AS-74.3199 Wireless Automation

Exam 9th of January 2013

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. Feedback in control

    b. Jitter margin

    c. Symbol rate

    d. TinySec

    e. Quality of Service

    f. Wireless Sensor Network

2. Security in wireless automation

    a. Describe some security methods that can be applied for wireless automation. Take as examples the methods used by TinySec or WirelessHART. (3 p)

    b. Temperature measurements are transmitted wirelessly in a factory. What security techniques are needed? What security do the factory operators want? (3 p)

3. How to design a wireless control system? Describe what you have learned during the course of the issues to take into account in designing a wireless control loop. How would you design and test it in practice? (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 could 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. You are a technical sales representative from the company "Wireless Sensor Systems". You visit a paper mill with the intent to sell your wireless sensor products. Present the advantages of *wireless sensors* in automation for the paper mill executives? What components does a wireless automation system compose of? What devices from your (hypothetical) product line would you recommend for the paper mill? (6 p)