

Lecture 5 (H.W)

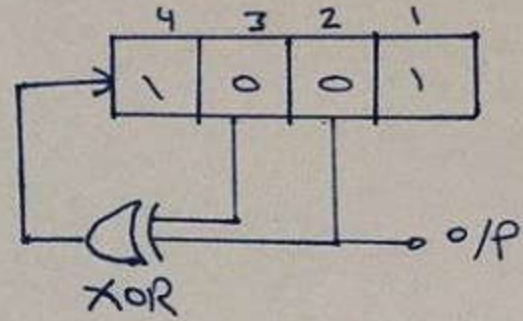
Q1 - Lec5

①

Q1

no. of stages = 4

seq. length $N = 2^4 - 1 = 15$



State	P	R	B	S	Generation
1	1	0	0	1	
2	0	1	0	0	
3	1	0	1	0	
4	1	1	0	1	
5	↓	1	1	0	
6	0	1	1	1	
7	0	0	1	1	
8	↓	0	0	1	
9	0	1	0	0	
10	1	0	1	0	
11	1	1	0	1	
12	↓	1	1	0	
13	0	1	1	1	
14	0	0	1	1	
15	1	0	0	1	
16	0	1	0	0	Repeat state

↑
O/P

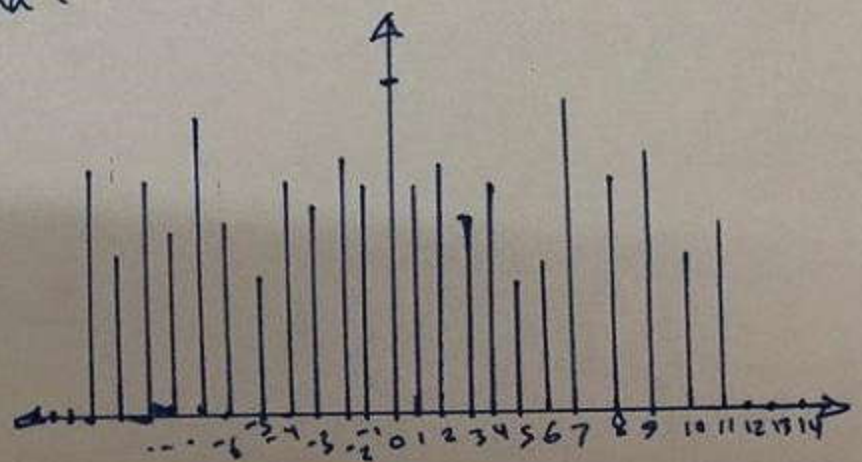
$$R_{xx}(0) = \frac{8}{15} \quad R_{xx}(1) = \frac{4}{14} \quad R_{xx}(2) = \frac{4}{13}$$

$$R_{xx}(3) = \frac{3}{12} \quad R_{xx}(4) = \frac{3}{11} \quad R_{xx}(5) = \frac{2}{10}$$

$$R_{xx}(6) = \frac{2}{9} \quad R_{xx}(7) = \frac{4}{8} \quad R_{xx}(8) = \frac{2}{7}$$

$$R_{xx}(9) = \frac{2}{6} \quad R_{xx}(10) = \frac{1}{5} \quad R_{xx}(11) = \frac{1}{4}$$

$$R_{xx}(12) = 0 \quad R_{xx}(13) = 0 \quad R_{xx}(14) = 0$$



Q2

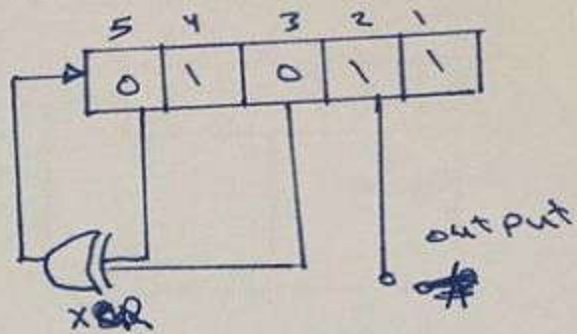
Q2 - Lec5

(2)

NA. of stages = 5

Sequence length = $N = 2^5 - 1$

$N = 31$



state	PRBS Gen.				
1	0	1	0	1	1
2	0	0	1	0	1
3	1	0	0	1	0
4	1	1	0	0	1
5	1	1	1	0	0
6	0	1	1	1	0
7	1	0	1	1	1
8	0	1	0	1	1
9	0	0	1	0	1
10	1	0	0	1	0
11	1	1	0	0	1
12	1	1	1	0	0
13	0	1	1	1	0
14	1	0	1	1	1
15	0	1	0	1	1
16	0	0	1	0	1
17	1	0	0	1	0
18	1	1	0	0	1
19	1	1	1	0	0
20	0	1	1	1	0
21	1	0	1	1	1
22	0	1	0	1	1
23	0	0	1	0	1
24	1	0	0	1	0
25	1	1	0	0	1
26	1	1	1	0	0
27	0	1	1	1	0
28	1	0	1	1	1
29	0	1	0	1	1
30	0	0	1	0	1
31	1	0	0	1	0

out put

$$R_{xx}(0) = \frac{18}{31}$$

$$R_{xx}(1) = \frac{8}{30}$$

$$R(25) = \frac{2}{6}$$

$$R(2) = \frac{9}{29}$$

$$R(3) = \frac{8}{28}$$

$$R(26) = \frac{2}{5}$$

$$R(4) = \frac{8}{27}$$

$$R(5) = \frac{8}{26}$$

$$R(27) = \frac{1}{4}$$

$$R(6) = \frac{7}{25}$$

$$R(7) = \frac{14}{24}$$

$$R(28) = \frac{2}{3}$$

$$R(8) = \frac{6}{23}$$

$$R(9) = \frac{7}{22}$$

$$R(29) = \frac{0}{2}$$

$$R(10) = \frac{6}{21}$$

$$R(11) = \frac{6}{20}$$

$$R(30) = \frac{1}{1}$$

$$R(12) = \frac{6}{19}$$

$$R(13) = \frac{5}{18}$$

$$R(14) = \frac{10}{17}$$

$$R(15) = \frac{4}{16}$$

$$R(16) = \frac{5}{15}$$

$$R(17) = \frac{4}{14}$$

$$R(18) = \frac{4}{13}$$

$$R(19) = \frac{4}{12}$$

$$R(20) = \frac{3}{11}$$

$$R(21) = \frac{6}{10}$$

$$R(22) = \frac{2}{9}$$

$$R(23) = \frac{3}{8}$$

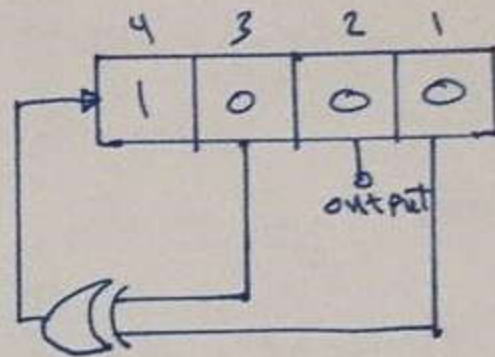
$$R(24) = \frac{2}{7}$$

Q3

Q3 - Lec5

③

No. of Stages = 4

Sequence length = $N = 2^4 - 1 = 15$ 

States	PRBS Gen.			
1	1	0	0	0
2	0	1	0	0
3	1	0	1	0
4	0	1	0	1
5	0	0	1	0
6	0	0	0	1
7	1	0	0	0
8	1	1	0	0
9	1	1	1	0
10	1	1	1	1
11	0	1	1	1
12	0	0	1	1
13	1	0	0	1
14	1	1	0	0
15	1	1	1	0

↓
output

$$R(0) = \frac{7}{15}$$

$$R(1) = \frac{3}{14}$$

$$R(2) = \frac{3}{13}$$

$$R(3) = \frac{2}{12}$$

$$R(4) = \frac{2}{11}$$

$$R(5) = \frac{2}{10}$$

$$R(6) = \frac{3}{9}$$

$$R(7) = \frac{2}{8}$$

$$R(8) = \frac{1}{7}$$

$$R(9) = \frac{1}{6}$$

$$R(10) = \frac{1}{5}$$

$$R(11) = \frac{0}{4}$$

$$R(12) = \frac{1}{3}$$

$$R(13) = \frac{0}{2}$$

$$R(14) = 0$$

Lec 6

Q1. $\omega = 0.2 \rightarrow 2$
① $G = 34 \text{ dB} \rightarrow 14$

$$G_1 = \frac{1}{s}$$

② $G_{\text{dB}} = 36 - 20 = 16 \text{ dB}$

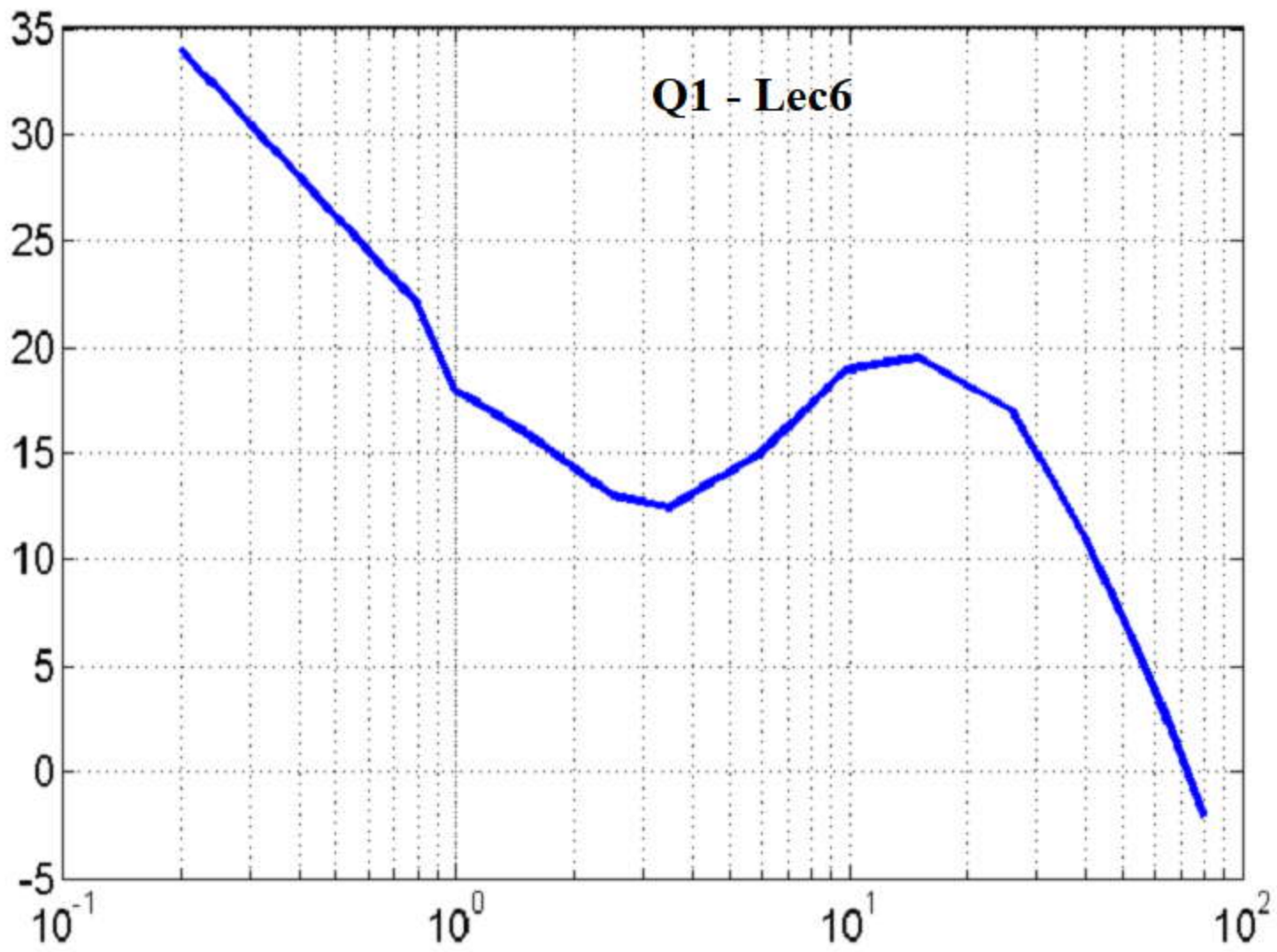
$$K = 10^{\frac{16}{20}} = 6.3$$

③ $\omega_1 = 3.5 \text{ rad/sec}$
Double Zero at $(1 + \frac{s}{3.5})^2$

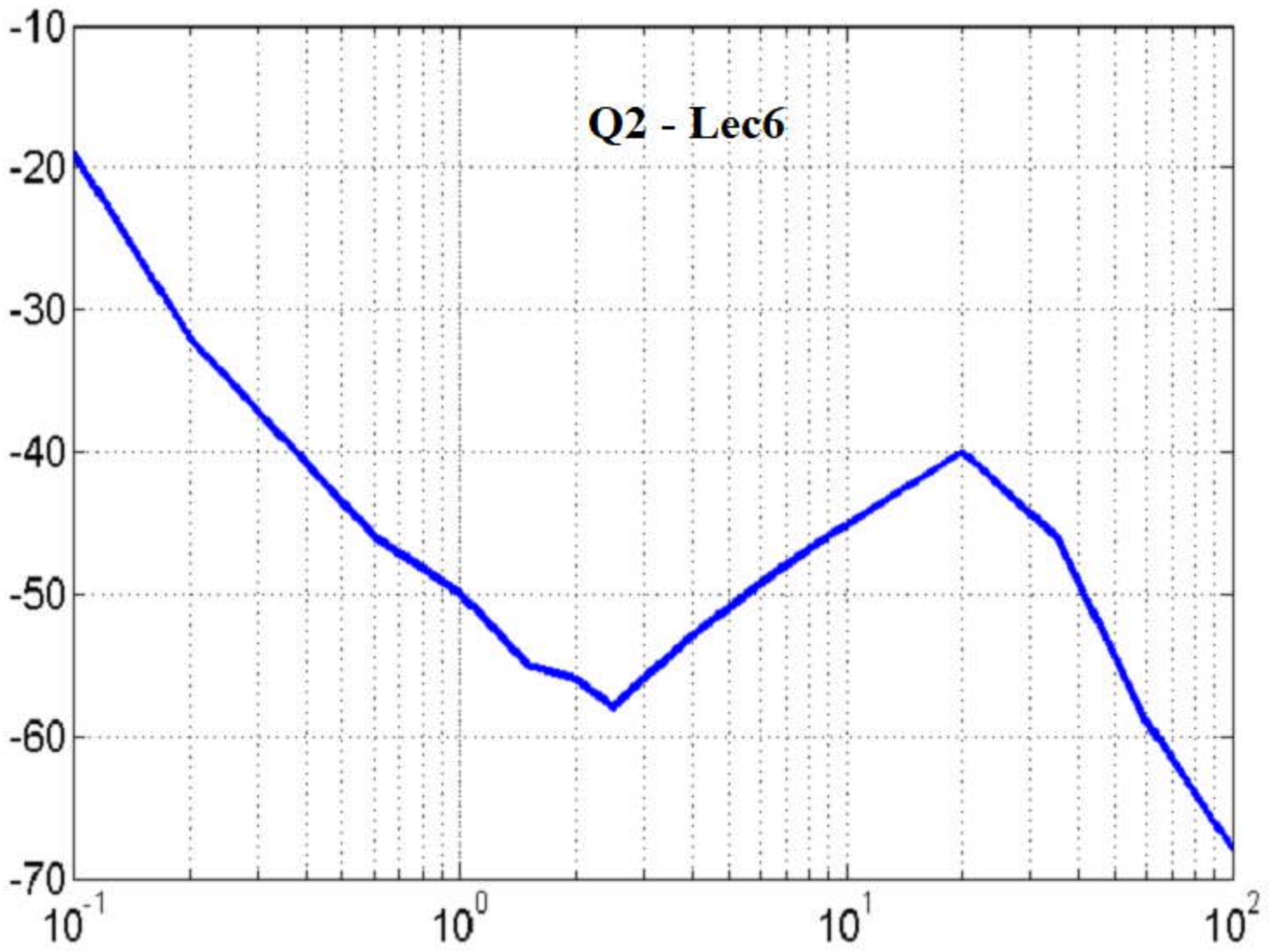
④ $\omega_2 = 16 \text{ rad/sec}$
double pole at $(1 + \frac{s}{16})^2$

⑤ $\omega_3 = 26 \text{ rad/sec}$
pole at $(1 + \frac{s}{26})$

$$G = \frac{6.3 (1 + \frac{s}{3.5})^2}{s (1 + \frac{s}{16})^2 (1 + \frac{s}{26})}$$



Q2 - Lec6



Q2

① $w = 0.1 \rightarrow 1$

$$G = -19 - (-49) = -30$$

$$G_1 = \frac{1}{s^{3/2}} \quad \text{slope} = \frac{5}{2} (20 \log 10)$$

② $G_{dB} = 20 - (-19) = 39 \text{ dB}$

$$K = 10^{\frac{39}{20}} \approx 89$$

③ $w_1 = 2.5$

$$G = -38 - (-58) = +20 \text{ dB}$$

$$\left(\frac{s}{2.5} + 1\right)^{5/2}$$

$$\text{slope} = \frac{5}{2} (20 \log 10 \left(\frac{w_1}{2.5}\right))$$

④ $w_2 = 20$

$$G = -80 - (-40) = -40$$

$$\text{slope} = -40 - (-20) = -60$$

$$\left(1 + \frac{s}{20}\right)^3$$

$$G = 89 \frac{\left(1 + \frac{s}{2.5}\right)^{5/2}}{\left(1 + \frac{s}{20}\right)^3}$$

Q3

$$G = -12.3$$

$$K = 10^{\frac{-12.3}{20}} = 0.2426$$

$$\omega_i = 1.4 \text{ rad/sec}$$

$$G|_{\omega=1.4} = -23 \text{ db}$$

$$\omega = 1.4$$

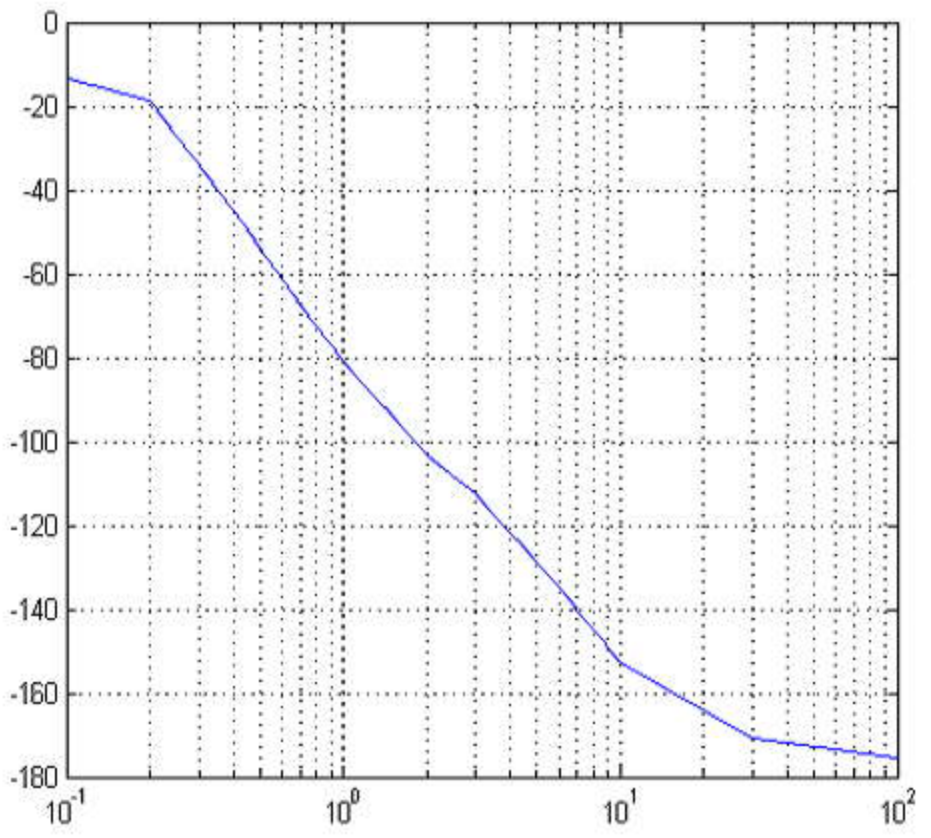
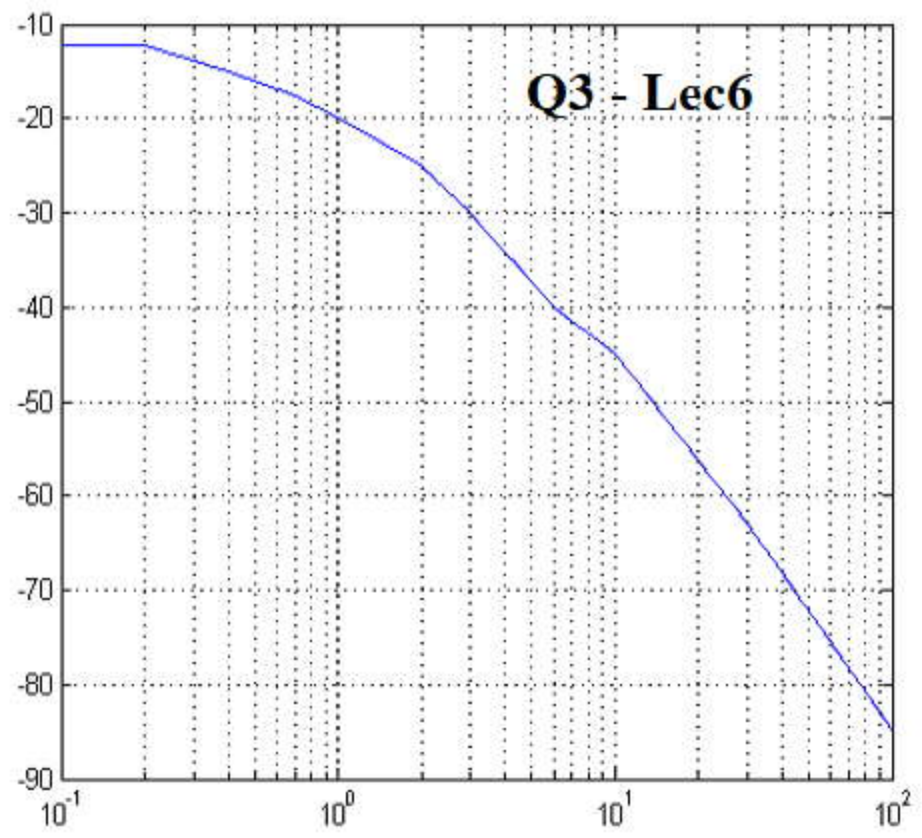
$$|G|_{\omega=1.4} = 10^{-1.15} = 0.0708$$

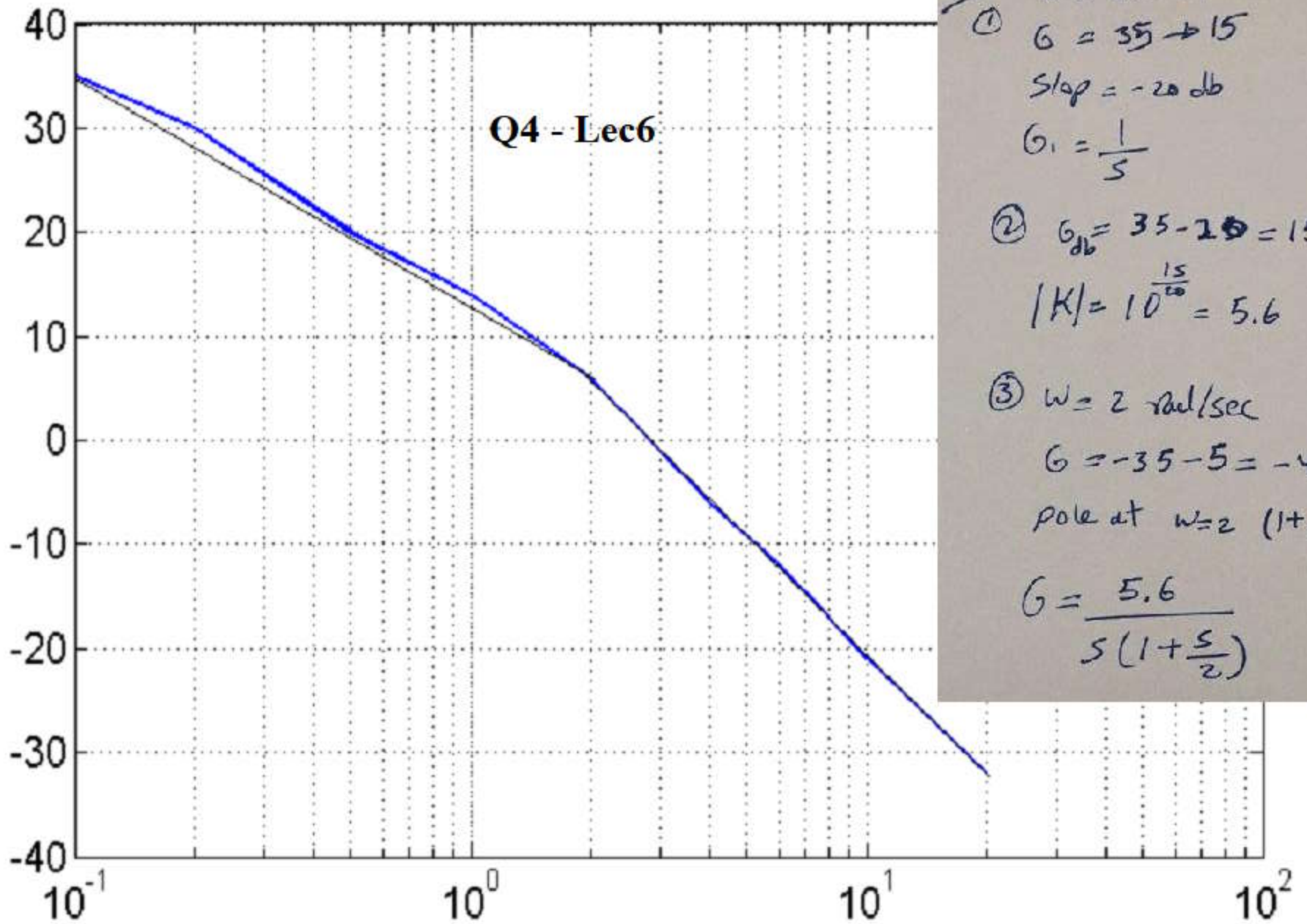
$$0.0708 = \frac{0.334}{2\zeta}$$

$$\zeta = \frac{0.334}{2 \times 0.0708} = 2.359$$

$$G = \frac{K}{1 + \frac{2\zeta}{\omega_n} s + \frac{s^2}{\omega_n^2}}$$

$$G = \frac{0.2426}{1 + 3.37s + \frac{s^2}{2}}$$



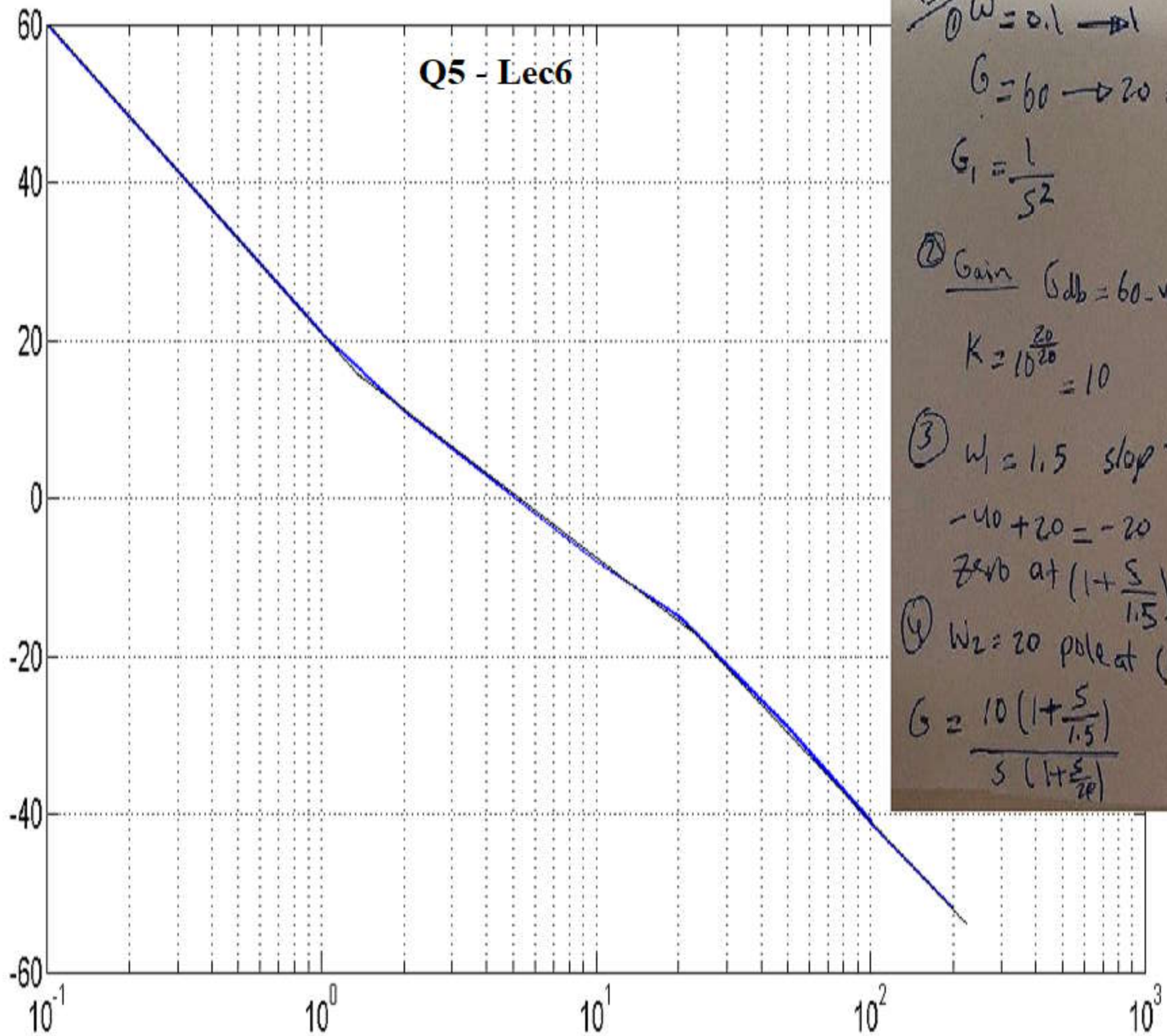


Q4
 ① $\omega = 0.1 \rightarrow 1$
 $G = 35 \rightarrow 15$
 Slope = -20 db
 $G_1 = \frac{1}{s}$

② $G_{db} = 35 - 20 = 15$
 $|K| = 10^{\frac{15}{20}} = 5.6$

③ $\omega = 2$ rad/sec
 $G = -35 - 5 = -40$ db
 pole at $\omega = 2$ $(1 + \frac{s}{2})$

$$G = \frac{5.6}{s(1 + \frac{s}{2})}$$



Q5
 ① $\omega = 0.1 \rightarrow 1$

$G = 60 \rightarrow 20 = -40 \text{ dB}$

$G_1 = \frac{1}{s^2}$

② Gain $G_{\text{dB}} = 60 - 40 = 20$

$K = 10^{\frac{20}{20}} = 10$

③ $\omega_1 = 1.5$ slope ~~20~~

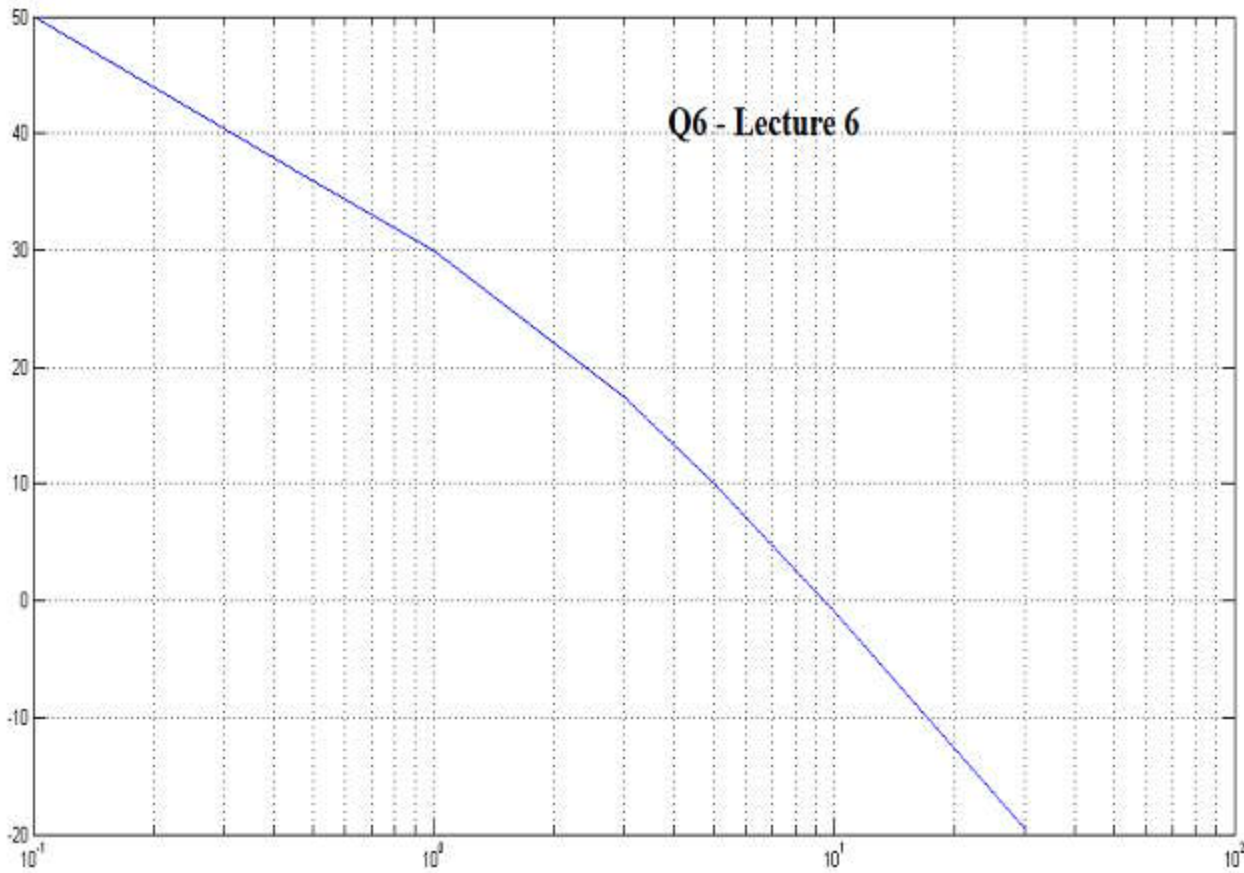
$-40 + 20 = -20$

Zero at $(1 + \frac{s}{1.5})$

④ $\omega_2 = 20$ pole at $(1 + \frac{s}{20})$

$G = \frac{10(1 + \frac{s}{1.5})}{s(1 + \frac{s}{20})}$

Q6 - Lecture 6



Q6
 ① $G_{db} = 50 - 20 = 30$

$K = 10^{30/20} = 31.62$

② $G_1 = \frac{1}{s}$

$G_3 = \frac{1}{(Ts+1)} = \frac{1}{(1+\frac{s}{3})}$

$G = \frac{31.62}{s(1+\frac{s}{3})}$

