

Total No. of Questions : 10]

P1302

SEAT No. :

[Total No. of Pages : 5

[4858] - 1018

T.E. (Mechanical) (Semester - II)

MACHATRONICS

(2012 Pattern) (End Semester)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

Q1) a) Temperature of a hot plate is to be measured using Thermocouple. For this, draw the set-up and explain the principle of working. **[06]**

b) From the block diagram in Figure 1, determine the transfer function: C/R. **[4]**

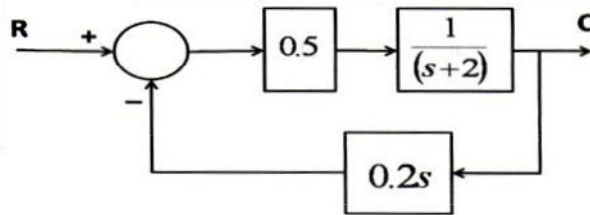


Figure 1

OR

Q2) a) A capacitive type proximity sensor is to be used for displacement measurement. Discuss the criterion for selection of this sensor. **[6]**

b) Discuss the role played by following four elements in a Mechatronic system: **[4]**

- i) Actuator
- ii) Sensor
- iii) Signal Conditioner
- iv) Digital Architecture.

P.T.O.

- Q3) a)** For a DAC that is converting a voltage level ranging 0 -12 V into a single byte of 6 bits, determine the equivalent decimal as well as analog values and complete Table 1 below. **[8]**

Table - 1

Digital	Decimal	Analog
010000	?	?
111110	?	?

- b) Draw a suitable block diagram to depict the principle of operation of open loop control. **[2]**

OR

- Q4) a)** In the process of sampling, define as well as discuss the importance of: **[8]**

- i) Sampling Theorem
- ii) Aliasing

- b) Write two distinct points of comparison between open loop and closed loop control system. **[2]**

- Q5) a)** Using suitable example, draw a ladder diagram and explain how Latching is implemented. **[8]**

- b) Write ladder logic for a simple traffic light controller for the following sequence of operations as below: **[8]**

Step 1: Turn Green ON for 35 seconds.

Step 2: Turn Yellow ON for 5 seconds,

Step 3: Turn Red ON for 40 seconds,

Step 4: Repeat the sequence i.e. Step 1-Step 2-Step 3.

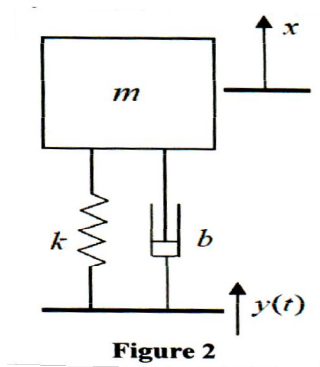
OR

- Q6) a)** Using suitable example, draw a ladder diagram and explain how timer is implemented **[8]**

- b) Discuss the role played by following four elements in a PLC: **[8]**

- i) Input Module
- ii) Memory
- iii) CPU
- iv) Bus.

- Q7) a)** For the system in Figure 2, assume m =mass=1kg, k =spring stiffness=2 N/m and b =damping=0.5 Ns/m. Also, x is the system output and y is the system input, Which is motion of the base on which the system rests.[10]



For this system:

- i) Determine the transfer function: $x(s)/y(s)$
 - ii) Identify the location of the Poles and zeros.
 - iii) Comment on the stability of the system
- b)** Draw suitable sketch to depict the unit step response of a second order system when: [6]
- i) System poles are negative and real
 - ii) System poles are complex conjugate pair with negative real part
 - iii) System poles are a imaginary pair with no real part

OR

- Q8) a)** Define the following terms: [6]
- i) Steady State Error
 - ii) Gain Margin
 - iii) Phase Margin
 - iv) Rise Time
 - v) Damping Frequency
 - vi) % Overshoot

b)

[10]

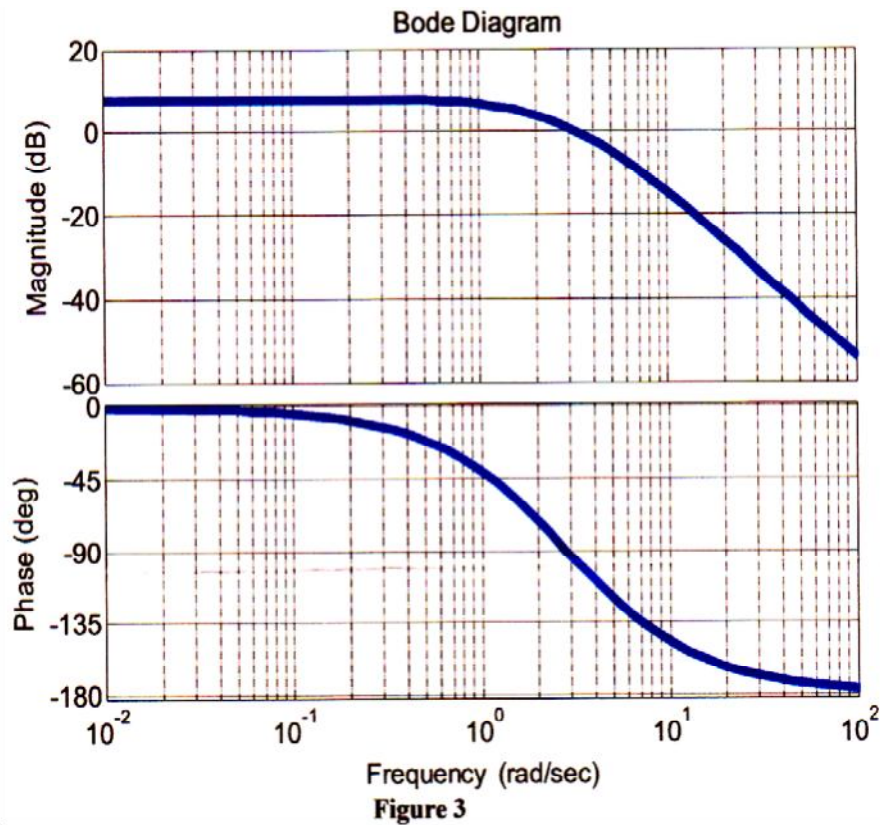


Figure 3

Estimate the approximate transfer function of a system. of which the bode plot is shown in Figure 3.

- Q9) a)** Figure 4 shows an error time graph. Sketch the PID controller (parallel form) output w.r.t time. Assume $K_p = 10$, $K_i = 2$, $K_d = 0.5$ and $P_o = 0$ i.e the controller output is zero when the error is zero. [10]

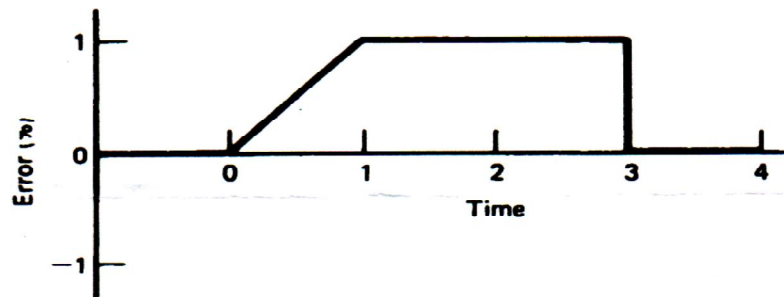


Figure 4

- b) A second order system is under damped. inherently. Discuss the step by step procedure for manual tuning of a PID controller so that the behavior of the system becomes that of a critically damped one. [8]

OR

Q10)a)

[10]

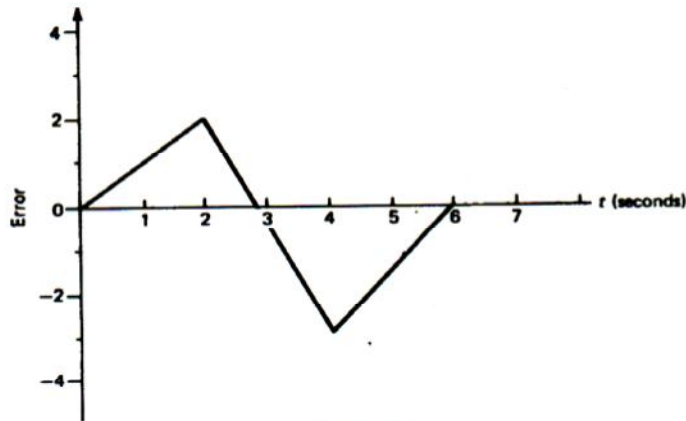


Figure 5

Figure 5 shows an error time graph. Sketch the PID controller (series form) output w.r.t time. Assume $K_p = 10$, $K_i = 2$, $K_d = 0.5$ and $P_0 = 0$ i.e the controller output is zero when the error is zero.

- b) Using a suitable block diagram explain the working of PID control in Parallel form. [8]

