Register Number: ………………………

B. E. DEGREE EXAMINATIONS: NOV/DEC 2010

Seventh Semester

MECHANICAL ENGINEERING

U07ME703: Mechatronics

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Which element in the measurement system takes the signal from the sensor and manipulates it into suitable condition for display?

   A. A Sensor   B. A Signal Conditioner   C. A Display System   D. A Scale

2. The capacitance 'C' of a parallel plate capacitor is given by,

   A. $C = \varepsilon_r\varepsilon_o d / A$ B. $C = \varepsilon_r A d / \varepsilon_o$ C. $C = \varepsilon_r\varepsilon_o A / d$ D. $C = \varepsilon_o A d / \varepsilon_r$

3. The element, which converts the pressure energy into mechanical energy, in a hydraulic system is,

   A. Hydraulic pump   B. Electrical Motor   C. Control valve   D. Hydraulic Actuator

4. In a stepper motor 1 pulse produce 6°, then for one revolution how many pulses are required?

   A. 6 pulses   B. 36 pulses   C. 60 pulses   D. 360 pulses

5. The hydraulic inertance 'I' is defined as,

   A. $I = L.\rho / A$ B. $I = A.\rho / L$ C. $I = A.L / \rho$ D. $I = L.\rho.A$

6. The function of accumulator in the microprocessor is,
   A. To performing the data manipulation
   B. To temporarily store the data for an input to the ALU
   C. To determine the timing and sequence of operations
   D. To allow the CPU to keep track of its position in a program

7. The programming language for PLC is called as,
   A. C programming   B. Fuzzy logic programming
   C. Ladder logic programming   D. Simple Logic programming

8. In PLC, the meaning of the Mnemonic LDI is,
   A. Start a rung with an open contact   B. Start a rung with a closed contact
   C. Start a rung without any contacts   D. Start a rung with an open and closed contact

9. Conceptual stage in Mechatronics design process is,
   A. Analysis of the problem   B. Preparation of the specification
   C. Generation of possible solutions   D. Production of a detailed drawing

10. The temperature sensor used in car engine management system is,
    A. Thermocouple   B. Resistance temperature detector
    C. Bimetallic strip   D. Thermistor

PART B (10 x 2 = 20 Marks)

11. Differentiate between open loop and closed loop control systems.
12. Define the terms Range and Span of a transducer.
13. A pneumatic system is operated at a pressure of 1000 kPa. What diameter cylinder will be required to move a load requiring a force of 12 kN?
14. Write the principle involved in Solenoid type switches.
15. Write down the basic building blocks for mechanical and electrical models.
16. How does thermal resistance differ from fluid resistance?
17. How the PLC is different from mechanical Relays?
18. What is latching in PLC?
19. What are the stages in designing Mechatronics system?
20. State the principle of Oxygen sensor.

PART C (5 x 14 = 70 Marks)

21. a) (i) Explain the basic elements of a closed loop control system with the help of block diagram. (7)
    (ii) Explain the principle and operation of a LVDT with neat sketch. (7)

(OR)

   b) (i) What is measurement system? Explain the constitutional elements of measurement system. (7)
    (ii) Explain the working principle of Thermocouple sensor with neat sketch. (7)

22. a) (i) A hydraulic cylinder is to be used to move a work piece in a manufacturing operation through a distance of 50 mm in 10 sec. A force of 10 kN is required to move the work piece. Determine the required working pressure and hydraulic liquid flow if a cylinder with a piston diameter of 100 mm is available. (7)
    (ii) Explain the Specifications of a stepper motor in detail. (7)

(OR)

   b) Discuss about the following mechanical actuation systems:
       (i) Gear trains   (ii) Ratchet and pawl   (iii) Belt drives

23. a) Explain briefly building up models for the following systems:
       (i) Mechanical system   (ii) Electrical system   **(OR)**

   b) Discuss briefly the following controllers
       (i) PI controllers   (ii) PD controllers   (iii) PID controllers

24. a) (i) With the help of block diagram, explain the main components of a programmable logic controller. (6)
    (ii) What are timers? Explain the following arrangements of timers:
          1. Cascaded Timer   2.ON-OFF cyclic Timer (8)

(OR)

   b) (i) What are Down counters and Up counters? Illustrate the working of a counter with an example program. (8)
    (ii) What are the factors to be considered while selecting a PLC? (6)

25. a) Discuss the mechatronic aspects of an automatic Car-parking system with the help of block diagram depicting the electronic system.

(OR)

   b) Explain the each elements of a car engine management system with a neat block diagram.

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