Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Automation and Supervision Networks

1.2. Scientific area acronym

EE

1.3. Duration

Campo alfanumérico (100 carateres).

1.4. Total of Working Hours

Campo alfanumérico (100 carateres).

1.5. Contact hours

Campo alfanumérico (100 carateres).

1.6. ECTS

Campo alfanumérico (100 carateres).

1.7. Observations

Campo alfanumérico (1.000 carateres).

2. Responsible Academic staff and lecturing load in the curricular unit (enter full name)

Maria da Graça Vieira de Brito Almeida	3h

3. Other academic staff and lecturing load in the curricular unit

Armando José Leitão Cordeiro Mafalda Maria Morais Seixas	1,5h 1,5h

4. Learning outcomes of the curricular unit

After completion of this course the students should be able to: - Explain the capabilities and limitations of signal encoding methods, media access rules and error control methods used in fieldbuses; - Critically analyze the essential characteristics of various data communication networks used in automation and interpret their specification documents; - Experimentally develop SCADA applications using professional software and digital image processing

5. Syllabus

-Understanding signal transmission and digital communication; signal encoding; transmission capacity of a channel; error control; linear and polynomial codes; experimental testing of data communication protocols MODBUS and USS;
-OSI Model; topologies and special nodes of data networks; media access rules; protocols;
-Detailed study of some fieldbuses: CAN, Profibus, Sensor bus (As-I, interbus). Fieldbus Ethernet Networks: Profinet;
-Notion of Supervisory Control and Data Acquisition; architecture of a SCADA system; management of communication with peripherals, synoptic human-machine interfaces;
- Development of applications using a professional SCADA software;
- Study of automation solutions and communication networks applied to energy management and technical management of buildings (Smartpanels);
- Artificial vision. Image proccessing: Basic operations, image pre-processing, and object recognition.

6. Demonstration of the syllabus coherence with the curricular unit's objectives

This course begins with an introduction to basic concepts in the field of digital communication up to the OSI model. Simultaneously the experimental practice with industrial protocols Modbus and USS is promoted to recognize some of the concepts. Then a detailed study of some fieldbuses with real impact in industrial automation is undertaken, making an extensive use of concepts previously studied. Laboratory demonstration of as-i and interbus sensor and actuator networks. The experimental training with an integrated system complements the objective of mastering automation fieldbuses. The study of the concepts *digital image processing and* supervisory control and the structure of SCADA systems, complete another important aspect of today automation.

7. Teaching methodologies (including evaluation)

The Theoretical part (T) is presented along the semester and individually evaluated at the end by a written test. A final exam is also available for the students but is restricted to the theoretical part and does not avoid attending and getting approval on the others.
The Theoretic-Practical (TP) part concerning SCADA, digital image processing and practical tests using communication protocols and a Profibus plus As-i network structure.
The Laboratory part (L) consists of practical tests. The written reports are subject to individual oral scrutiny to achieve the corresponding evaluation.
The final grade results from simple average of the grades obtained by F = 0,5*T + 0,5*L. It is mandatory that the grade in each part is at least 9,5 in a range of 0-20.

8. Demonstration of the coherence between the teaching methodologies and the learning outcomes

The theoretical part is devoted to the development of skills on the fundamental concepts of digital communication networks as well as on the essential features of a set of fieldbuses and LAN networks with importance in today automation.
The theoretic-practical and practical parts are devoted to developing the skills of designing supervision systems by training with a professional SCADA environment, digital *image* processing *and* devoted to the development of skills of using industrial protocols for data communication between devices and in the parameterization of more complex fieldbus systems.

9. Bibliography

- Palma, J., Introdução às Redes de Campo de Automação, Folhas de Apoio, ISEL, 2004.
- Jordan, J., Serial Networked Field Instrumentation, Wiley, 1995.
- Mahalik, N., Fieldbus Technology: Industrial Network Standards for Real-Time Distributed Control, Springer, 2003.
- Boyer, S. A., SCADA: Supervisory Control and Data Acquisition, ISA, 2nd. Ed., 1999.
- Halsall, F., Data Communications, Computer Networks and Open Systems, Ad.-Wesley, 1996.
- Weigmann,J., Kilian G., Decentralization with profibus-dp : architecture and fundamentals, configuration and use with SIMATIC S7 , Verlag : Publicis MCD, 2000.
- Gonzalez, R. C., Woods R. E.,Digital image processing using Matlab, Prentice Hall, 2004.