s^8	1	13	12	-2	-24
s^7	1	1	0	-2	0
s^6	13	12	-2	-24	0
s^5	1/[illegible]	2/[illegible]	-2/[illegible]	0	0
s^4	$-\frac{14}{[illegible]}$ -7	$-\frac{24}{[illegible]}$ -12	$-\frac{24}{[illegible]}$ -12	0	0
s^3	2/[illegible]	2/[illegible]	0	0	0
s^2	-5	-12	0	0	0
s^1	$-\frac{19}{5}$	0	0	0	0
s^0	12	0	0	0	0

1 2 3 4

$+2-0$

$1 \times (-24)$

$-24 + 26$

$+2$

$2 - \frac{12}{13}$

1

$26 - 12$

$\frac{14}{13}$

$-2 + \frac{2}{13}$

$-24 + 10$

$\frac{+14}{-5}$

$-\frac{+24}{13}$

$\frac{-2}{-7}$

$-12 + 14 = +2$

$-14 + 24$

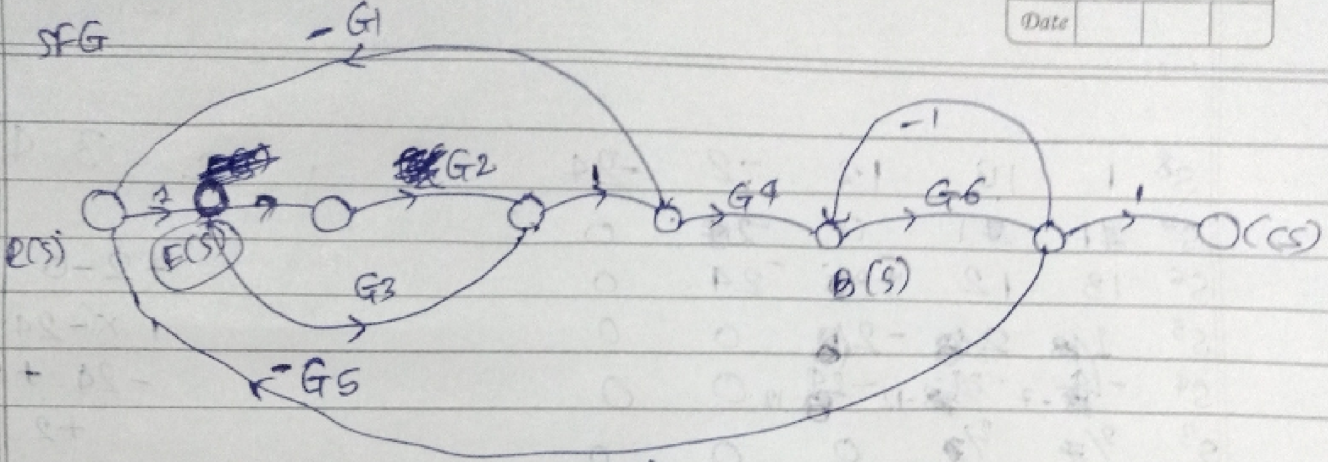
$-\frac{10}{2} - 5$

$-7 \times 0 + 12 \times 2$

$\frac{-24}{2}$

$\frac{+24}{-15}$

2). SFG



Forward path gains :- $\left(\frac{B(S)}{R(S)}\right)$

i) $1 \times 1 \times G2 \times 1 \times G4 \times$ $\Delta_1 = 1$

(ii) $1 \times G3 \times 1 \times G4 \times$ $\Delta_2 = 1$

loop gain:-

$\Delta = 1 + G_1G_2.$

$$\therefore \frac{B(S)}{R(S)} = \frac{\sum T_K \Delta_K}{\Delta} = \frac{G_2G_4 + G_3G_4}{1 + G_1G_2}$$

---

forward paths :-

1). $G2 \times G4 \times G6$ $\Delta_1 = 1$

2) $G3 \times G4 \times G6$ $\Delta_2 = 1$

loop gain

$$\Delta = 1 - \left(-G_1G_2 - G_2G_4G_6G_5 - G_3G_4G_6G_5 - G_6\right) + G_6 \times G_1G_2 + G_3G_1 + G_3G_1G_6$$

$$\Delta = 1 + G_1G_2 + G_2G_4G_6G_5 + G_3G_4G_6G_5 + G_6 + G_6G_1G_2 + G_3G_1 + G_3G_1G_6$$

$$\therefore T.F. = \frac{G_2G_4G_6 + G_3G_4G_6}{\Delta}$$

$$G(s) = \frac{K}{(s+6)(s+12)(s+13)}$$ $\underline{K > 0}$

$$T.F. = \frac{K}{(s+6)(s+12)(s+13)+K}$$

S.S.E < 0.1

$$e(\infty) = \lim_{s \to 0} \frac{s\,U(s)}{1+G(s)}$$

for, ~~step~~ step U(s). $s\,U(s) = 1$

$$e(\infty) = \lim_{s \to 0} \frac{1}{1+G(s)}$$

$$= \lim_{s \to 0} \frac{K}{K+(s+6)(s+12)(s+13)}$$

$$\frac{K}{K+936} < 0.1$$

$K < 0.1K + 93.6$

$0.9K < 93.6$

$K < 104$

$\underline{e}$

0.2

ts < 0.5

$0 < K$

99.8

$$\frac{0.2}{100} = \frac{K}{K + 936}$$

$0.2K + 187.2 = 100K$