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Question Paper Code : 50888

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth/Seventh Semester

Mechanical Engineering

ME 8791 — MECHATRONICS

(Common to Manufacturing Engineering/Mechanical Engineering
(Sandwich)/Mechanical and Automation Engineering/Production Engineering)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Is 3D printer a mechatronics product? Justify your answer.

2.   What is meant by LVDT? Mention its uses.

3.   Tabulate the difference between microprocessor and microcontroller?

4.   Draw the structure of port 1 pin in 8051 microcontroller.

5.   What are the operating modes of port A of 8255?

6.   Mention the need of keyboard interfacing in 8255 PPI.

7.   What are some common examples of mnemonics used in PLC programming?

8.   "PLCs are the most preferred controller for industrial automation". Justify
     your answer.

9.   Write down the applications of stepper motors.

10. How does engine timing, controlled in the mechatronic system?

PART B — (5 × 13 = 65 marks)

11. (a) Explain with a neat sketch, the working principle of different
          sensors/transducers used for measuring "Displacement" and
          "Temperature" quantities.

Or

(b) (i) Explain in detail the concepts of Mechatronics approach with a neat diagram (10)

(ii) Mention the need for Mechatronics system. (3)

12. (a) Draw the functional block diagram of 8051 microcontroller and explain the functions of each block.

Or

(b) (i) Draw the timing diagram for the instruction MOV A, B and calculate the time required to execute the instruction using 8085 microprocessor. (7)

(ii) Briefly explain the addressing modes of 8051 microcontroller with an example. (6)

13. (a) Explain the architecture of 8255 programmable peripheral interface and show how to configure P_A as input. P_B as output in MODE 1 when connected in memory mapped mode.

Or

(b) With schematic, explain the role of 8255 in I/O interfacing. Design interface logic to read the status of keys connected to Port A and display in LEDs connected to Port B when connected in Mode 0. The ports are I/O mapped with addresses 90 H, 91 H, 92 H and 93 H for P_A, P_B, P_C and control register respectively.

14. (a) Explain the architecture of PLC with a neat block diagram.

Or

(b) (i) Explain the operation of PLC with its scan cycle. (7)

(ii) Draw a PLC logic diagram to turn ON/OFF the chuck clamping mechanism of a CNC machine using a single footswitch. (6)

15. (a) Explain the purpose of the following mechatronic system and recommend the appropriate sensor and actuator to carry out the specified task.

Pick and place robot – purpose : pick and place robots are used in the manufacturing industry for tasks such as assembling, packaging, sorting and palletizing.

Or

(b) With a suitable case study discuss the purpose of the following mechatronic system and recommend the appropriate sensor and actuator to carry out the specified task.

Engine management system – purpose : to optimize the performance, efficiency and emissions of the engine.

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16. (a) Write a PLC program to implement the process illustrated in Figure 16. (a) The sequence of operation is to be as follows:

(i) Normally open start and normally closed stop pushbuttons are used to start and stop the process.

(ii) When the start button is pressed, solenoid A energizes to start filling the tank.

(iii) As the tank fills, the empty level sensor switch closes.

(iv) When the tank is full, the full level sensor switch closes.

(v) Solenoid A is de-energized.

(vi) The motor starts automatically and runs for 3 min to mix the liquid.

(vii) When the motor stops, solenoid B is energized to empty the tank.

(viii) When the tank is completely empty, the empty sensor switch opens to deenergize solenoid B.
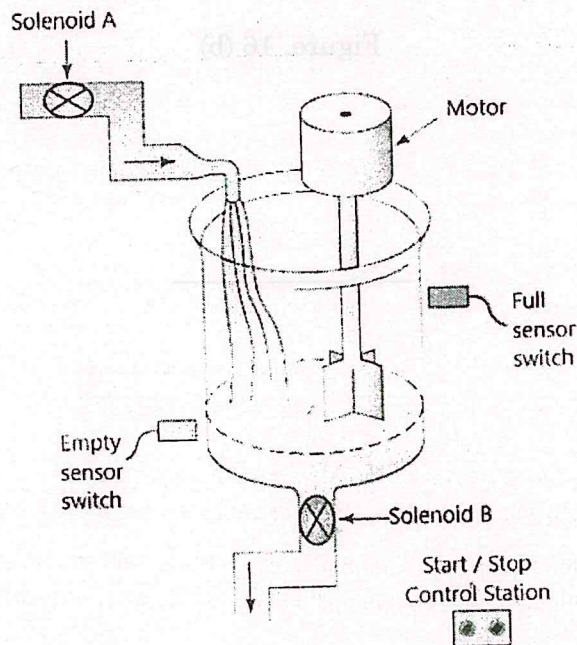

Figure. 16 (a)

Or

(b) Write a program to implement the process illustrated in Figure 16 (b). A company that makes electronic assembly kits needs a counter to count and control the number of resistors placed into each kit. The controller

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must stop the take-up spool at a predetermined amount of resistors (100). A worker on the floor will then cut the resistor strip and place it in the kit. The circuit should operate as follows:

(i)   A start/stop pushbutton station is used to turn the spool motor drive on and off manually

(ii)   A through-beam sensor counts the resistors as the pass by.

(iii)   A counter preset for 100 (the amount of resistors in each kit) will automatically stop the take-up spool when the accumulated count reaches 100.

(iv)   A second counter is provided to count the grand total used.
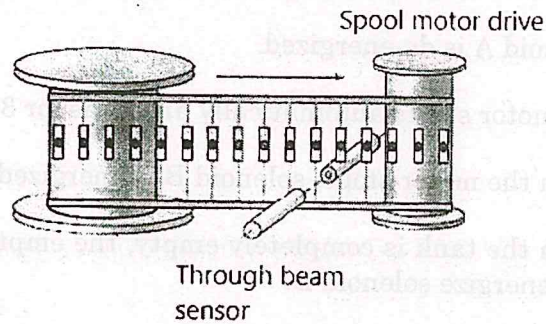
(v)   Manual reset buttons are provided for each counter

Figure. 16 (b)