Total No. of Questions : 8]

SEAT No. :

PB-3900

[Total No. of Pages : 3

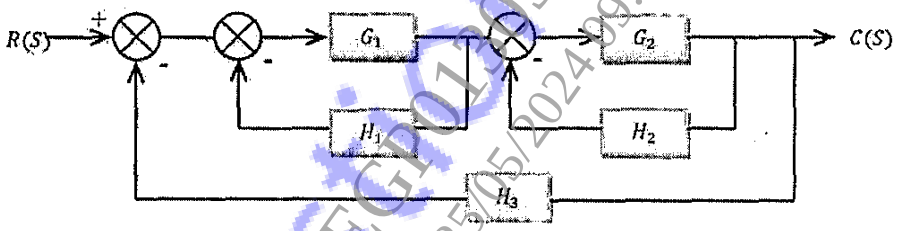
[6262]-165
T.E. (Mechanical/Mechanical Sandwich)
MECHATRONICS
(2019 Pattern) (Semester - I) (302044)

Time : 2½ 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.***
2) ***Neat diagrams must be drawn wherever necessary***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data wherever necessary.***
5) ***Use of electronic pocket calculator is allowed.***

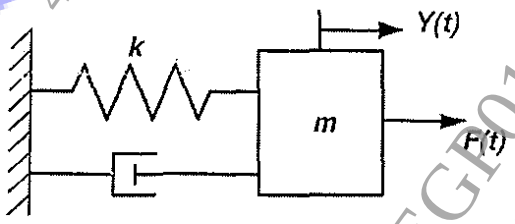
Q1) a) Find overall transfer function for following block diagram representation using block diagram reduction technique. **[10]**



b) Differentiate between open loop and closed loop control system. **[7]**

OR

Q2) a) For the System Shown in Fig. Assume m = mass =1 kg, k = stiffness = 2N/m, and d = damping = 0.5 Ns/m - Also, F- Force input in N and Y = Displacement output in m. For this system **[10]**



i) Derive transfer function Y(s)/ F(s)

ii) Identify the location of poles and zeros

iii) Comment on stability of the system.

b) Using a suitable block diagram explain the application of a closed loop control system in temperature control in household refrigerator **[7]**

P.T.O.

Q3) a) For The Transfer Function $G(s) = \dfrac{200}{s^2 + 2s + 200}$ Find Peak Time, Rise Time, Delay time, Settling Time **[10]**

b) Define the following terms and draw transient response mentioning following terms for second order mechanical system **[8]**

i) Delay Time

ii) Rise Time

iii) Peak Time

iv) Peak Overshoot

v) Settling Time

OR

Q4) a) The transfer function of a system is $\dfrac{C(s)}{R(s)} = \dfrac{1}{(s + 3 + 7j)\,(s + 3 - 7j)}$

Draw the pole zero plot and Find Following for Unit Step input **[10]**

i) Damping Ratio

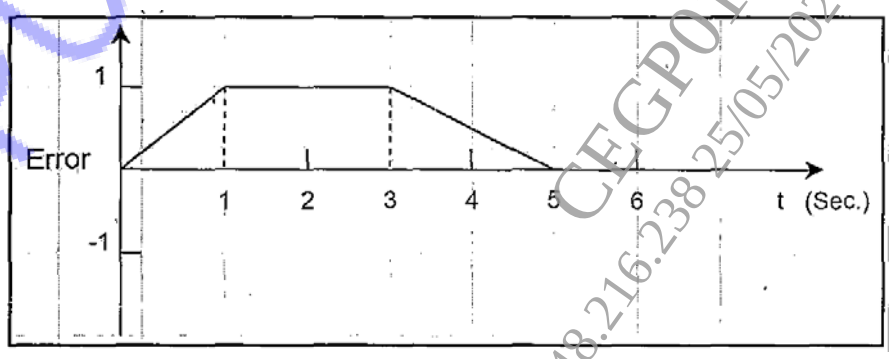
ii) Damped Natural Frequency

iii) Settling Time

iv) Peak Time

b) Differentiate time response analysis and frequency response analysis. **[8]**

Q5) a) Fig. shows an error time graph sketch PD Controller Output w.r.t. time Kp=5, Kd=0.5 %/sec. and P(0)30 %. **[10]**



b) Draw a suitable diagram and derive equation of PID(Proportional, Integral and Derivative) Controller Output in parallel form **[7]**

OR

Q6) a) The equation of error is $e_r = 0.5\ t+0.03t^2$. With $K_p = 5$, $K_D = 0.5$ and P(0)=50 %. Sketch the graph of the controller output Vs time for proportional derivative controller (Parallel Form) From t = 0 to t=2 sec. **[10]**

b) Using Suitable block diagram, Explain the working of PI Controller with its advantages. **[7]**

Q7) a) Develop ladder diagram to meet Following Objectives **[10]**

Given 2 push to ON buttons(PB1, PB2) Red and green lamps,

i) When PB1 is pushed, RED lamp should be ON and it will continue to be ON till PB2 is pushed.

ii) When PB2 is pushed GREEN lamp should be ON and it will continue to be ON till PB1 is pushed.

iii) if PB1 and PB2 both are pushed simultaneously both light should be OFF

b) Draw a suitable block diagram and explain architecture of a PLC. **[8]**

OR

Q8) a) Given four normally open switches (P1, P2, S1 & S2), with DC motor (M) write a PLC Program to satisfy following objectives. **[10]**

i) When P1(Start Button) is pushed the Cycle Shall Start. The Cycle Shall continue to remain ON until P2(Stop Button) is pushed.

ii) When S1 is pushed and S2 is not pushed then Motor is ON clockwise direction.

iii) When S2 is pushed and S1 is not pushed then Motor is ON in counter clockwise direction.

iv) When P2 is pushed the program stops.

b) Write a short note on following in context with PLC : **[8]**

i) Counters

ii) Latching