Subject programme

1. Subject name / subject module: **Internet of Things**
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
		SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				33	42	3																3
Part-time studies																						
Credit rigor				Exam																		

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	33
Preparation to laboratory classes	16
Independent study of the subject	8
Preparation to an exam test	16
Participation in an exam / graded assignment	2
Total student workload (TSW)	75
ECTS credits	3
* Student's workload related to trainings	75
Student's workload in classes requiring direct participation of academic teachers	33

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_W04	**A student has sufficient knowledge in the field of technical informatics and telecommunications, necessary to understand, at an advanced level, the complex dependencies in the Internet of Things devices and systems and to apply this knowledge in prac**	**Laboratory work**	**Inquiry methods**	**Exam Student learning activities**
K_W06	**A student has adequate knowledge of specific issues in the field of technical computer science related to programming, computer networks, databases in the Internet of Things solutions as well as practical applications of this knowledge.**			
Skills				
K_U02	**A student is able to use their knowledge - to formulate and solve problems and perform tasks typical for designing, prototyping, creating software, and implementing devices, software, and systems for the Internet of Things.**	**Laboratory work**	**Inquiry methods**	**Exam Student learning activities**

K_U14	A student possesses sufficient skills to see problems, imperfections in functioning, or newly designed and prototyped solutions for the Internet of Things, identify the problem, and formulate a specification of solutions for the perceived engineering			
K_U16	A student possesses sufficient skills to use appropriate methods, techniques, and tools - in accordance with the given specification - to design and implement a simple device, object, system, or process, typical for the Internet of Things.			

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 (3,4,5,4) * 50%	2,0
Exam	bdb (5)	5.0 * 50%	2,5
Final result			4,5
Grade		4,5/5 = 90%	**db+ (4,5)**

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

(Laboratory work)

1.Introduction to IOT: definition of IOT, Industry

4.0 and Industrial Internet of Things, Internet of Medical Devices (IOMT), design rules for IOT systems and devices, security in IOT systems, ethics and law in Internet of Things world;

2.Communication interface for IOT: 802.11 based solutions, LoRa, LoRaWAN, Sigfox, 6LoWPAN, NB-IOT,

3. IOT devices prototyping: hardware platforms, MQTT protocol, AMQP protocol, JSON data exchange standard;

4.Platforms and tools for data visualization: NodeRED, ThingsSpeak.

5.Applications examples: smart clothes, home automation/smart buildings – house access control, sensor networks – ar quality, environmental measurement systems, PV monitoring system, health monitoring system.

11. Required teaching aids:

a. Lecture - multimedia projector.

b. Laboratory classes - specialist laboratory.

c. Exercises - a room adapted for conducting classes in the form of exercises / workshops, multimedia projector.

12. Literature:

a. Basic literature:

1. Big Data and the Internet of Things; Robert Stackowiak, Art Licht, Venu Mantha, Louis Nagode; ISBN 978-1-4842-0986-8; Apress, Berkeley; 2016

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

b. Supplementary literature:

1. Internet of Things (IoT) Technologies for HealthCare; Mobyen Uddin Ahmed, Shahina Begum, Jean-Baptiste Fasquell; 4th International Conference, HealthyIoT 2017

2. Internet of Things. IoT Infrastructures; Second International Summit, IoT 360° 2015

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

c. 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
6. Arduino tutorial - www.arduino.cc/en/Tutorial/HomePage
7. ESP32 tutorial - randomnerdtutorials.com/projects-esp32
8. ESP8266 tutorial - randomnerdtutorials.com/projects-esp32

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

Laboratory classes manuals and code examples.

14. Teachers implementing particular forms of education:

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Ocetkiewicz Tomasz, mgr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	