Specification for the book of courses

Study program	Electrical Engineering and Computer Science		
Module	Computing and Informatics		
Type and level of studies	Undergraduate Academic Studies		
The name of the course	Microcomputer Based Measurement Systems		
Lecturer (for lectures)	Jovanović R. Jelena, Živanović B. Dragan		
Lecturer/associate (for exercises)	Jovanović R. Jelena		
Lecturer/associate (for OFE)	Jovanović R. Jelena		
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	Introducing students with hardware design and development of real-time data acquisition systems based on C and Java programming languages; Introduction and realization of functional interactions between software and hardware peripherals; Realization of a system for real-time functioning.		
Course outcomes	Upon completion of this course, students will: have basic knowledge about analog and digital sensors, as well as the techniques for conditioning and converting data from analog to digital format; have knowledge about different types of measurement information transferring; be familiar with the "open source" Arduino platform and the Raspberry Pi microcomputer; be able to select adequate sensors (analogue or digital) for a particular application, select and realize data transmission type depending on the end user's requirements; be able to write programs in the C programming language to work with the "open source" Arduino development environment, as well as programs in C and Java object-oriented programming languages for the Raspberry Pi microcomputer platform, also using appropriate tools to optimize and correct errors; be trained to design and develop systems for real-time acquisition of measurement data based on Arduino and Raspberry Pi platforms; be trained to store and display data using Cloud services.		
Course outline			
Theoretical teaching	Analog sensors; Signal conditioning and A/D conversion; Digital sensors; Types of data transmission, advantages and disadvantages; Arduino microcontroller boards and their connection with sensors and additional electronics (shields); Types of communication interfaces between the Arduino microcontroller and sensors; Raspberry Pi microcomputers and their application in realization of real-time acquisition systems; Raspberry Pi hardware; Raspberry Pi software; Connecting peripherals to Raspberry Pi microcomputer; C, C ++ and Java programming on Raspberry Pi microcomputer; General Purpose Input/Outputs - GPIO; Upgrading of input/output interfaces on the Raspberry Pi microcomputer; Real-time acquisition of measurement data using Raspberry Pi microcomputer and Arduino microcontroller; Raspberry Pi microcomputer as IoT sensor and web server.		
Practical teaching (exercises, OFE, study and research	Code writing for data acquisition with Arduino and Raspberry Pi platforms using C and Java programming languages; Getting acquainted with the basic hardware of real-time data acquisition systems; Presentation of real-time collected data and their storage using Cloud services; Realization of project tasks; Practical lectures will be carried out through laboratory exercises.		
Textbooks/references			
1	Volker Ziemann, "A Hands-On Course in Sensors Using the Arduino and Raspberry Pi", CRC Press, Boca Raton, USA, 2018.		
2	Emily Gertz, Patrick Di Justo, "Environmental Monitoring with Arduino", O'Reilly, Sebastopol, USA, 2012.		
3	Derek Molloy, ""Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux", Wiley, New York, USA, 2016.		
4	Stephen Chin, James L. Weaver, "Raspberry Pi with Java, Programming the Internet of Things (IoT) ", McGraw-Hill Education, New York, USA, 2016.		
5	Pradeeka Seneviratne, John Sirach, "Raspberry Pi 3 Projects for Java Programmers", Packt Publishing Ltd., Birmingham, UK, 2017.		

Number of classes of active education per week during semester/trimester/year				
Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
2	2	1	0	0
Teaching methods	Multimedia lectures; Auditory exercises; Laboratory exercises			

Grade (maximum number of points 100)			
Pre-exam duties	**Points**	**Final exam**	**Points**

Activity during lectures	5	**Written exam**	20
Exercises	15	**Oral exam**	10
Colloquia	40		
Projects	10		