COURSE DESCRIPTION CARD - SYLLABUS

Course name
Flexible manufacturing systems

Course

Field of study
Mechatronics

Year/Semester
1 / 2

Area of study (specialization)
Mechatronic Constructions

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Prerequisites

Basic knowledge of automation, control and programming basics as well as basic information on manufacturing techniques, the ability to solve elementary problems in the construction of control algorithms (programming principles) and automation based on knowledge, the ability to obtain information from specified sources, the ability to think logically, understanding the need to broaden their competences, readiness to cooperate as part of a team.

Course objective

1. Providing students with theoretical and practical issues related to the essence of flexibility in production systems and the way of organization and control of flexible production processes (ESP)

2. Developing students' skills in solving simple technical problems and integrating knowledge on issues from various areas of planning, controlling and optimizing production in ESP

3. Performing simple experiments and analyzing results based on acquired knowledge

4. Developing students' teamwork skills.

Course-related learning outcomes

Knowledge

1. Identify, describe and explain the principle of operation of the basic subsystems of the flexible production system [K_W17]

2. Understand how vision systems, industrial robots, industrial control systems, data exchange protocols, CNC machine tools work [K_W18, K_W19]

3. Know and be able to apply the appropriate programming instructions for a specific task of industrial robot control, PLC and CNC machine tools taking into account the initial and final conditions - [K_W18, K_W04]

4. Identify and describe issues (problems) of operation and diagnostics of manufacturing systems, including their life cycle - [K_W25]

Skills

1. Identify a technical problem, determine its complexity, and then propose a solution that takes into account the final goal (effect) - [K_U30, K_U31]

2. Develop algorithms and control programs for cooperating industrial robots, machine tools and manufacturing systems and carry out tests of the control program taking into account the conditions - [K_U21]

Social competences

1. Actively engage in solving the problems posed, independently develop and expand their competences and cooperate in a team - [K_K01, K_K03]

2. Set the priorities for the implementation of the task you or others specify - [K_K04]

3. Act in an entrepreneurial and creative (innovative) way - [K_K06]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

a) in the scope of lectures, verification of assumed learning outcomes is carried out by:

assessment of knowledge and skills demonstrated on a written exam or test problem;

b) in the scope of laboratories: verification of assumed learning outcomes is carried out by: assessment of student preparation for individual classes and assessment of skills related to the implementation of

exercises, continuous assessment, in each class (oral answers), rewarding the increase in the ability to use known principles and methods, assessment practical skills during individual tasks

Programme content

Lecture:

Flexible manufacturing systems (ESP) features and properties, principles of ESP functioning, criteria for the selection of automated flexible manufacturing means; basic functional subsystems of ESP (machining, assembly, quality control, transport and storage, control, etc.); scope and rationale for using flexible automation; flow of objects and tools in ESP, diagnostics and control in ESP, ESP economic assessment methods, technical and organizational aspects of ESP implementation. Basic theoretical concepts regarding, definition, classification, construction and possible application of vision systems, industrial robots, CNC machine tools, industrial manipulators, PLC controllers. Definition and industrial application of the Internet of Things (IoT) in ESP.

Laboratory - exercises in a flexible robotic system:

Exercise 1. Prototyping of flexible line control algorithms in the S7-1200 PLC environment

Exercise 2. Flexible gripper exchange system

Exercise 3. Programming cooperation between a CNC machine tool and an industrial manipulator

Exercise 4. Visual identification systems in flexible production

Teaching methods

1. lecture: multimedia presentation, examples illustrated with examples - films, discussion and problem analysis.

2. laboratory exercises: practical exercises, problem solving, discussion, teamwork.

Bibliography

Basic

1. Honczarenko J., Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe, WNT Warszawa 2000

2. Krzyżanowski J., Wprowadzenie do elastycznych systemów wytwórczych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2005

3. Design of Flexible Production Systems – Methodologies and Tools. By T. Tolio. Berlin: Springer, 2009. ISBN 978-3-540-85413-5

4. Manufacturing Systems – Theory and Practice. By G. Chryssolouris. New York, NY: Springer Verlag, 2005. 2nd edition.

Additional

. Honczarenko J., Roboty przemysłowe. Budowa i zastosowanie, WNT, Warszawa, 2010

2. Zdanowicz R. Podstawy robotyki, WPŚ, Gliwice, 2011

3. Steger C., Ulrich M., Wiedemann Ch.; Machine vision algorithms and applications, wyd. VCH

4. Steger C., Ulrich M., Wiedemann Ch., Handbook of machine vision, wyd. VCH

5. PLC S7-1200 Easybook, Siemens

6. Podręcznik programowania robotów ABB oraz RobotStudio

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	36	1,4
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)[1]	14	0,6

[1] delete or add other activities as appropriate