AS-74.3199 Wireless Automation

Exam 11th of January 2012

Answer all the questions. The answer with the least points may be substituted by the points you have from the optional homework (max. 6 points). You can get a maximum of 6 points from each question in the exam (total 36 points).

You can answer in Finnish, Swedish or English.

1. Explain the following concepts (1 p / concept)
    a. Frequency modulation
    b. Jitter margin
    c. Sensor network
    d. Time division multiple access (TDMA)
    e. Service Level Agreement (SLA)
    f. Message Integrity Code (MIC)
2. Security in wireless automation
    a. Is security important in wireless automation? Why/why not? How much security is needed really? (4 p)
    b. Describe some security methods that can be applied for wireless automation. Take as examples the methods used by TinySec or WirelessHART. (2 p)
3. What are the differences between a wireless sensor network (WSN) and a wireless control system (WNCS)? Explain the special properties and requirements of a WNCS compared to other applications using wireless networks? (6 p)

Turn the page!

4. Wireless communications

    a. Explain the reasons for signal modulation and describe some signal modulation technique. What is the tradeoff when selecting the number of bits per symbol? (2 p)

    b. Classify the communication receivers ("radio technologies") available for short, medium and long distance wireless communications in automation? Evaluate their properties from the wireless automation system point of view, that is, which technologies are suitable and why? In which parts of the wireless automation system each technology chould be used and why? (4 p)

5. Practical constraints of wireless control systems

    a. Mention three limitations per category that are present in the wireless control systems (3 p)

        i. Wireless node hardware

        ii. Wireless communication

        iii. Control

    b. Take one limitation from every category and describe some methods to reduce the impact of the limitation. (3 p)

6. Why wireless automation? What are the advantages of *wireless* sensors in automation? What components does the wireless automation system compose of? Compare to a regular wired automation system. What are the advantages, disadvantages and problems comparing wired to wireless systems? (6 p)