C 3322

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

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. Why are "Modelling and simulation" studies important for designing mechatronjc systems? State two important reasons.

2. What is "GUI"? Explain its relevance to mechatronic systems.

3. What are the three types of channels in an I/O cards?

4. Explain why 'buffers' are used in GPIO cards.

5. How is strain computed from the output of a four arm wheat stone strain gauge bridge?

6. List the essential components required for calibrating the force — displacement characteristic of solenoid.

7. State the sensor and actuator required to control the output water temperature of a mixing valve fed by two reservoirs supplying hot and cold water respectively.

8. Explain briefly the working of a Pin ball Tilt sensor.

9. State two advantages of "Fuzzy Logic System" over conventional control system

10. State one direct and one indirect sensing technique for tool wear monitoring.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State three major differences between the "conventional design process" and "mechatronic design process" (6)

(ii) What are the key elements that constitute a mechatronic product? (6)

(iii) Give four examples each of a mechatronic and non-meehatronic products. (4)

Or

(b) (i) Explain the various "Industrial Design" aspects to be incorporated in product design. (6)

(ii) List the requirements of a man — machine interfaces for a CNC machine. (5)

(iii) List the factor that has to be considered in system safety and explain them in detail. (5)

12. (a) (i) List five important specification to be considered while selecting a PC for real time interfacing for data acquisition in a given application. (8)

(ii) Explain the term "Overframing" with respect to real time interfacing and suggest two possible actions that may help in overcoming this problem. (8)

Or

(b) Draw a block diagram indicating all the necessary hardware and software units for real time data acquisition of an increasing vertical force acting at the free end of a cantilever beam. (16)

13. (a) Explain a testing method with the necessary hardware and software, to acquire data on the properties of materials used on the surface of a bridge. (16)

Or

(b) Explain a method with necessary hardware and software, to calibrate a proximity sensor working on eddy current principle. (16)

14. (a) Explain with necessary diagrams a mechatronic solution for automatically melting the ice formed on the lifting surfaces of commercial aircraft, using hot engine exhaust gas. (16)

Or

(b) (i) Draw the block diagram of the entire "engine management system" of a modem automobile. (8)

(ii) List the sensor requirements needed for the above mentioned system. (8)

15. (a) (i) Using a hierarchical control structure diagram, explain the different levels of control in an automated manufacturing plant. (8)

(ii) Explain how supervisory control can be made effective in optimising a machining process such as "Through-hole drilling". (8)

Or

(b) (i) Using an example, explain the difference between 'conventional logic' and 'Fuzzy Logic' (6)

(ii) Explain the important elements that constitute a fuzzy logic system. (6)

(iii) Explain the working principle of a micro humidity sensor. (4)
