Subject programme

1. Subject name / subject module: **Hardware platforms for IOT**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Control Systems Engineering**
   - Degree of the studies: **2nd degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **The 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																						Total
Form of classes / Mode of study		SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				45	55	4																**4**
Part-time studies																						
Credit rigor	...			Graded assigment																		

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	**45**
Preparing to the laboratories	**20**
Independent study of the subject	**33**
Participation in an exam / graded assignment / final grading	**2**
Total student workload	**100**
ECTS credits	**4**
* Student's workload related to practical forms	**100**
Student's workload in classes requiring direct participation of academic teachers	**45**

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_W05	**A student knows and understands selected facts and phenomena in development boards for IoT, is able to explain the complex relationships between them, which constitute the advanced general knowledge in the field of automation, electronics, and electrical engineering, sufficient to design an IoT device.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**

K_W07	A student possesses sufficient knowledge in the field of technical informatics, necessary to understand hardware platforms for the Internet of Things programming rules, and to apply this knowledge in practice through the use of appropriate programming language and software environment due to the project specification.			
Skills				
K_U02	A student is able to use information and communication technologies (ICT) to create documentation of an IoT device and use the engineering graphics to prepare an effective HMI implementation.	Laboratory work	Inquiry methods	Student learning activities

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	**db; bdb; bdb; db (4; 5; 5; 4)**	**4 * 25% + 5 * 25% + 5 * 25% + 4 * 25% = 4.5**	**4.5**

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

(Laboratory work)

1. Software and programming tools for IOT devices prototyping: ESP Easy; ESP-Open-RTOS; MicroPython; NodeMCU; Mongoose OS; PlatformIO;

2. IOT devices prototyping: ESP8266 and ESP32 cores; RaspberryPi IOT gateway; LoRa32u4 development board; Prototyping LoRa using Arduino platform - Arduino MKR board; SiPy development platform;

3. Platforms and tools for data visualization: Connecting ESP32 to Amazon cloud, Cayenne MQTT and ESP8266; NodeRED and ESP8266; ThingsSpeak;

4. Applications examples: Smart clothes; Smart buildings – house access control; Sensor networks – ar quality, environmental measurement systems, PV monitoring system; Health monitoring system;

11. Required teaching aids

Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

1. Building Arduino Projects for the Internet of Things; Adeel Javed; ISBN 978-1-4842-1940-9; Apress, Berkeley; 2016

2. Blum J.; Exploring Arduino ; tools and techniques for engineering wizardry; ISBN 978-1-118-54936-0; Wiley 2013

a. Supplementary literature:

1. MicroPython for the Internet of Things; Charles Bell; ISBN 978-1-4842-3123-4; Apress, Berkeley; 2017

2. John C. Shovic; Raspberry Pi IoT Projects; ISBN 978-1-4842-1377-3; Apress, Berkeley; 2016

3. Tianhong Pan, Yi Zhu ; Designing Embedded Systems with Arduino; ISBN 978-981-10-4418-2; Springer 2018

b. Internet sources:

1. LoRa Alliance - lora-alliance.org

2. Sparkfun Tutorials - learn.sparkfun.com

3. MQTT - docs.oasis-open.org/mqtt/mqtt/v5.0/mqtt-v5.0.html

4. NodeRed Documentation - nodered.org/docs

5. The Things Network Documentation - www.thethingsnetwork.org

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.