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J 3333

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Sixth Semester

Mechatronics Engineering

MH 1353 — DESIGN OF MECHATRONICS SYSTEM

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State any two integrated design issues in Mechatronics.

2. Mention any one device used for transferring information from machine to man and vice versa in a mechatronic product.

3. Specify how overframing problem can be solved in a real time data acquisition and control system.

4. List the components required for real time interfacing.

5. State the functions of Triac Opto isolator in pick and place robot.

6. State the purpose of configuring a strain gauge as a wheat stone bridge circuit.

7. Name a method that is often employed to remove noise while acquiring data through thermocouple.

8. Explain briefly the working of a pin ball tilt sensor.

9. Mention any one common technique used for defuzzification in fuzzy control system.

10. Define condition monitoring and specify the need.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Compare and contrast traditional design process with Mechatronics design process and state role of Mechatronics engineers. (8)

(ii) Specify the factors that should be considered in different types of design such as design for stiffness, design for manufacturing and maintainability. (8)

Or

(b) (i) Discuss in detail the advanced approaches in Mechatronics such as intelligent supervisory control structure and model based monitoring system. (8)

(ii) Specify few sources of risk in a system and main area of operator risk. (8)

12. (a) Discuss in detail the major components of a data acquisition and control system and their interconnections for a system with four sensors and two actuators.

Or

(b) A cantilever beam of length 'l' and rectangular cross section ('w' x 'h') is subjected to an arbitrary force F = f(t), (t is the time) acting at free end. Using strain gauge instrumentation, explain how the value of "F" can be acquired in real time, using a PC a GPIO card and a software such as Vissim/ Simulink/ Labview.

13. (a) (i) Explain how data on the magnitude of angular movement can be acquired in real time, if an incremental optical encoder is used as a sensor. The other components available are a PC, a GPIO card and software such as VisSim/Labview/Simulink. (8)

(ii) Explain how data on direction of angular movement is acquired while using an incremental optical encoder in real time. (8)

Or

(b) (i) Explain the process of real time calibration of a solenoid (displacement of the plunger vs force), choosing appropriate instrumentation and using a PC, a GPIO card and a software package such as VisSim/ Labview/ Simulink. (8)

(ii) List the hardware required for pneumatic controlled pick and place robot case study and draw its control circuit. (8)

14. (a) Design a De-icing temperature control system with essential hardware and describe the logic used in interfacing with virtual instrumentation software.

Or

(b) (i) Draw the block diagram of the entire engine management of a modern automobile. (10)

(ii) List the sensor requirement needed for the above mentioned system. (6)

15. (a) (i) What is fuzzy logic and explain the important elements that constitute a fuzzy logic system? (10)

(ii) State the role of fuzzy logic in the following products (6)

(1) Washing machine

(2) Hand held computer

(3) Elevator control.

Or

(b) (i) State the principle and applications of micro-flow and micro optical sensors. (8)

(ii) Explain the purpose of machine monitoring system and illustrate the procedure of wear behaviour monitoring. (8)

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