# Precision drives and industrial robots - course description

## General information

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|---|---|
| Course name | Precision drives and industrial robots |
| Course ID | 11.9-WE-AutP-PDIR-Er |
| Faculty | Faculty of Computer Science, Electrical Engineering and Automatics |
| Field of study | Automatic Control and Robotics |
| Education profile | academic |
| Level of studies | First-cycle Erasmus programme |
| Beginning semester | winter term 2022/2023 |

## Course information

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|---|---|
| Semester | 6 |
| ECTS credits to win | 3 |
| Course type | optional |
| Teaching language | english |
| Author of syllabus | • prof. dr hab. inż. Robert Smoleński<br>• dr hab. inż. Jacek Kaniewski |

## Classes forms

| The class form | Hours per semester (full-time) | Hours per week (full-time) | Hours per semester (part-time) | Hours per week (part-time) | Form of assignment |
|---|---|---|---|---|---|
| Lecture | 15 | 1 | - | - | Credit with grade |
| Laboratory | 30 | 2 | - | - | Credit with grade |

## Aim of the course

- formation of basic skills in the selection of open and closed systems for speed, torque and position control,
- to familiarize students with the servo motors used in robots and robotic systems.

## Prerequisites

Engineering physics, Electrical engineering principles, Electronics principles, Control engineering, Control of electrical drives

## Scope

*Servomotors used in robots and robot systems.* DC motors (conventional and disc), synchronous motors permanent magnet and reluctance, step motors and asynchronous. Power electronic converter servo drives.
*Control methods of electric drives.* Scalar control. Field oriented control. Direct torque control. Sensorless control.
*Open and closed loop control of speed, torque and position.* Realization of four-quadrant direct and alternating current drives. Follow-up and position servo drives, precise drives. Robot drives. Sensor systems of robots.

## Teaching methods

Lecture, laboratory exercises.

## Learning outcomes and methods of theirs verification

| Outcome description | Outcome symbols | Methods of verification | The class form |
|---|---|---|---|
| Can choose control parameters of converter drives | | • an ongoing monitoring during classes<br>• carrying out laboratory reports | • Laboratory |
| Can choose appropriate drive systems to the specific requirements of working machines | | • an ongoing monitoring during classes<br>• carrying out laboratory reports | • Laboratory |
| Knows operation principles of electric servo-motors and can characterize their static and dynamic properties | | • an evaluation test<br>• an ongoing monitoring during classes<br>• carrying out laboratory reports | • Lecture<br>• Laboratory |
| Is aware of the importance of electric drives for technology development and drives influence onto power system | | • an evaluation test | • Lecture |

## Assignment conditions

**Lecture** – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.

**Laboratory** – the passing condition is to obtain positive marks from all laboratory exercises to be planned during the semester.

Calculation of the final grade: lecture 60% + laboratory 40%

## Recommended reading


1. Kaźmierkowski M. P., Tunia H.: Automatic Control of Converter-Fed Drives, Warsaw - Amsterdam - New York - Tokyo: PWN-ELSEVIER SCIENCE PUBLISHERS, 1994.
2. Kaźmierkowski M. P., Blaabjerg F., Krishnan R.: Control in Power Electronics, Selected Problems, Elsevier 2002.
3. Boldea I., Nasar S.A, Electric Drives, CRC Press, 1999.
4. Kaźmierkowski M. P. and Orłowska-Kowalska T.: Neural Network estimation and neuro-fuzzy control in converter-fed induction motor drives, Chapter in Soft Computing in Industrial Electronics, Springer-Verlag, Heidelberg, 2002.
5. Leonhard W.: Control of Electrical Drives, Springer, Berlin, New York, 2001.
6. Miller T.J.E.: Brushless Permanent-Magnet and Reluctance Motor Drives, Oxford University Press, Oxford, England, 1989.
7. Ryoji O.: Intelligent sensor technology, John Willey & Sons, 1992.
8. Samson C., Le Borgne M., Espinau B.: Robot control. Oxford University Press, 1991.
9. Canudas C., Siciliano B., Bastin G.: Theory of robot control. Springer Verlag, 1996.


## Further reading

## Notes

Modified by dr hab. inż. Wojciech Paszke, prof. UZ (last modification: 11-04-2022 09:05)