems. Accurate and approximate algorithms (including metaheuristic) for scheduling production tasks.

Laboratory exercises: getting acquainted with the selected problem of scheduling tasks, selection of the model of tasks and scheduling criterion, selection of the categories of existing resources, analysis of the complexity of an exemplary exact algorithm. Development of an exemplary construction heuristic algorithm, Simulation of the algorithm's operation on an exemplary problem instance. Visualization of

the schedule and work with the Gantt chart. Preparation of the concept of a metaheuristic algorithm to solve an example problem. Preparing simple implementations of algorithms in a sample ERP system.

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board.

Laboratory exercises: a multimedia presentation, a presentation illustrated with examples given on the blackboard and carrying out the tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Badania operacyjne dla informatyków, Błażewicz J., Cellary W., Słowiński R., Węglarz J., WNT, Warszawa, 1983

2. Scheduling Computer and Manufacturing Processes, 2nd ed., Błażewicz J., Ecker K.H., Pesch E., Schmidt G., Węglarz J., Springer - Verlag, 2001

3. T. Sawik, Optymalizacja dyskretna w elastycznych systemach produkcyjnych, WNT, Warszawa 1992

Additional

1. Różycki R., Zimniak A., Heuristics with grouping of jobs for power-aware scheduling problems , Proc. of the 20th IEEE Internation-al Conference on Methods and Models in Automation and Robotics MMAR 2015, Międzyzdroje, 24-27.08.2015, s.47-51.

2. Różycki R.,Szeregowanie zadań obliczeniowych z uwzględnieniem ograniczeń energetycznych , Wydawnictwo Nakom, Seria: Po-znan Monographs in Computing and Its Applications, Nr 15, Poznań, 2013.

3. Różycki R., Algorytm ewolucyjny i jego zastosowanie w optymalizacji rozdziału zasobów ciągłych i dyskretnych , Zarządzanie i technologie informacyjne. Tom 2. Metody sztucznej inteligencji w zarządzaniu i sterowaniu, Józefowska J.(red.), roz.12, Wydaw-nictwo Uniwersytetu Śląskiego, Katowice 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	102	4,0
Classes requiring direct contact with the teacher	36	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	66	2,5

[1] delete or add other activities as appropriate