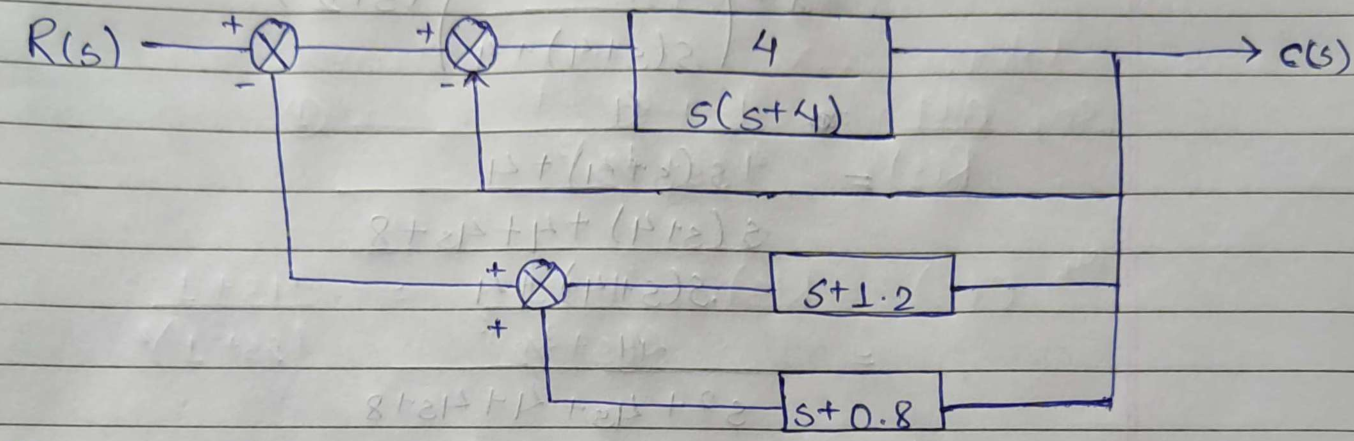
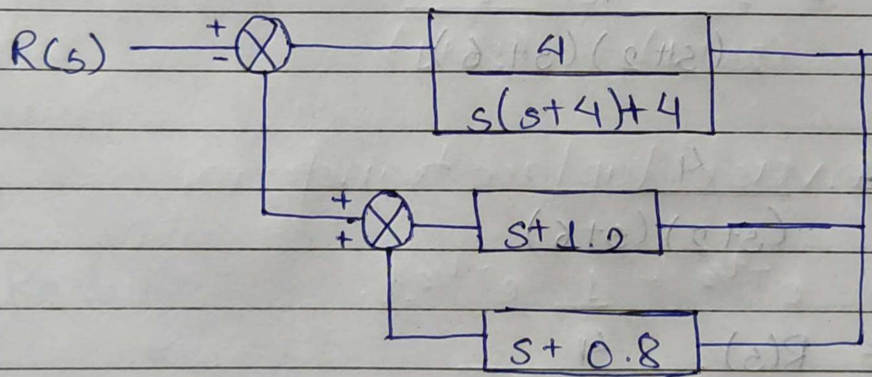
Aashutosh Aryal (05)
COEG Classwork.

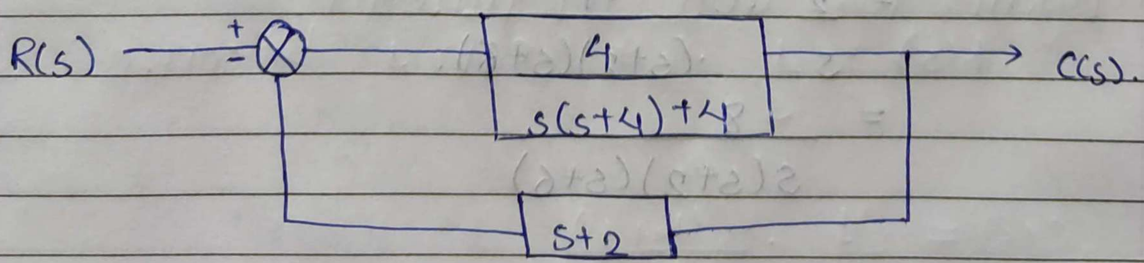
Q.



Here, $r(t) = 2$, $R(s) = \frac{2}{s}$



$$\frac{\frac{4}{s(s+4)}}{1+\frac{4}{s(s+4)}\cdot 1} = \frac{4}{s(s+4)+4}$$



Solving the block diagram:

$$\frac{\frac{4}{s(s+4)+4}}{1+\left(\frac{4}{s(s+4)+4}\right)(s+2)}$$

$$= \frac{\frac{4}{s(s+4)+4}}{\frac{s(s+4)+4+4s+8}{s(s+4)+4}}$$

$$= \frac{4}{s^2+4s+4+4s+8}$$

$$= \frac{4}{s^2+8s+12}$$

$$= \frac{4}{(s+2)(s+6)}$$

So, $\frac{C(s)}{R(s)} = \frac{4}{(s+2)(s+6)}$

or, $C(s) = R(s) \cdot \frac{4}{(s+2)(s+6)}$

$$= \frac{2}{s} \cdot \frac{4}{(s+2)(s+6)}$$

$$= \frac{8}{s(s+2)(s+6)}$$

Breaking the expression for $C(s)$ into partial fraction:

$$C(s) = \frac{2}{3s} - \frac{1}{s+2} + \frac{1}{3(s+6)}$$

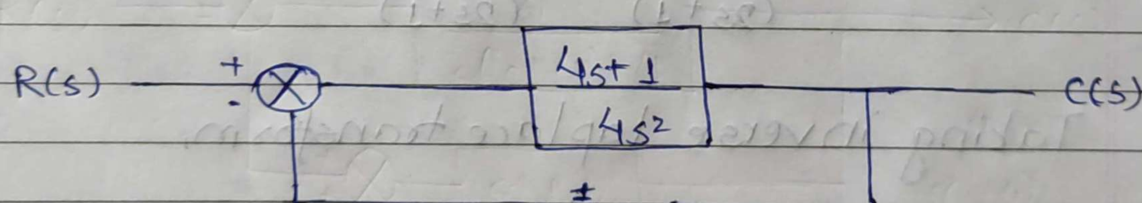
Taking inverse laplace:

$$c(t) = -\frac{2}{3} e^{-2t} + \frac{1}{3} e^{-6t}$$

Q. $G(s) = \frac{4s+1}{4s^2}$ for unit impulse function.

⇒ For unit impulse function, $R(s) = 1$

Now, we have;



Reducing the block diagram:

$$= \frac{\frac{4s+1}{4s^2}}{1 + \left(\frac{4s+1}{4s^2} \cdot 1\right)}$$

$$= \frac{\frac{4s+1}{4s^2}}{\frac{4s^2+4s+1}{4s^2}}$$

$$= \frac{4s+1}{4(s^2+s+1/4)}$$

$$= \frac{4s+1}{(2s^2+1)^2}$$

So, $\frac{C(s)}{R(s)} = \frac{4s+1}{4(s+1/2)^2}$ ——— ①

or, $C(s) = R(s) . \frac{4s+1}{4(s+1/2)^2} = \frac{4s+1}{(2s+1)^2}$

converting to partial fraction,

$$C(s) = \frac{2}{(2s+1)} - \frac{1}{(2s+1)}$$

Taking inverse laplace transform,

$$c(t) = e^{-t/2} - \frac{1}{4} e^{-t/2} t.$$

Again, for unit-step function,
$R(s) = \frac{1}{s}$. so, eqn 1 becomes;

$$C(s) = \frac{1}{s} . \frac{(4s+1)}{(2s+1)^2}$$

Breaking into partial fraction,

$$C(s) = \frac{1}{s} - \frac{2}{2s+1} + \frac{2}{(2s+1)^2}$$

Taking inverse laplace,

$$c(t) = 1 - e^{-t/2} + \frac{1}{2} e^{-t/2} \cdot t$$

Q. $G(s) = \frac{2}{s(s+3)}$ for unit step function.

$\Rightarrow$ $R(s) = \frac{1}{s}$ for unit step function.

Now,

$$\frac{C(s)}{R(s)} = \frac{\frac{2}{s(s+3)}}{1 + \left(\frac{2}{s(s+3)} \cdot 1\right)}$$

$$= \frac{\frac{2}{s(s+3)}}{\frac{s(s+3)+2}{s(s+3)}}$$

$$= \frac{2}{s(s+3)+2}$$

$\Rightarrow$ $C(s) = R(s) \frac{s}{s(s+3)+2} = \frac{1}{s^2+3s+2} = \frac{1}{(s+1)(s+2)}$

Breaking into partial fractions;

$$C(s) = \frac{1}{s+1} - \frac{1}{s+2}$$

Taking inverse laplace transform,

$$c(t) = e^{-t} - e^{-2t}$$