Last update: 24-05-2016

340609 - XACO-R2O44 - Communication Networks

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering

Teaching unit: 744 - ENTEL - Department of Network Engineering

Academic year: 2016

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Teaching unit Compulsory)

ECTS credits: 5 Teaching languages: Spanish

Teaching staff

Coordinator: Jordi Mataix Oltra

Others: Jordi Mataix Oltra

Opening hours

Timetable: Monday : from 18 to 19h.
Friday: from 18 to 19h. Room: D-171
And linking to the CAMPUS ATENEA and by e-mail: jordi.mataix@upc.edu

Degree competences to which the subject contributes

Specific:

1. CEV03 - Analyze and evaluate the different protocols and wireless networks in the field of robotics and automated systems
5. CB10 - Skills that enable to continue studying in a way that should be self-directed and autonomous

6. CB7 - Students can apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
7. CB8 - Students will be able to integrate knowledge and handle complexity and formulate judgments from a incomplete or limited information, including reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments
8. CB9 - Students can communicate their conclusions, knowledge and rationale underpinning these, to skilled and unskilled public in a clear and unambiguous way
9. CC08 - Acquire concepts and techniques related to quantitative and experimental methods for analysis and decision making

Transversal:

2. EFFECTIVE USE OF INFORMATI0N RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
3. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

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Teaching methodology

Main topics will be introduced by the professor as a lecture in the classroom, not only exposing the daily topic orally, but using all type of docent material as well, ie. Slides, multimedia material, web searches, and so on. Students will also participate in the development of the class by solving precisely determined exercises, short talks concerning the topics being explained and discussions of up-to-date information from technical medias and/or daily press or magazines.
Some collaborative activities will also be programmed to foster the team work among students, active techniques such as problem based learning and/or collaborative learning will be used for a suitable topic that requires such techniques rather than oral expositions.

Learning objectives of the subject

This course is introductory to the topics related with data networking by focusing on the TCP-IP protocols suite. Internet allows the interconnection of computers, devices, sensors and in general electronic devices to run distributed applications; and to control, configure, in other words, to allow remotely the automatization of any industrial process. Furthermore, the new paradigm well known as the "Internet of Things aims to literally have everything imaginable connected to a network so that information from all these connected "things" can be stored, transferred, analyzed and acted upon in new and, usually automated, ways via network connections with everything else. Knowledge of industrial networks and fieldbuses will also be given; control facilities and study protocols in real time.
Topics addressed in this course provide insight into the networks operation, by applying a top-down approach; from the application till the network layer. And, finally some effort should be devoted to analyze networks, either fix or mobile, which interconnect communication equipments and end user devices.

Study load

Total learning time: 125h	Hours large group:	22h 30m	18.00%
	Hours medium group:	0h	0.00%
	Hours small group:	22h 30m	18.00%
	Guided activities:	0h	0.00%
	Self study:	80h	64.00%

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Content

- Topic 1: Networks of communications. Internet.

Learning time: 8h

Theory classes: 3h
Guided activities: 1h
Self study : 4h

Description:
Concepts. Telematics. Internet. Network components. Fundamental parameters. Classification of networks. Switching. The delay in communications.
Architecture of a computer network. ISO OSI model. Functions of the entire network. Networking. Internet. The Internet protocol stack. Architecture TCP / IP.

Related activities:
Transmission problems and network delays.

- Topic 2: The Application and transport layers

Learning time: 8h

Theory classes: 3h
Guided activities: 1h
Self study : 4h

Description:
Application Level. WEB application. Http protocol. Name resolution.
Transport layer. UDP protocol. TCP protocol. Format segment. Control packet error. Flow control. Congestion control. Sequence number, transmit and receive windows.

Related activities:
Transmission problems and network delays.

- Topic 3: The Network layer

Learning time: 8h

Theory classes: 3h
Practical classes: 1h
Self study : 4h

Description:
Network level. IP. IP Addressing. Routing. IP packet format. IP header. Fragmentation. ICMP. IPv6.

Related activities:
Transmission problems and network delays.

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- Topic 4: Level data link. LANs.

Learning time: 9h

Theory classes: 4h 30m
Guided activities: 3h
Self study : 1h 30m

Description:
Level data link. Lattice. Data link protocols. Control of bit errors. LAN. LANs elements and standards. Media Access Protocols MAC. Logical Link Control LLC. IP over a LAN packets. ARP.

Related activities:
Problem solving

- Topic 5: Ethernet and interconnection networks.

Learning time: 9h

Theory classes: 3h
Practical classes: 1h 30m
Self study : 4h 30m

Description:
Ethernet. Frame format. Ethernet physical layer. Architecture, services and types. Fast Ethernet and Gigabit Ethernet.
Interconnection equipment. Hubs. Bridges. Switches. Routers. Gateways. Congestion LAN segmentation, switching. Switched LAN. VLANs.

Related activities:
Problem solving

- Topic 6: Industrial networks

Learning time: 14h

Theory classes: 3h
Guided activities: 4h
Self study : 7h

Description:
Industrial Communications Networks. Features. Hierarchies. Traffic. Real-time communications. Control of building services.

Related activities:
Workgroups. 12h
Draft. Design and specification of an implementation of an industrial network to a manufacturing, industrial process or control of a facility

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Topic 7 Fieldbuses	Learning time: 14h Theory classes: 3h Guided activities: 4h Self study : 7h

Description:
CAN. EIB. PROFIBUS. Ethernet Industrial. PROFINET.

Related activities:
Workgroups. 12h
Draft. Design and specification of an implementation of an industrial network to a manufacturing, industrial process or control of a facility

Topic 8 Real Time protocols	Learning time: 14h Theory classes: 3h Guided activities: 4h Self study : 7h

Description:
Formal especification of real time protocols. Extended Finites States Machine. Petri Nets.
Estudy of bus token pass protocol IEEE 802.4.

Related activities:
Workgroups. 12h
Draft. Design and specification of an implementation of an industrial network to a manufacturing, industrial process or control of a facility

Qualification system

The final mark will be the result of the average of the activities undertaken by the student throughout the course:
- Theory : The theoretical concepts related with the subject acquired by the student by individual study and by any other learning activity performed mainly in the classroom. They will be assessed by appropriate written exams or tests. Precisely there will be two main written exams as detailed below:
* A partial exam, named CONTROL , at the middle of the course
* and the final exam at the end of the semester, named Aval Final.
Work : The practice tasks performed at the laboratory will be assessed according some parameters: personal attitude, task developed, attendance to the lab sessions and the result of the final test to be done once the task is finally delivered.

Regulations for carrying out activities

As usual exams or tests:
- there will be held in the classroom
- They will last between 1 and 2 h.
- They include theoretical questions as well as problems to be solved realted to the topics.

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Bibliography

Basic:

Kurose, James F.; Ross, Keith W. Redes de computadores. Un enfoque descendente basado en Internet. 5a ed. Madrid [etc.]: Pearson, 2010. ISBN 9788478291199.

Stallings, William. Comunicaciones y redes de computadores. 7a ed. Madrid [etc.]: Pearson Educación, 2004. ISBN 8420541109.

Comunicaciones industriales : principios básicos. Madrid: UNED, 2007. ISBN 9788436254600.