Subject programme

1. Subject name / subject module: **Basic Engineering Course**
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: **Ocetkiewicz Tomasz, mgr 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
	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies	54	71	5																			5
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 laboratory classes	**54/0**
Independent study of the subject – preparing for graded assignment	**69/0**
Participation in an exam / graded assignment / final grading	**2/0**
Total student workload (TSW)	**125/0**
ECTS credits	**5**
* Student's workload related to practical forms	**125/0**
Student's workload in classes requiring direct participation of academic teachers	**54/0**

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:

   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_W11	**Student possesses sufficient knowledge of technical standards and norms regarding commonly used technical solutions for electronic device prototyping.**	**Laboratory classes**	**inquiry methods**	**Assesment of laboratory tasks.**
Skills				
K_U09	**Student possesses sufficient skills to use tools for electronics device prototyping to solve engineering tasks. A student is able to make decisions in the context of the quality and effectiveness of action and economic realities as to the participa**	**Laboratory classes**	**inquiry methods**	**Assesment of laboratory tasks.**

K_U16	Student has adequate skills to use appropriate methods, techniques, and tools - in accordance with the given specification - to design and build a prototype of a simple electronic device.			

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

0% - 60%	ndst	**81% - 90%**	db
61% - 70%	dst	**91% - 93%**	db+
71% - 80%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Laboratory tasks	**5; 4; 5; 4; 5(bdb; db; bdb; db; bdb)**	**5 * 10% + 4 * 10% + 5 * 10% + 4 * 10% + 5 * 10% = 2.3**	**2.3**

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

Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

- Blum J.; Exploring Arduino ; tools and techniques for engineering wizardry; ISBN 978-1-118-54936-0; Wiley 2013
- Bob Dukish; Coding the Arduino; ISBN 978-1-4842-3510-2; Apress, Berkeley, CA 2018

b. Supplementary literature:

- Tianhong Pan, Yi Zhu ; Designing Embedded Systems with Arduino; ISBN 978-981-10-4418-2; Springer 2018
- Indira Knight; Connecting Arduino to the Web; ISBN 978-1-4842-3480-8; Apress, Berkeley, CA 2018
- Jeff Cicolani; Beginning Robotics with Raspberry Pi and Arduino; ISBN 978-1-4842-3462-4; Apress, Berkeley, CA 2018

c. Internet sources:

- Sparkfun Tutorial - learn.sparkfun.com
- Arduino Language Reference - www.arduino.cc/reference/en
- Adafruit Learn - learn.adafruit.com
- Arduino Library List - www.arduinolibraries.info
- Last Minute Engineers Tutorials - lastminuteengineers.com/electronics/arduino-projects/

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. Laboratory classes	Ocetkiewicz Tomasz, mgr inż.