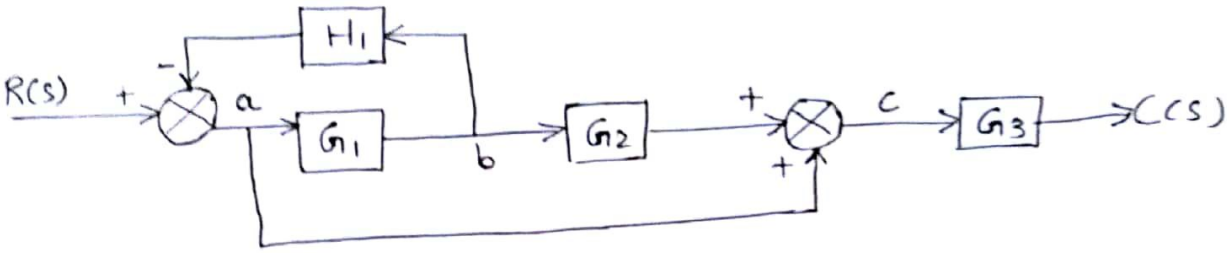
Quiz-④ Solution ME-359A

Find closed loop transfer function $T(s) = \frac{C(s)}{R(s)}$ for the system



Soln:

$$R(s) - b H_1(s) = a \quad \text{— *}$$

$$b = a G_1(s)$$

$$a = \frac{b}{G_1(s)} \quad \text{— ①}$$

Substitute in (*) we get

$$R(s) - b H_1(s) = \frac{b}{G_1(s)}$$

$$R(s) = b\left[\frac{1}{G_1(s)} + H_1(s)\right] \quad \text{— ②}$$

Also,

$$c = a + b G_2(s)$$

$$c = b\left[\frac{1}{G_1(s)} + G_2(s)\right] \quad \text{— ③}$$

Using ② Substituting b in eq ③

$$\frac{R(s) G_1(s)}{1 + H_1(s) G_1(s)}\left[\frac{1 + G_2(s) G_1(s)}{G_1(s)}\right] = C$$

$$c = \left[\frac{1 + G_2(s) G_1(s)}{1 + G_1(s) H_1(s)}\right] R(s)$$

Now,

$$C(s) = c G_3(s)$$

$$C(s) = G_3(s)\left[\frac{1 + G_2(s) G_1(s)}{1 + G_1(s) H_1(s)}\right] R(s)$$

$$\boxed{T(s) = \frac{C(s)}{R(s)} = \left[\frac{1 + G_1(s) G_2(s)}{1 + G_1(s) H_1(s)}\right] G_3(s)}$$ Ans