Subject programme

1. Subject name / subject module: **Robotics**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Engineering and Mechatronics**
   - Degree of the studies: **1st degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Repka Michal, dr inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Teaching activities with the tutor																						
Mode of study	Form of classes																					Total
	...	SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				43	57	4																4
Part-time studies																						
Credit rigor				Graded assignment																		

6. Student workload – ECTS credits balance:
   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	**Hourly student workload (full-time studies/part-time studies)**
Participation in lectures	-
Participation in laboratory classes	43
Preparation to laboratory classes	30
Independent study of the subject	25
Participation in an exam / graded assignment	2
Total student workload (TSW)	100
ECTS credits	4
* Student's workload related to trainings	100
Student's workload in classes requiring direct participation of academic teachers	43

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Specific learning outcomes for the subject		**Form**	**Teaching method**	**Methods for testing of (checking, assessing) learning outcomes**
Outcome symbol	**Outcome description**			
Knowledge				
K_W08	**Student knows and understands selected specific issues in the field of robotics related to: designing control systems, robotics and practical applications of this knowledge.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
Skills				
K_U02	**Student is able to use their knowledge - solve problems and perform tasks typical for robotics.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**

9. Assessment rules / criteria for each form of education and individual grades:

0% - 50%	ndst	80% - 86%	db
51% - 70%	dst	87% - 93%	db+
71% - 79%	dst+	94% - 100%	bdb

Activity	Grades	Calculation	To Final
Lab reports	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,5,4,4)* 90%	3,6
Attendance	on 70% of all classes	70% * 5 -> 3,5 * 10%	0,35
Final result			3,95
Grade		3,95/5 = 79%	**db (4.0)**

10. The learning contents with the form of the class activities on which they are carried out:

(Laboratory work)

1. Introduction to Matlab environment;

2. Introduction to Arduino;

3. Robot movement - open-loop controller; Cause the robot to drive in a straight line, a circle, a rectangle;

4. Line following task; Reading values from line sensors on the under-side of the robot; Sensor calibration;

5. Robot movement - closed-loop system; Use encoders encoder attached to the motor shafts to improve robot behavior;

6. Distance sensors; Reading values from bump sensors and the distance sensors(optical, ultrasonic);

7. Obstacle avoidance; Write code to drive robot while avoiding crashing into the objects in front; Write code to drive along the wall;

8. Mapping; Maze exploration - write code to explore a maze and find the center; Find shortest path in a maze;

9. Inertial navigation; Use acceleration sensor to calculate robot speed and position;

10. Advanced navigation(GPS);

11. Kalman filtering; Write a code to implement Kalman filter to improve motion parameters estimation.

11. Required teaching aids:

a. Lecture - multimedia projector

b. Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

- Corke P.; Robotics, Vision and Control; ISBN 978-3-319-54413-7; Springer 2017
- Siciliano B., Khatib O.; Springer Handbook of Robotics; ISBN 978-3-319-32552-1; Springer 2016

b. Supplementary literature:

- Huimin Lu, Xing Xu, Artificial Intelligence and Robotics, Springer, Cham, 2018

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education:

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Repka Michal, dr inż.
3. Training	