AS-74.3199 Wireless Automation

Exam 14th of May 2010

Answer all the questions. The answer with the least points will be substituted by the points you get from the 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. Carrier Sense Multiple Access (CSMA)
    b. Control
    c. Data fusion
    d. Frequency hopping
    e. Message Authentication Code
    f. Wireless Sensor Network
2. Discuss briefly the following topics
    a. Sleep mode of a wireless node. When is it used? Why is it important? Mention some methods to increase sleeping? (3 p)
    b. Is security important in wireless automation? Why/why not? (3 p)
3. Wireless automation
    a. What are the advantages and disadvantages of *wireless* sensors in automation? Consider the installation and operation aspects. (3 p)
    b. What are the differences between a wireless sensor network (WSN) and wireless control? Explain the special properties and requirements of a wireless control system compared to wireless sensor networks applications? Consider these differences at least from MAC, reliability and real-timeliness, and system design points of view. (3 p)

Turn the page!

4. Network type and communication properties. Describe the differences between WirelessHART, Zigbee and GPRS from the wireless automation viewpoint. In which kinds of applications could they be applied?

5. The industry is conservative and will not adopt wireless control before some fundamental problems are solved. Name three of these "show stoppers", explain what the problems are, and why it is important to solve these before widespread deployment in the industry. (6 p)

6. Mote programming and operating systems. Take e.g. TinyOS and FreeRTOS/NanoStack as examples.

    a. Describe the services of a sensor node operating system and a network protocol stack. (2 p)

    b. Assume you are developing a program for a wireless sensor network at the application layer. You write a command to transmit a packet with some data in it. What exactly happens, when this command is executed? Describe the operations done at different layers, both at the transmitter and receiver node. What functionalities do the different layers offer? (4 p)