

## Programmable Manufacturing Cells

Code: MK3PGYCR04G117-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 3<sup>rd</sup> year, 2<sup>nd</sup> semester

Its prerequisite(s): Applied Automatization

Further courses are built on it: No

Number of teaching hours/week (lecture + practice): 1+2

### Topics:

General introduction to the history of Programmable Manufacturing Cells, background of robotics. Concept and classification of Programmable Manufacturing Cells s. Architecture of robot, coordinate systems, workspaces of robots, restrictions/constraints on workspaces. Structure of Programmable Manufacturing Cell, installing robots. Mechanical structure of Programmable Manufacturing Cells s, characteristics of the mechanical structure of robot, kinetic chains, constraint equations. Programmable Manufacturing Cells programming and information technology, principles of Programmable Manufacturing Cells programming, basic concepts in programming. Fundamentals of robot programming.

Material handling, combined application of technological and material handling systems, synchronizing tasks. Introducing the concept of „Intelligent Space“: Programmable Manufacturing Cells in human spaces. Programmable Manufacturing Cells simulation.

### Literature:

*Recommended:*

- Mikell Groover: Automation, Production Systems, and Computer-Integrated Manufacturing, Global Edition, 4/E ISBN-10: 1292076119 • ISBN-13: 9781292076119 ©2016 • Pearson • Paper, 816 pp
- Alasdair Gilchrist: Industry 4.0: The Industrial Internet of Things Google Book

### Schedule

1 <sup>st</sup> week Registration week	
<b>2<sup>nd</sup> week:</b> <b>Lecture:</b> Geometric and kinematic characteristics of Programmable Manufacturing Cells. Denavit-Hartenberg parameters. Jacobi matrix. <b>Practice:</b> Accident prevention. Solving tasks using Denavit-Hartenberg parameters, Jacobi matrix.	<b>3<sup>rd</sup> week:</b> <b>Lecture:</b> Industry 4.0, industrial manipulators in production processes. Concept of robots, structure of robots. <b>Practice:</b> Solving tasks using Denavit-Hartenberg parameters, Jacobi matrix.
<b>4<sup>th</sup> week:</b> <b>Lecture:</b> 6DOF robots: structural elements, drives. <b>Practice:</b> Robot control (6DOF or 4 DOF) – operator level.	<b>5<sup>th</sup> week:</b> <b>Lecture:</b> 6DOF robots: coordinate systems, installing coordinate systems. <b>Practice:</b> Programmable Manufacturing Cells control (6DOF or 4 DOF) – operator level.
<b>6<sup>th</sup> week:</b>	<b>7<sup>th</sup> week:</b>

**Lecture:** Point-to-point and continuous path controls. Point-to-point control.

**Practice:** Programmable Manufacturing Cells control (6DOF or 4 DOF) – operator level.

**8<sup>th</sup> week: 1<sup>st</sup> drawing week**

**9<sup>th</sup> week:**

**Lecture:** 4DOF (Scara) robots: structural elements, coordinate control, point-to-point control, continuous path control.

**Practice:** Robot control (6DOF or 4 DOF) – operator level.

**11<sup>th</sup> week:**

**Lecture:** Offline Programmable Manufacturing Cells programming.

**Practice:** Offline Programmable Manufacturing Cells programming.

**13<sup>th</sup> week:**

**Lecture:** Programmable Manufacturing Cells and their simulation.

**Practice:** Programmable Manufacturing Cells simulation.

**15<sup>th</sup> week: 2<sup>nd</sup> drawing week**

**Lecture:** 6DOF Programmable Manufacturing Cells s: Singularity of s.

**Practice:** Programmable Manufacturing Cells control (6DOF or 4 DOF) – operator level.

**10<sup>th</sup> week:**

**Lecture:** Offline Programmable Manufacturing Cells programming.

**Practice:** Mid-term test (theoretical), Robot control – classified.

**12<sup>th</sup> week:**

**Lecture:** “Intelligent Space”: Programmable Manufacturing Cells in human spaces.

**Practice:** Offline Programmable Manufacturing Cells programming.

**14<sup>th</sup> week:**

**Lecture:** Programmable Manufacturing Cells simulation.

**Practice:** Programmable Manufacturing Cells simulation.

**Requirements**

**A, for a signature:**

Attendance in practical classes (see Rules and Regulations). Submitting homework assignments until the deadline. Passing mid-term test.

**B, for grade:**

Oral exam in the theoretical part.