Total No. of Questions : 8]

SEAT No. :

**PF5025**

[Total No. of Pages : 3

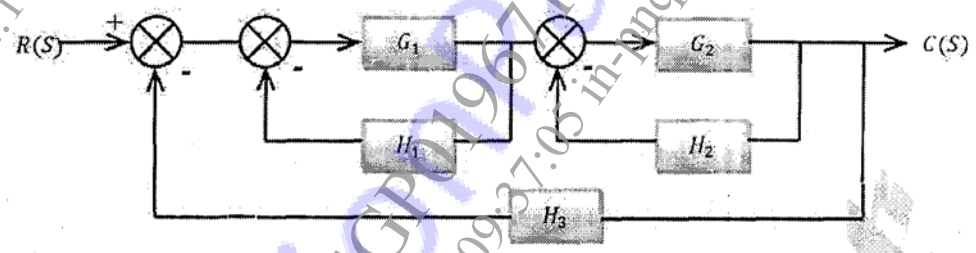
# [6626]-163
## T.E. (Mechanical) (Mechanical Sandwich)
## MECHATRONICS
## (2019 Pattern) (Semester - V) (302044)

*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.*

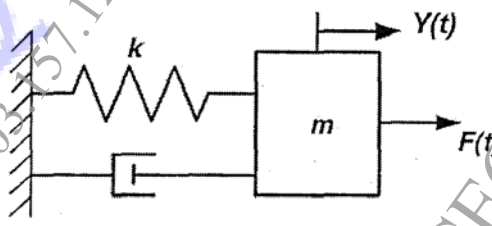
***Q1)*** a) Find overall transfer function for following block diagram representation using block diagram reduction technique. **[10]**




b) Discuss significance of transfer function approach when modeling mechanical system. **[7]**

OR

***Q2)*** a) For the System Shown in Fig. Assume m=mass=l 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) Explain any feedback control system with the help of a block diagram. **[7]**

***P.T.O.***

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***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) With suitable diagram, explain transient response specifications for second order System. **[8]**

OR

***Q4)*** a) The transfer function of a system is $\dfrac{C(s)}{R(s)}=\dfrac{1}{(s+3+7j)(s+3-7j)}$. **[10]**

Draw the pole zero plot and find following for unit step input

i) Damping Ratio

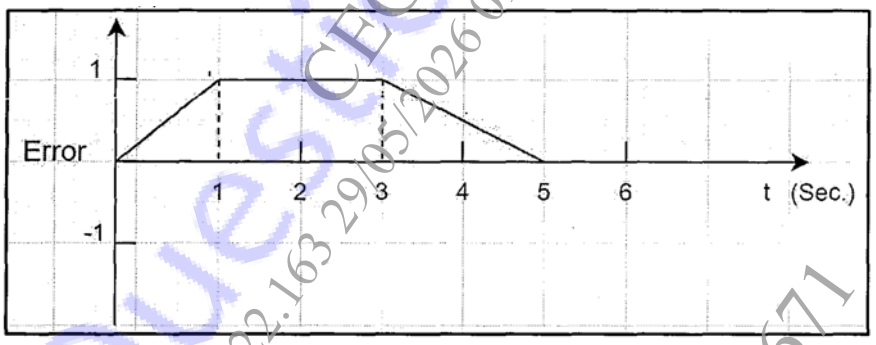
ii) Damped Natural Frequency

iii) Settling Time

iv) Peak Time

b) Write a short note on gain margin and phase margin. **[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 $e=0.5\ t+0.03t^2$. 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]**



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b) Using suitable block diagram, explain the working of PD 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 PB1and 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 Sl 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) Latching

ii) Timers





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