COURSE DESCRIPTION CARD – SPECIMEN

<table>
<tr><td colspan="10">Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Electrical and Electronics Engineering</td><td colspan="2">Degree level and programme type</td><td>bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Internet of Things</td><td colspan="2">Course code</td><td>IS-FEE-10051S</td></tr>
<tr><td colspan="2">Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>15</td><td></td><td>15</td><td>15</td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>4</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Fundamentals of Digital Technique</td></tr>
<tr><td>Course objectives</td><td colspan="9">The course is designed to teach students about the Internet of Things (IoT), which relates to the study of sensors, serial data buses, actuators, cloud computing, MQTT protocol and controllers, IoT applications, system security and examples overview (building automation, transportation, healthcare, industry). After completing the course a student will explain principles of operation of a variety of IoT digital subsystems and will be able to design a simple IoT application.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Topics address main concepts behind the Internet of Things (the IoT paradigm, smart objects, convergence of technologies, security, protocols), technologies related to the Internet of Things, single board microcomputer IoT nodes, microcontroller based IoT nodes, sensors and serial interfaces.
Laboratory class: Practical exercises in programming and designing IoT systems elements based on microcontrollers, single board microcomputers, FPGA and softcore processors and digital sensors.
Project: Can encompass a broad field but should be relevant and related with the Internet of Things type of applications. (eg. microprocessor based control of an exemplary system, scheme, calculations, software, peripheral devices, cloud computing / database, web browser based data presentation and control). Dependant on how many participants of the course, a specialization can be made within the project but an understanding of the full design flow is vital for all participants.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, laboratory class, project</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture – written exam + oral exam, laboratory classes – evaluation of reports, verification of preparation for classes, project – project completion, presentation and discussion.</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="7">Learning outcomes
After completing this subject student is able to:</td><td colspan="2">Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="7">Recognise and understand wiring diagrams related to IoT nodes.</td><td colspan="2"></td></tr>
<tr><td>LO2</td><td colspan="7">Identify various data buses and interfaces from the wiring diagrams.</td><td colspan="2"></td></tr>
<tr><td>LO3</td><td colspan="7">Determine the function and operation of the various modules and sensors and have a good knowledge of how they are used in the management of the IoT devices.</td><td colspan="2"></td></tr>
</table>

LO4	**Use suitable programming tools.**	
LO5	**Use application notes and data sheets**	
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	**written test on lecture content**	**L**
LO2	**written test on lecture content**	**L**
LO3	**written test on lecture content**	**L**
LO4	**evaluating the student's reports and projects**	**LC, P**
LO5	**evaluating the student's reports and projects**	**LC, P**
Student workload (in hours)		**No. of hours**
Calculation	**Lecture attendance**	**15**
	participation in laboratory classes and project sessions	**30**
	preparation for laboratory classes and projects	**15**
	working on projects, reports,	**15**
	implementation of project tasks	**20**
	preparation for and participation in exams/tests	**5**
	TOTAL:	**100**

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**45**	**1,5**
Student workload – practical activities	**80**	**3**

Basic references	1. Rao M., 'Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects' , Packt Publishing Ltd., 2018. 2. Girardin G., Bonnabel A., Mounier E., 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024', Yole Développement, 2014. 3. Waher P., 'Learning Internet of Things', Packt Publishing, 2015. 4. Bahga A., Madisetti V., 'Internet of Things (A Hands-on-Approach)', Published by authors 2014. 5. Ida N., 'Sensors, Actuators and Their Interfaces', Scitech Publishers, 2014.
Supplementary references	1. Frenzel L. E., Handbook of Serial Communications Interfaces: A Comprehensive Compendium of Serial Digital Input/Output (I/O) Standards', Elsevier, 2015. 2. Papazoglou P. M., 'An Educational Guide to the AVR Microcontroller Programming: AVR Programming::Demystified (Assembly Language)', Kessariani, 2018. 3. Barnett R. H., Cox S., O'Cull L., 'Embedded C Programming and the Atmel AVR', 2nd Edition, Delmar Cengage Learning, 2006. 4. Geddes M., 'Arduino Project Handbook: 25 Practical Projects to Get You Started', 2016.

Organisational unit conducting the course	**Department of Automatic Control and Robotics**	**Date of issuing the programme**
Author of the programme	**Ph.D., Eng. Wojciech Wojtkowski**	**28-02-2021**

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar