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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION ENGG.)

END SEMESTER DEGREE EXAMINATIONS, JANUARY - 2021

SMART SENSORS [ICE-4305](OPEN ELECTIVE)

TIME: 3 HOURS 06-02-2021 MAX. MARKS: 50

Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.*

1A. What are the four important features that differentiates a smart sensor from normal sensor? Explain the different generation of smart sensors with supporting diagrams.

1B. What is linearization in smart sensors? State the important advantage of regression based linearization technique over other linearization techniques. With supporting diagram, discuss the working details of regression based linearization technique.

1C. A sensor is used to measure the temperature of water. The full scale output voltage/current of this sensor is very small and hence a basic amplifier is used to amplify the signal received from the temperature sensor. However, after some time it was observed that measurement noise from nearby surroundings got merged with the sensor signal and was getting amplified along with sensor signal. This lead to a very poor quality output. A new amplifier replaced the old amplifier and the new amplifier ensured that only sensor signal got amplified and the noise effect was completely eliminated. Specify the two amplifiers used based on their performance. Mention the salient features of the new amplifier with a neat circuit diagram of the same.

(5+3+2)

2A. What is the need for having IEEE 1451 family of standards in smart sensors? How is the class 1 different from class 2 mixed mode IEEE 1451 standard? With neat diagram, explain the working flowchart of mixed mode IEEE 1451 standard.

2B. Which is the industrial standard software interface that is developed by amalgamation of industrial supply companies to provide high degree of application compatibility during the exchange of data? What are its salient features? Discuss the different types of this industrial standard.

2C. Differentiate between the two communication topologies of Process Control Network (PCN).

(5+3+2)

3A. What is Intelligent Transportation System and why is it needed in modern smart city set-up? With the help of diagram, explain different components of ITS and their working.

3B. With supporting diagrams, describe the working of remote emission sensing and remote keyless entry technologies.

3C. A surface scanning technique which was initially developed to be used at sub-nanoscale levels has found itself very good application in surface measurement in molecular biology. Which is this technique? Describe the working of this technique.

(5+3+2)

4A
a) Describe the four types of faults that are usually present in any industrial process.
b) With the help of supporting graphs, explain the working of the two commonly used univariate charts for detection of faults in a process.

4B Assume that you are working in an automotive engine management system (EMS) where the data collected from smart-sensors at various part of the engine. This data may come with rich noise and hence, a robust filtering technique may be needed for accurate extraction of features from time and frequency domain simultaneously. Which filtering technique can be used here? How is this filtering technique different from its predecessors? State the salient features of this filtering technique and describe its working principle.

4C With the help of block diagram, highlight the important features of 8 to 16 channel Ethernet based smart sensor.

(5+3+2)

5A With neat diagram, explain the smart home automation technology.

5B How is the Wireless Sensor Networks technology (WSN) different from Internet of Things (IOT) technology? Describe in brief any six important factors which effect the performance of WSNs.

5C Describe the working of the digital communication technique that was developed by IBM company for providing low-cost and packet switched data service.

(4+4+2)

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