Zał. nr 4 do ZW 64/2012

FACULTY OF COMPUTER SCIENCE AND MANAGEMENT

SUBJECT CARD

Name in Polish	**Podstawy Internetu Rzeczy**
Name in English	**Introduction to IoT**
Main field of study (if applicable):	**Computer Science**
Specialization (if applicable):	**-**
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
Subject code	**…….**
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	90		90		
Form of crediting	Examination		Crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3		3		
including number of ECTS points for practical (P) classes	0		3		
including number of ECTS points for direct teacher-student contact (BK) classes	1,8		1,8		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

The following academic courses are passed or the equivalent to them knowledge and skills are possessed:

1. Structural and Object Oriented Programming,
2. Computer Architecture,
3. Computer Networks.

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SUBJECT OBJECTIVES

C1. Acquiring basic knowledge about the theoretical foundations of the Internet of Things and programming devices functioning in it.

C2. Acquiring basic practical skills in the programming of Internet of Things devices.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge a student:

PEK_W01 - acquires basic knowledge about the theoretical foundations of the Internet of Things and programming devices functioning in it.

relating to skills:

PEK_U01 - acquires basic practical skills in the programming of Internet of Things devices.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Introduction to Internet of Things (IoT). Devices in Internet of Things: sensors, actuators, smart devices and embedded systems.	2
Lec 2	High-level languages in programming IoT devices and microcontrollers. Introduction to programming of microcontrollers in IoT devices: architecture, programming interfaces (JTAG, etc.), CPU, memory and access to memory.	2
Lec 3	Introduction to programming of microcontrollers in IoT devices: events, system clock, power management, startup and boot modes, system control and reset, watchdog timer (WDT), interrupts and programmable interrupt controllers, I/O ports, timers, real time counter (RTC).	2
Lec 4	Introduction to programming of microcontrollers in IoT devices: cryptographic engine, cyclic redundancy check (CRC) generator, analog to digital converter (ADC), digital to analog converter (DAC), analog comparator, embedded sensors (temperature, etc.).	2
Lec 5	Input and output devices: LED and LCD displays, programmable RGB LEDs, buttons, keyboard, potentiometers and quadrature encoders, etc.	2
Lec 6	Sensors of light, motion, ultrasonic, temperature, humidity, real time clocks, etc. Signaling elements and actuators: servomechanisms, relays, electronic switching circuits, etc.	2
Lec 7	Local communication interfaces and buses of Internet of Things devices: USB, UART, RS232, RS458, I2C, 1Wire, CAN, etc.	2
Lec 8	Wireless technologies for Internet of Things: Bluetooth, IEEE 802.15.4, IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT, etc.	2
Lec 9	The IP protocol in the network layer of Internet of Things.	2
Lec 10	Architecture and design of Internet of Things.	2
Lec 11	Application protocols in Internet of Things.	2
Lec 12	Acquiring, storing and analyzing large amounts of data generated by Internet of Things devices.	2
Lec 13	Security and privacy in Internet of Things.	2
Lec 14	Internet of Things in practice - examples (part I).	2
Lec 15	Internet of Things in practice - examples (part II).	2
	Total hours	**30**

Form of classes - laboratory		Number of hours
Lab 1	Introduction to the laboratory. OSH training. Introduction to Arduino programming.	2
Lab 2	Creating simple programs with the use of Arduino IDE.	2
Lab 3	Programming support for peripheral devices using Arduino libraries.	2
Lab 4	Introduction to microcontroller programming in professional programming environments using a high-level programming language.	2
Lab 5	Creating simple programs for microcontrollers.	2
Lab 6	Selected input and output devices: LED and LCD displays, programmable RGB LEDs, buttons, keyboard, potentiometers and quadrature encoders, etc.	2
Lab 7	Selected sensors: light, motion, ultrasonic, temperature, humidity, real time clocks, etc. Selected signaling and executive elements: servomechanisms, relays, electronic switching circuits, etc.	2
Lab 8	Communication using selected interfaces: USB, UART, RS232, RS458, I2C, 1Wire, CAN, etc.	2
Lab 9	Communication using wireless technology.	2
Lab 10	Communication using computer networks based on the IP protocol (part I).	2
Lab 11	Communication using computer networks based on the IP protocol (part II).	2
Lab 12	Programming for Internet of Things - programming task (part I).	2
Lab 13	Programming for Internet of Things - programming task (part II).	2
Lab 14	Programming for Internet of Things - programming task (part III).	2
Lab 15	Presentation of the results of the programming task. Final grading.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Traditional lecture. N2. Laboratories. N3. Consultations for students. N4. Own work - preparation for laboratories. N5. Own work - learning of theoretical foundations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C (lecture)	PEK_W01	To get credit for the lecture (pass), a student should be given more than half of the points for the theoretical exam. If the above is met, then the grading scale is as follows: P - the sum of obtained points in percent. Range P : Grade 100 - 91%: 5.0 (very good) 90 - 81%: 4.5 (good plus) 80 - 71%: 4.0 (good) 70 - 61%: 3.5 (satisfactory plus) 60 - 51%: 3.0 (satisfactory) 50 - 0%: 2.0 (unsatisfactory)
F1 (laboratory)	PEK_U01	Knowledge tests in the field of theoretical preparation for the laboratory and practical skills obtained at the laboratory.
F2 (laboratory)	PEK_U01	Evaluation of the effects of the programming task.
C (laboratory)		To get credit for the laboratory (pass), a student should be given more than half of the points possible to get on tests (F1) and for programming task (F2). The student’s absences may constitute the grounds for not crediting the course. The number of student's absences must not exceed the limit given by the lecturer. If the above are met, then the grading scale is as follows: P = F1 + F2 - the sum of points in percent. Range P : Grade 100 - 91%: 5.0 (very good) 90 - 81%: 4.5 (good plus) 80 - 71%: 4.0 (good) 70 - 61%: 3.5 (satisfactory plus) 60 - 51%: 3.0 (satisfactory) 50 - 0%: 2.0 (unsatisfactory)

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Rob Barton, Gonzalo Salgueiro, David Hanes: IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017, ISBN: 9780134307091.
[2] Perry Lea: Internet of Things for Architects, Packt Publishing, 2018, ISBN: 9781788470599.
[3] Arvind Ravulavaru: Enterprise Internet of Things Handbook, Packt Publishing, 2018, ISBN: 9781788838399.
[4] Andrew Minteer: Analytics for the Internet of Things (IoT), Packt Publishing, 2017, ISBN: 9781787120730.
[5] Agus Kurniawan: Smart Internet of Things Projects, Packt Publishing, 2016, ISBN: 9781786466518.
[6] Amir Vahid Dastjerdi, Rajkumar Buyya: Internet of Things, Morgan Kaufmann, 2016, ISBN: 9780128093474.
[7] Elliot Williams: Make: AVR Programming, Maker Media, Inc, 2014, ISBN: 9781449355784,
in Polish: Programowanie układów AVR dla praktyków, Helion, 2014, ISBN: 97888324695010.
[8] Tomasz Francuz: Język C dla mikrokontrolerów AVR, Helion, 2015, (in Polish) ISBN: 9788324698141.

SECONDARY LITERATURE:

[1] Technical documentation of devices and microcontrollers used in the course on the websites of producers and distributors.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Introduction to IoT
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Computer Science
AND SPECIALIZATION -

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01 (knowledge)	K1INF_W04	C1	Lec 1-15	N1,3,5
PEK_U01 (skills)	K1INF_U01	C2	Lab 1-15	N2,3,4

** - enter symbols for main-field-of-study/specialization educational effects
*** - from table above