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Subject	=	Contool Tech.
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Date	=	23/9/20

Q=1 $G(s) = 500(s+2)(s+5)/(s+8)(s+10)(s+12)$

sol: First verify the closed-loop system is stable.

$K_p = \lim_{s \to 0} G(s) = \frac{500 \times 2 \times 5}{8 \times 10 \times 12} = 5.208$

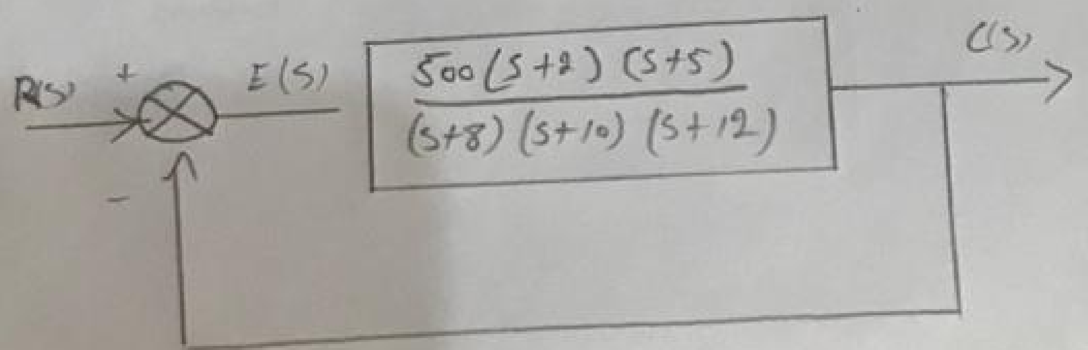
$K_v = \lim_{s \to 0} sG(s) = 0$

$K_a = \lim_{s \to 0} s^2 G(s) = 0$

Thus for step I/P,

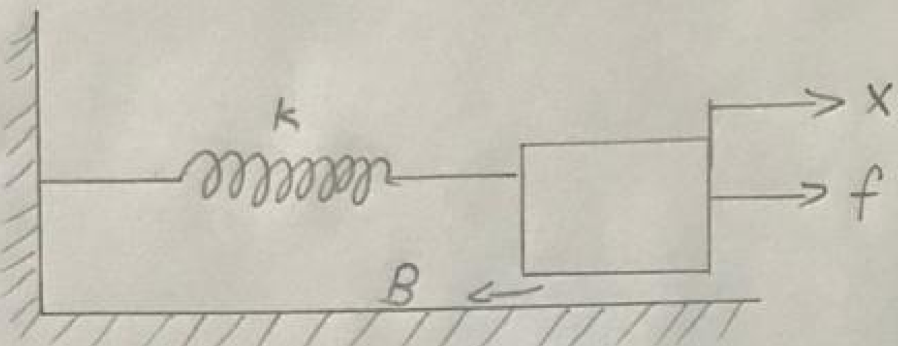
$e(\infty) = \frac{1}{1+K_p} = 0.161$

For ramp IP $e(\infty) = \frac{1}{K_v} = \infty$



Q = 2

For The following mechanical system find The Transfer system.



resisting force

① inertia force $= f_M = M \frac{d^2x}{dt^2}$

② spring force $= f_k = kx$

③ Damping force $= f_B = B \frac{dx}{dt}$

adding

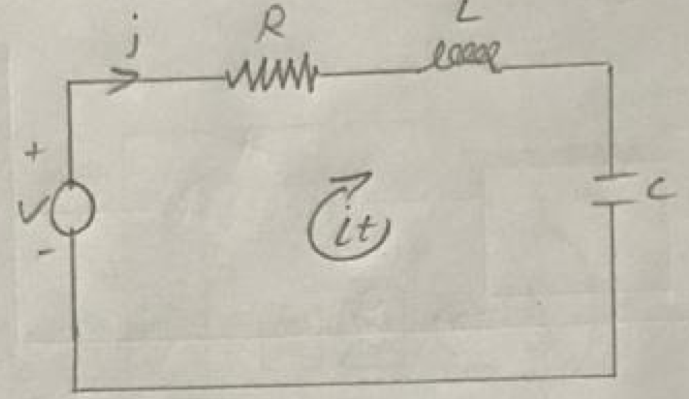
$$M \frac{dx^2}{dt} + B \frac{dx}{dt} + kx = f$$

$$\frac{X(s)}{f(s)} = \frac{1}{Ms^2 + Bs + k}$$

P-T-O

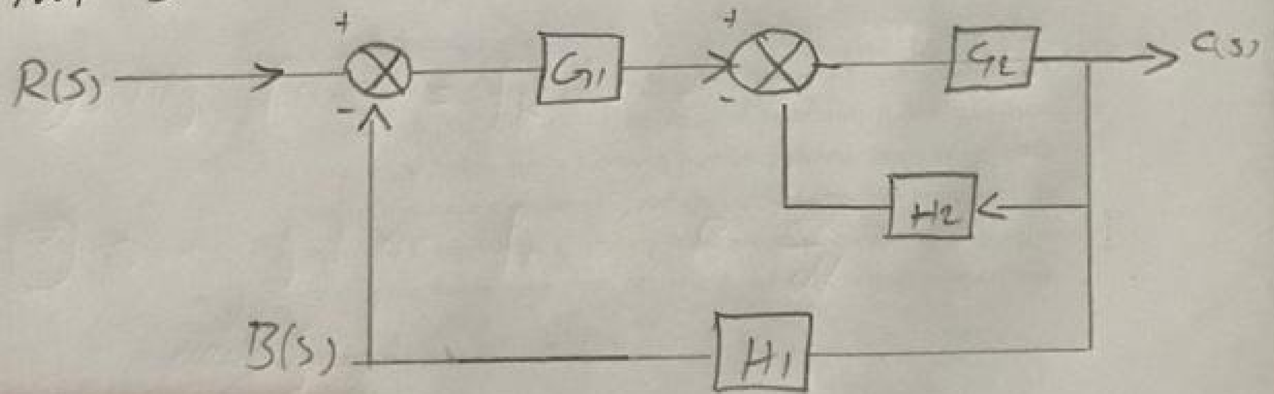
Mechanical into electrical Domain

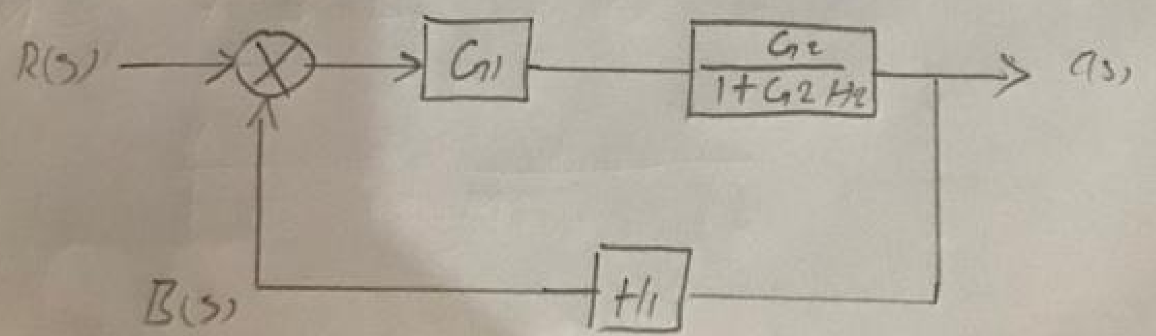
$$L \frac{d^2 q(t)}{dt^2} + R \frac{dqt}{dt} + \frac{qt}{c} = V$$

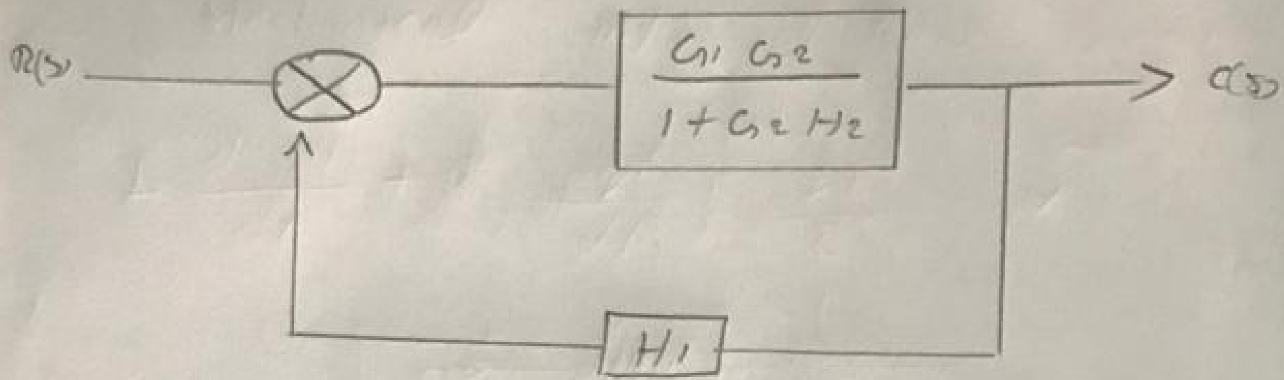


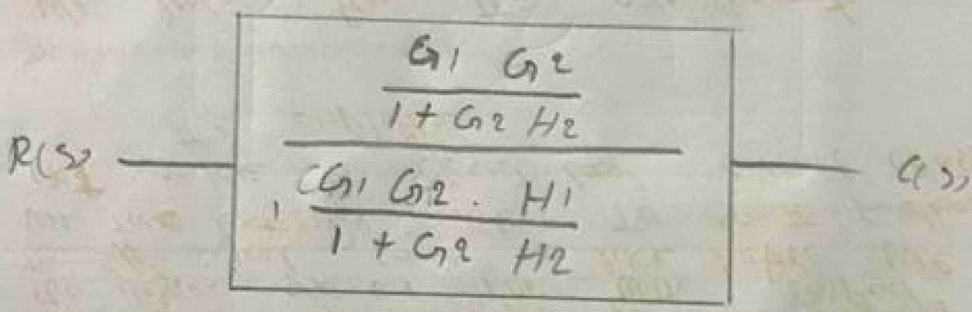
Q 2
Part B

Find overall Transfer function







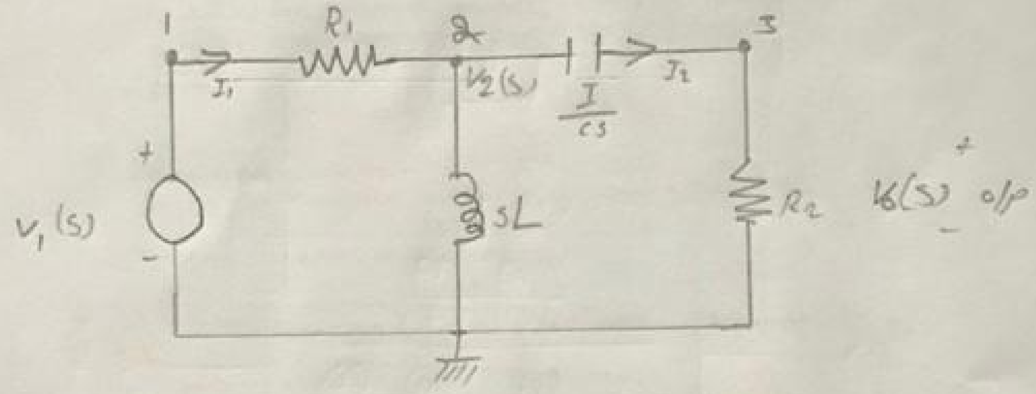


$$\frac{C(s)}{R_s} = \frac{G_1 G_2}{1 + G_2 H_2 + G_1 G_2 H_1}$$

Ans

Q = 3
Part # A

Construct The (SFG) of The following.

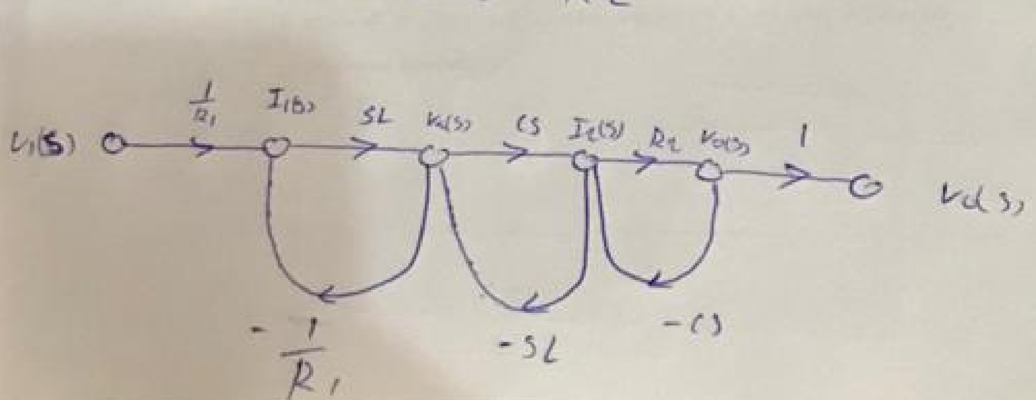


$$I_1(s) = \frac{V_1(s) - V_2(s)}{R_1}$$

$$V_2(s) = \left[I_1(s) - I_2(s)\right] SL$$

$$I_2(s) = \left[V_2(s) - V_0(s)\right] CS$$

$$V_0(s) = I_2(s)\ R_2$$

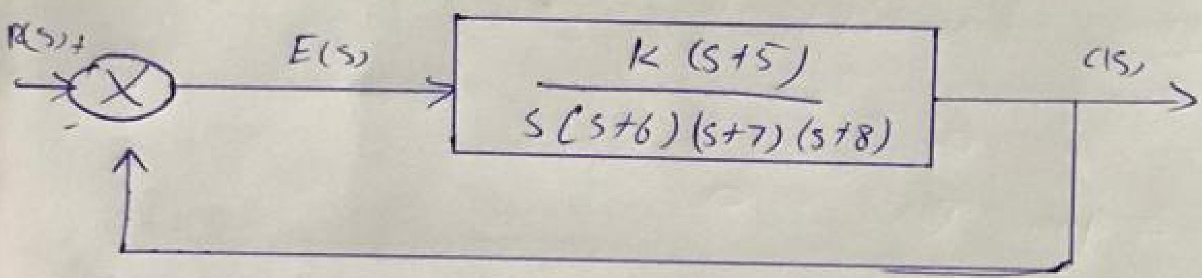


Q=3
Part # B

$F(s) = k(s+5)/s(s+6)(s+7)(s+8)$

Find The value of k so That 10% error in The steady state.

sol



$e(\infty) = \frac{1}{k_v} = \frac{1}{10} = 0.1$

$k_v = 10 = \lim_{s \to v} sG(s) = \frac{k*5}{6*7*8}$

$k = 672$

Q = 4

ExPlain The following Transient performance indicies -

① Time delay (td)

The Time delay is The Time required for The responce to initaly reach half The final value -

② Rise Time (Tr)

The Time for The waveform go to from 0.1 to 0.9 of its final value

$$T_r = \frac{2.2}{a}$$

③ Peak Time (tp)

The Time required to reach the first or maximum Peak.

$$T_P = \frac{\pi}{\omega_n\sqrt{1-\zeta^2}}$$

P - T.O

(4) setting Time (ts)

The Time required for The Transient's damped oscillation to reach and stay within ±2% of The steady-state value

$$T_s = \frac{4}{\zeta \omega_n}$$

(5) Percent overshoot (%OS)

The amount That The waveform overshoots The stedy-state or final value at Peak time, expressed as a Percentage of steady state value.

$$\%OS = e^{-(\zeta\pi / \sqrt{1-\zeta^2})} \times 100\%$$

$$\zeta = \frac{-\ln(\%OS/100)}{\sqrt{\pi^2 + \ln^2(\%OS/100)}}$$

Q = 5

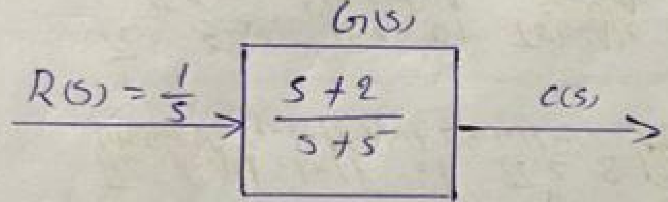
Part # A

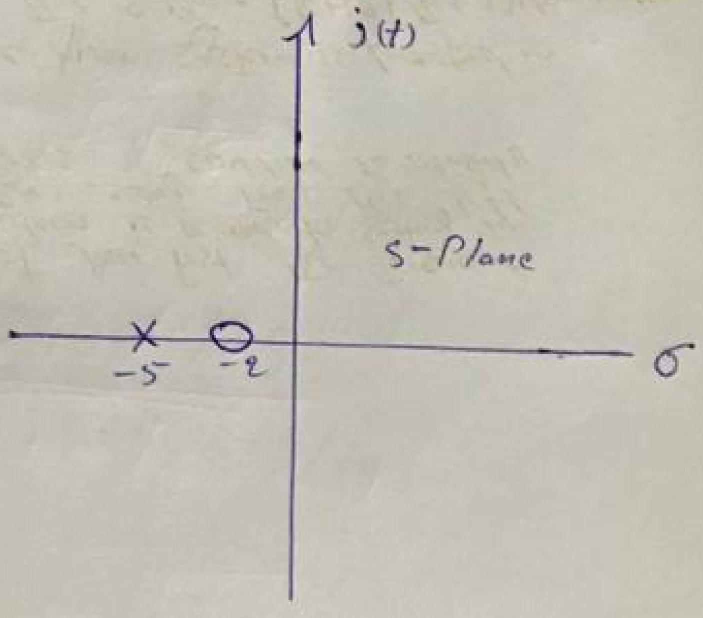
Draw The Poles & zeros of The followings functions.

$$G(s) = (s+2)/(s+5)$$

Pole at $s = -5$

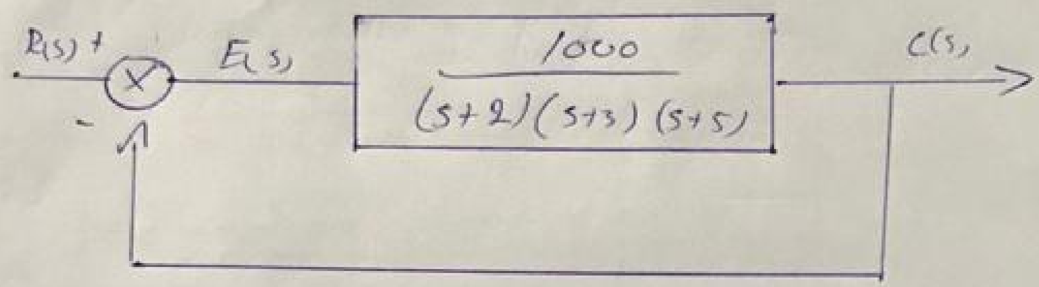
zero at $s = -2$

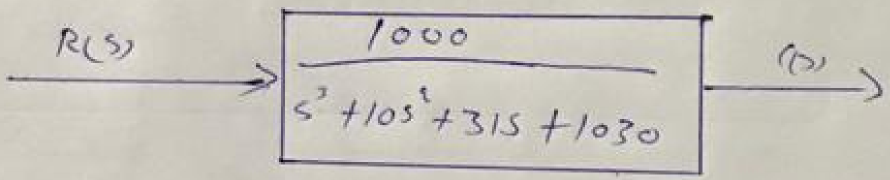




Q = 5
Part # B

$$P(S) = 1000 / S^3 + 10S^2 + 31S + 1030$$





Get The closed loop Transfer function.