Table S2.6.4. Form for the preparation of the course information sheets

Name of the subject	*IoT ecosystems*			
Code of the subject	**Status of the subject**	**Semester**	**Number of ECTS credits**	**Class load**
	elective		10	2+0+4

STUDY PROGRAMME FOR WHICH IT IS ORGANIZED:
PhD in Sustainable Development, MARDS

Dependency by other subjects:
None

Objectives of studying this subject:
The main goals of this course is that postgraduate students understand the basics concepts of IoT ecosystems and use gained knowledge in the analysis and synthesis of a IoT ecosystems in different applications.

Contents of the subject (teaching units, forms of students' individual work, forms of testing) presented per working weeks in the academic calendar:

Preparatory week	Interview and survey of interested PhD students, the level of their knowledge related to the subject matter, the area of interest, skills they have, etc.
I week	Introduction to the IoT Ecosystems, overview and short history
II week	IoT development platforms.
III week	Sensing and embedding components.
IV week	Sensors: temperature, gyroscope, pressure, light, GPS and many others.
V week	RFID: RFID readers, RFID tags and smart labels, UHF RFID, RFID applications, RFID used inside a living body, benefits of RFID solutions.
VI week	Connectivity Layer: connectivity of devices, gateways, standards and protocols, cloud, user interfaces.
VII week	Analytics Layer: using data to derive important business insights and drive business decisions, predictive learning/ deep learning-based models, big data infrastructure based on the use case.
VIII week	Data Management Layer: acquiring, managing and manipulating large scale raw and processed data, cloud-based architectures, very large-scale organizations.
IX week	Edge IT: architecture of software and hardware gateways to pre-process raw data, collect the raw data from sensors, transformation of the raw data before sending it to the cloud servers.
X week	End Components: smart devices like smartphones, tablets, PDA, etc., connecting to the IoT computational engine through cloud applications and remote connectivity.
XI week	Security in the IoT ecosystem: surveying IoT security challenges, creating an IoT cybersecurity plan, best practices in managing IoT cybersecurity
XII week	Application examples: smart homes, smart cities, smart markets, agriculture applications, environmental applications, etc.
XIII week	Project task. Defining the project task in groups.
XIV week	Project task. Discussion.
XV week	Project task. Consultations.

Methods of education:
- Lectures,
- Practical lab work,
- Team and/or individual project,
- Presentation of acquired knowledge

Students' load

Weekly	**In semester**
10 credits x 40/30 = 13 hours and 20 minutes **Structure:** **2** hours of **lectures** **0** hours of **exercises** **4** hours of **practical work** 7 hours and 2**0** minutes of **individual work, including consultation**	**Lectures and final exam:** (13 hours and 20 minutes) x 15 = 200 hours **Necessary preparations before the start of the semester:** *(administration, enrolment, verification)* 2 x (13 hours and 20 minutes) = 26 hours and 40 minutes **Total subject load:** 10 x 30 = 300 hours

	Additional hours for preparing correction of final exam, including the taking of the exam: 300h - (226h and 40 minutes) = 73h and 20 minutes **Load structure:** 200 hours (Lectures) + 26 hours and 40 minutes (Preparation) + 73h and 20 minutes (Remedial classes)

Students' obligations during the teaching:

- regularly attends classes and exercises,
- realizes seminar papers or homework,
- team work,
- scientifically and methodologically performs exam obligations and systematizes appropriate material,
- independently completes the practical part of the exam (with the help of literature),
- presents the acquired knowledge and achieved results.

LITERATURE:

- *S. R. Sinha, Y. Park, Building an Effective IoT Ecosystem for Your Business, Springer, 2017.*
- *M. Yildiz, A Practical Guide for IoT Solution Architects: Architecting secure, agile, economic, highly available, well-performing IoT Ecosystems, S.T.E.P.S. Publishing Australia, 2019.*
- *A. Salam, Internet of Things for Sustainable Community Development: Wireless Communications, Sensing, and Systems, Springer, 2019.*
- *G. Colbach, RFID Handbook: Technology, Applications, Security and Privacy, independently published, 2018.*
- *N. Lekić, Z. Mijanović, Identifikacioni sistemi i primjene u zdravstvu, BioEMIS (530417-TEMPUS-1-2012-1-UK-TEMPUS-JPCR) Edition, Podgorica, 2016*

Learning outcomes (complied with the outcomes for the study programme): Demonstrates a theoretical and practical knowledge and understanding of:

- principles of IoT ecosystems,
- structure of the IoT ecosystems,
- security challenges into the IoT ecosystems,
- cases in which IoT ecosystems can be successfully applied,
- structure of a particular IoT system,
- how to apply IoT ecosystems

Forms of tests and evaluation:

- *Seminar-colloquial work,*
- *project*

Name and surname of teacher and associate:

Prof. dr Nedjeljko Lekic

Particularities needed to be emphasized for the subject:

With cetain modification, the course is also recommended for a lower form of study (MSc)

Note (if needed):