COURSE DESCRIPTION CARD - SYLLABUS

Course name
Intelligent control engineering design

Course

Field of study
automatic control and robotics

Year/Semester
1 / 2

Area of study (specialization)
intelligent automation systems

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	30	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
Konrad Urbański Ph.D.

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Faculty of Control, Robotics and Electrical Engineering

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Responsible for the course/lecturer:

Prerequisites

A student beginning this course should have knowledge of automation and robotics corresponding to level 6 of the Polish Qualification Framework, in particular, knowledge of the basics of automation, matrix operations and programming skills. They should also understand the need to broaden their competences and be ready to cooperate in a team.

Course objective

To familiarize students with the methods of programming, simulation and analysis of selected control methods and structures in selected operating systems and programming environments. To familiarize

students with configuration methods and basic functions and capabilities of the system and programming environments used.

Course-related learning outcomes

Knowledge

understands the methodology of designing specialized analog and digital electronic systems;

Skills

is able to use information and communication techniques;

Social competences

is aware of the importance and understands the non-technical aspects and effects of engineering activities, including their impact on the environment and the related responsibility for the decisions taken; is ready to develop its professional achievements;

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: exam

Laboratory: checking the ability to create control structures, selection and determination of parameters of control modules and analysis of their operation

Programme content

Preparation of programming tools: installation and configuration of a selected Linux-based system, installation and configuration of the programming environment for the python language (auxiliary programs, software modules, libraries: communication, arithmetic, control, visualization, computational intelligence, including TensorFlow, etc.). Modelling and launching of the selected controller structures provided in the modules, creating models of control objects. Start-up of control structures, analysis of their correctness.

Issues:

selection of the regulator settings according to specific criteria

IMC – internal model control

SP – Smith predictor

MPC – model predictive control

KF – Kalman filter, implementation in control systems

SSN – artificial neural networks – implementation

TF, Keras and deep networks - training and implementation

impact of delays in the control loop

control of devices using Python

Teaching methods

Lectures with multimedia presentation (including: drawings, photos, animations, sound, films) supplemented by examples given on the board

Lectures conducted in an interactive way with formulation of questions to a group of students

Presentation of a new topic preceded by a reminder of related content known to students from other subjects

Laboratories:

- working in teams

- computational experiments

Bibliography

Basic

1. Online tutorials for the current version of Python 3.x

2. Documentation of selected Python packages for version 3.x

3. Documentation of Keras and TensorFlow libraries

4. PID Controllers : Theory, Design, and Tuning, 2nd Edition, K.J. Astrom, T. Hagglund, 1995

5. Control system design guide, G. Ellis, Elsevier 2004

Additional

1. Automate the Boring Stuff with Python, A. Sweigart, latest edition

2. Python: wprowadzenie, M. Lutz, Helion, wydanie jak najnowsze

3. Python dla każdego. Podstawy programowania, M. Dawson, wydanie jak najnowsze

4. Deep Learning with Python , F. Chollet, Manning Pub. Co. 2018

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	45	1,5
Student's own work (literature studies, preparation for laboratory classes, preparation for exam) [1]	45	1,5

[1] delete or add other activities as appropriate