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]**

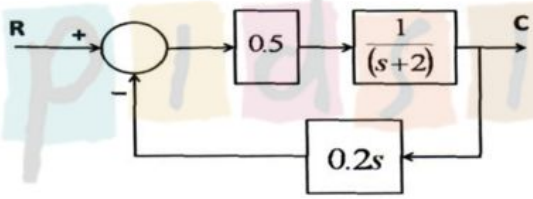

Figure 1

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.

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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=lkg. 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]**

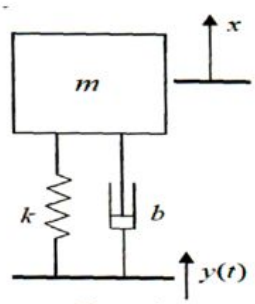

Figure 2

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

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b) **[10]**

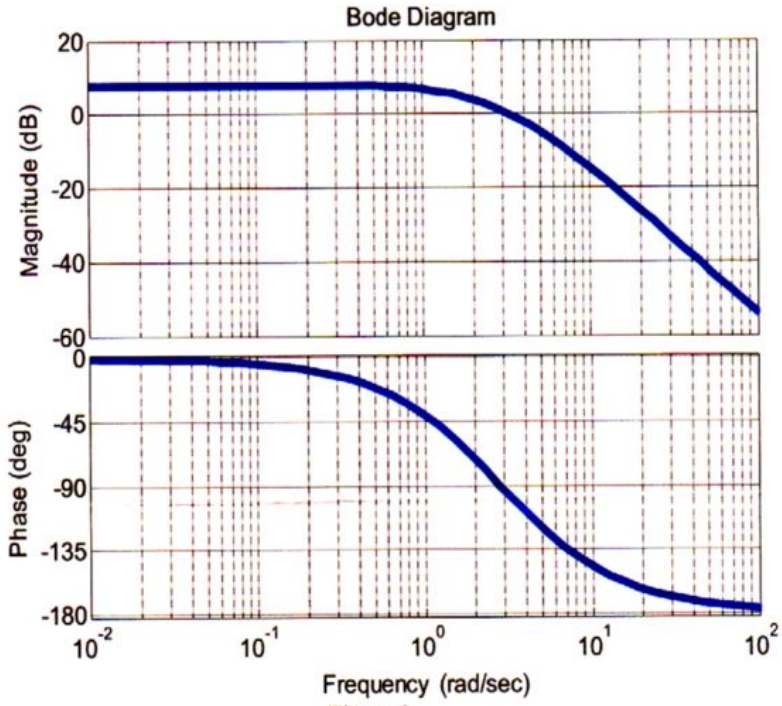

Figure 3

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

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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]**

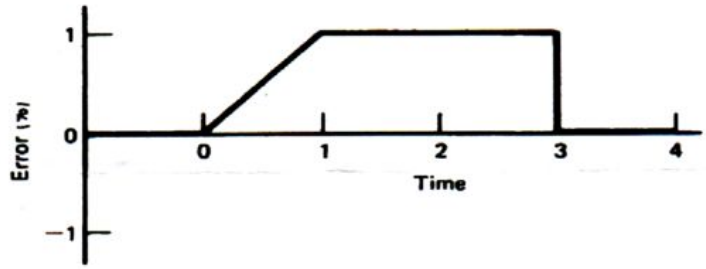

Figure 4

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]**

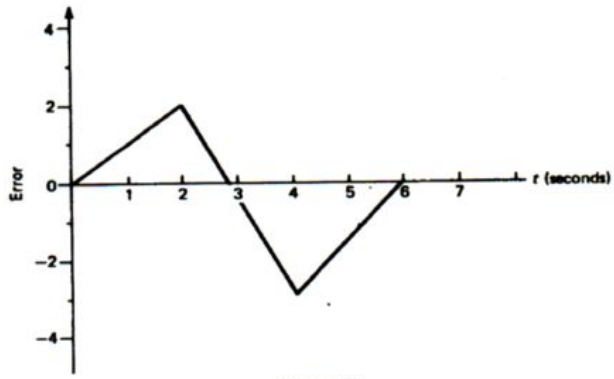

Figure 5

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]**

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