



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Flexible manufacturing systems

### Course

Field of study

Management and Production Engineering

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1 / 1

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

PhD., Eng. Jan Uniejewski

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

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### Prerequisites

Basic knowledge of manufacturing techniques, machine tool construction, automation, logical thinking skills, using information obtained from the library and the Internet, understanding the need for learning and acquiring new knowledge

### Course objective

In-depth knowledge of the problems related to the essence of flexibility in production systems

### Course-related learning outcomes

Knowledge

1. Student knows the essence, aims and the domain of the elastic automation of production systems - [K2\_W02, K2\_W05]



2. Student knows the technical means of the elastic automation and their possibilities - [K2\_W02]
3. Student knows the fundamentals of the systems theory in using to the elastic production - [K2\_W02,K2\_W05,K2\_W11]
4. Student knows structure (subsystems) of flexible system - [K2\_W02]
5. Student knows the principle of the modular design of the system and technical means - [K2\_W02]

#### Skills

1. Student is able to allocate subsystems of the flexible system appropriately to the tasks and the structure - [K2\_U08, K2\_U09]
2. Student is able to determine the methodology of the selection and to select groups of technical means of the flexible system - [K2\_U08, K2\_U09]
3. Student is able to determine the scope of the system flexibility appropriately to needs - [K2\_U08, K2\_U09]

#### Social competences

1. Student is aware to undertake the cooperation in the team - [K2\_K03]
2. student is conscious of the role of flexible systems in the contemporary economy and for the society - [K2\_K02, K2\_K07]

#### 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 at the written test;

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

assessment of student's preparation for individual classes and assessment of skills related to the implementation of exercises, continuous assessment, during each class (oral answers), rewarding the increase in the ability to use known principles and methods,

#### Programme content

Flexible manufacturing systems (FMS) ? idea of FMS, range: elasticity of technical equipment, of technology, of lot of production, of article and of development, partition of automatized elastic manufacturing equipment: single machine (single machine tools NC and CNC, autonomous tooling stations), many machines (flexible manufacturing cell FMC, flexible manufacturing line), features and properties of FMS, rules of work of FMS, criterions of choice of automatized flexible means of production, basic functional subsystems of FMS (cutting, assembly, quality control, transportation and storage, process control), range and premises of usage of flexible automation, flow of articles and of



tools in FMS, diagnostics and control in FMS, methods of economic estimation of FMS, technical and organizational aspects of FMS implementation

### Teaching methods

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

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

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

### 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

Additional

1. Kosmol J., Automatyzacja obrabiarek i obróbki skrawaniem. WNT Warszawa 2000

2. Lis S., Santarek K., Strzelczyk S., Organizacja elastycznych systemów produkcyjnych, PWN, Warszawa 1994

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	38	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	37	1,5

<sup>1</sup> delete or add other activities as appropriate