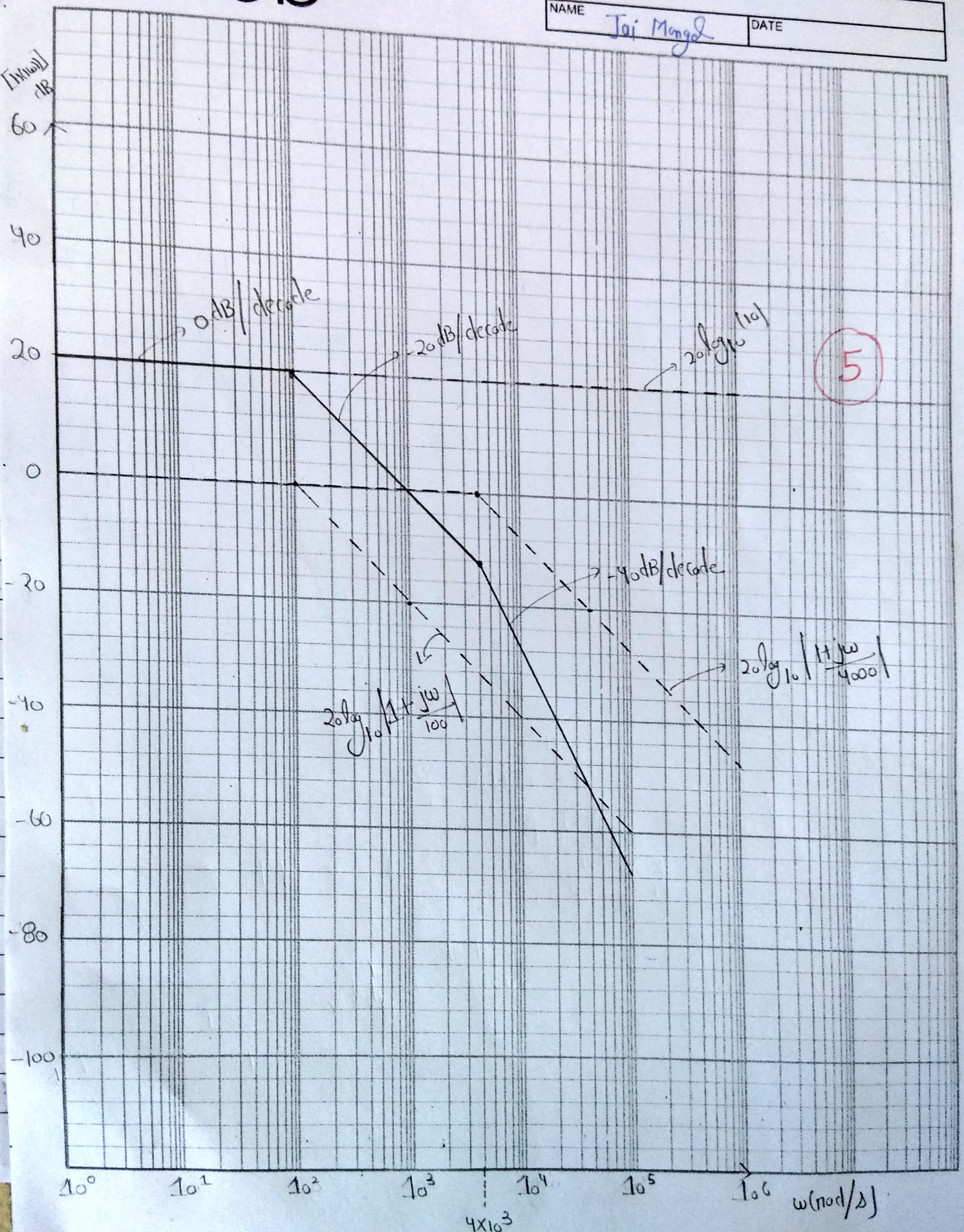
EEWeb

TITLE

NAME Jai Mangal

DATE



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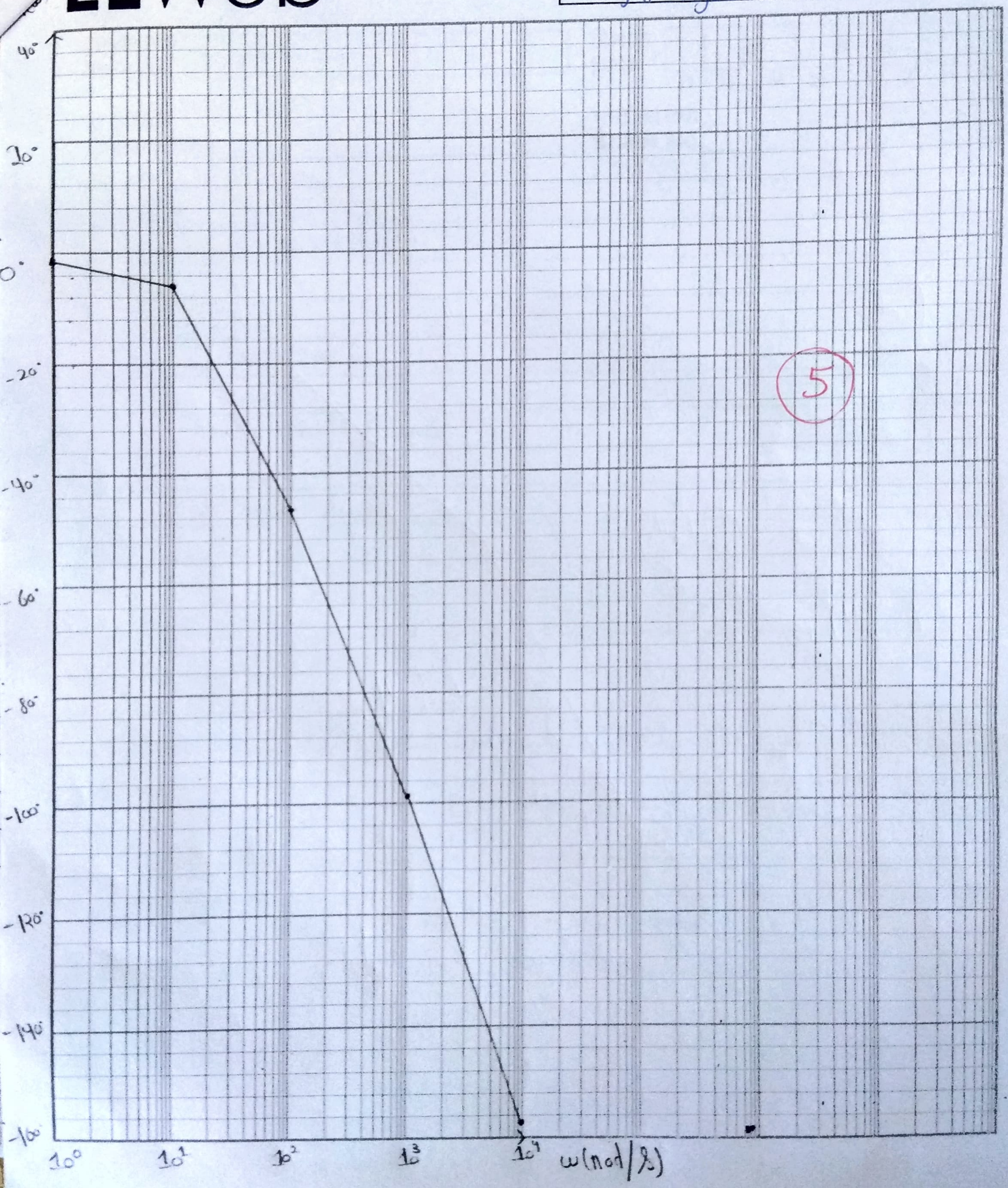

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IIIT-D
SUPPLEMENTARY SHEET

नाम
Name Jai Mangal

अनुक्रमांक
Roll No. P H D 2 2 1 0 4

दिनांक
Date D D M M Y Y Y Y

पाठ्यक्रम
Course Title

पृष्ठ संख्या
Sheet No.

a) $H(s) = \dfrac{4\times10^6}{s^2+4k\omega s+4\times10^5}$ 1

$= \dfrac{4\times10^6}{(s+100)(s+4000)}$ 3

$= \dfrac{4\times10^6}{4\times10^5(1+s/100)(1+s/4000)}$

$= \dfrac{10}{(1+s/100)(1+s/4000)}$

Now, put $s = j\omega$ 3

$\Rightarrow H(\omega) = \dfrac{10}{(1+j(\omega/100))(1+j(\omega/4000))}$

Now;

$[H(\omega)]\,dB = 20\log_{10}(10) - 20\log_{10}|1+j\omega/100| - 20\log_{10}|1+j\omega/4000|$ 1.5

Magnitude

$= 20 - 20\log_{10}|1+j\omega/100| - 20\log_{10}|1+j\omega/4000|$

b) $\angle H(\omega) = \tan^{-1}(0) - \tan^{-1}(\omega/100) - \tan^{-1}(\omega/4000)$ 1.5

$= -\tan^{-1}(\omega/100) - \tan^{-1}(\omega/4000)$

(i) Put $\omega = 1$; $-\tan^{-1}(1/100) - \tan^{-1}(1/4000)$

$= -0.57 - 0.014$

$= -0.5843°$

(ii) Put $\omega = 10$; $-\tan^{-1}(10/100) - \tan^{-1}(10/4000)$

$= -5.71 - 0.14$

$= -5.853°$

(iii) Put $\omega = 100$; $-\tan^{-1}(100/100) - \tan^{-1}(100/4000)$

$= -45° - 1.432°$

$= -46.43°$

(iv) Put $\omega = 1000$, $-\tan^{-1}(1000/100) - \tan^{-1}(1000/4000)$

$= -84.82° - 14.03°$

$= -98.31°$

(v) Put $\omega = 10,000$ $= -\tan^{-1}(10,000/100) - \tan^{-1}(10,000/4000)$

$= -89.42° - 68.19°$

$= -157.61°$

ω	$LH(\omega)$
1	$-0.5843°$
10	$-5.853°$
100	$-46.43°$
1000	$-98.31°$
10000	$-157.61°$

c) Nature of filter :- low pass filter (4)+(3)+(3)
order of filter :- 2nd order filter.
The filter is active filter.

d) Half power frequency :- $\omega_0 = 100$ rad/s (4)+(3)+(3)

Passband :- $\omega_0 < 100$ rad/s
Stopband :- $\omega_0 > 100$ rad/s

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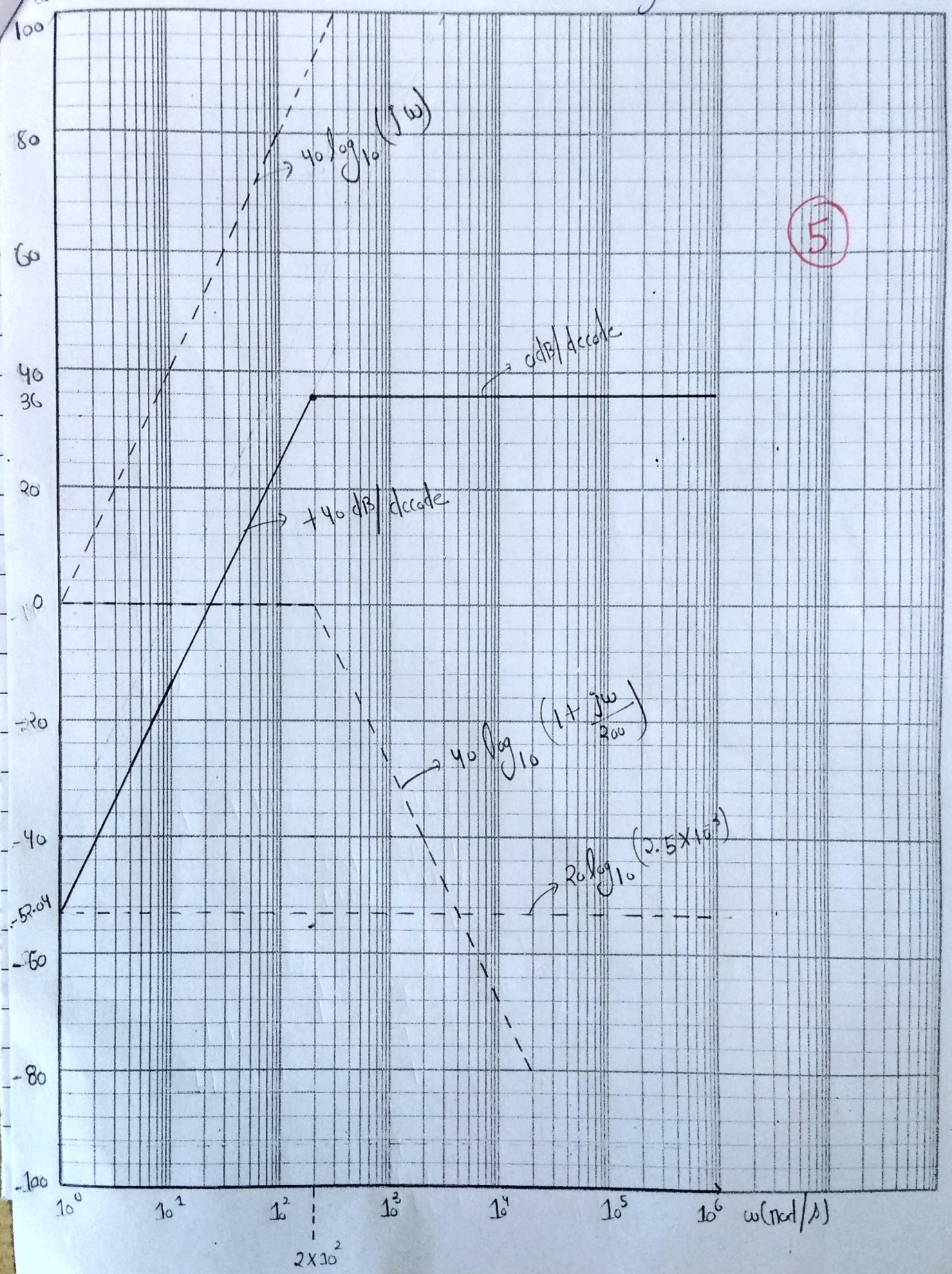

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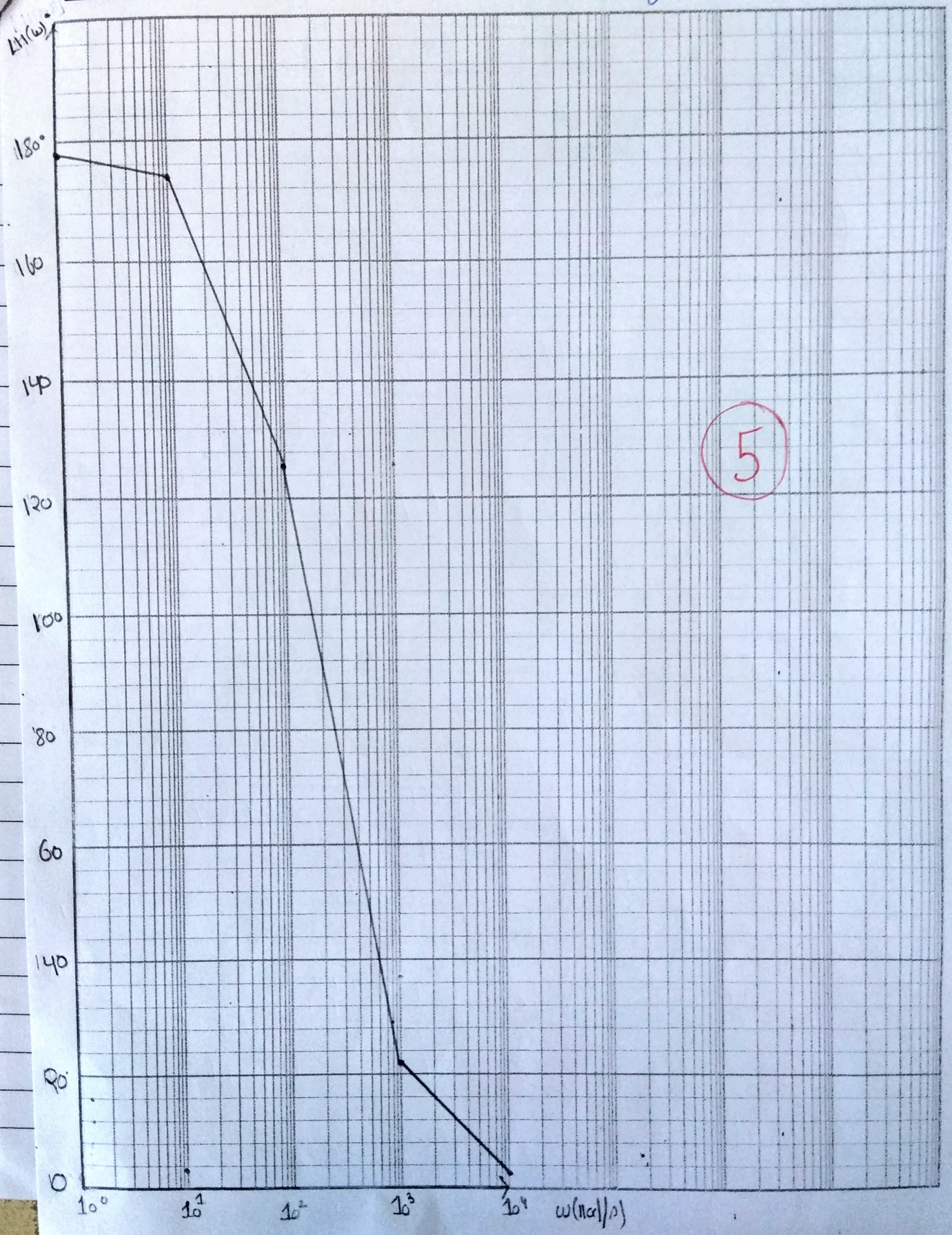

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IIIT-D
SUPPLEMENTARY SHEET

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Name Jai Mangal

अनुक्रमांक
Roll No. T h D 2 2 1 0 4

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पाठ्यक्रम
Course Title

पृष्ठ संख्या
Sheet No.

a) $H(s) = \dfrac{100s^2}{s^2 + 400s + 40000}$ 1

$= \dfrac{100s^2}{(s+200)(s+200)}$ 3

$= \dfrac{100s^2}{40000(1+s/200)(1+s/200)}$

$= \dfrac{1}{400}\left\{\dfrac{s^2}{(1+s/200)(1+s/200)}\right\}$

$= \dfrac{2.5\times10^{-3}\cdot s^2}{(1+s/200)(1+s/200)}$

$= \dfrac{2.5\times10^{-3}\cdot s\cdot s}{(1+s/200)(1+s/200)}$

now, put $s = j\omega$ 3

$\Rightarrow H(\omega) = \dfrac{2.5\times10^{-3}\cdot j\omega\cdot j\omega}{(1+j(\omega/200))(1+j(\omega/200))}$

$\Rightarrow$ now,

Magnitude $[H(\omega)]_{dB} = 20\log_{10}(2.5\times10^{-3}) + 20\log_{10}|j\omega| + 20\log_{10}|j\omega| - 20\log_{10}|1+j\omega/200| - 20\log_{10}|1+j\omega/200|$

$\Rightarrow -52.04 + 40\log_{10}|j\omega| - 40\log_{10}|1+j\omega/200|$ 1.5

b) $\angle H(\omega) = \tan^{-1}(0) + 90^\circ + 90^\circ - \tan^{-1}(\omega/200) - \tan^{-1}(\omega/200)$

(Angle) $= 180^\circ - 2\tan^{-1}(\omega/200)$

1.5

Put $\omega = 1$, $180^\circ - 2\tan^{-1}(\omega/200)$

$= 180^\circ - 2\tan^{-1}(1/200)$

$= 180^\circ - 2(0.286)$

$= 180^\circ - 0.572$

$= 179.42^\circ$

Put $\omega = 10$, $180^\circ - 2\tan^{-1}(\omega/200)$

$= 180^\circ - 2\tan^{-1}(10/200)$

$= 180^\circ - 5.72$

$= 174.28^\circ$

Put $\omega = 100$; $180^\circ - 2\tan^{-1}(\omega/200)$

$= 180^\circ - 2\tan^{-1}(100/200)$

$= 180^\circ - 53.13^\circ$

$= 126.87^\circ$

Put $\omega = 1000$; $180^\circ - 2\tan^{-1}(1000/200)$

$= 180^\circ - 2\tan^{-1}(5)$

$= 180^\circ - 157.38$

$= 22.62^\circ$

Put $\omega = 10{,}000$; $180^\circ - 2\tan^{-1}(10000/200)$

$= 180^\circ - 2\tan^{-1}(50)$

$= 180^\circ - 177.71$

$= 2.3^\circ$

ω	$\angle H(\omega)$
1	179.42°
10	174.28°
100	126.87°
1000	22.62°
10,000	2.3°

c) Nature of filter : High pass filter (4) + (3) + (3)
order of filter : 2nd order filter
The filter is active filter.

d) Half power frequency : $\omega_0 = 200$ rad/s (4) + (3) + (3)

Passband : $\omega_0 > 200$ rad/s
Stopband : $\omega_0 < 200$ rad/s

Q

$$H(s) = \frac{3000s}{s^2 + 3100s + 3\times10^5}$$ 1

Sol^n

$$H(s) = \frac{3000\,s}{(s+3000)(s+100)}$$ 3

$$H(s) = \frac{0.01\,s}{\left(\frac{s}{3000}+1\right)\left(\frac{s}{100}+1\right)}$$ 3

$s = j\omega$

$$|H(j\omega)| = \frac{0.01\,\omega}{\sqrt{\left(\left(\frac{\omega^2}{(3000)^2}\right)+1\right)}\sqrt{\left(\left(\frac{\omega^2}{(100)^2}\right)+1\right)}}$$

(a)

$$H_{dB} = 20\log(0.01\omega) - 10\log\left(\left(\frac{\omega}{3000}\right)^2+1\right)$$ 1 1/2

$$- 10\log\left(\left(\frac{\omega}{100}\right)^2+1\right)$$

(b)

$$\angle H(j\omega) = \tan^{-1}(\infty) - \tan^{-1}\left(\frac{\omega}{3000}\right) - \tan^{-1}\left(\frac{\omega}{100}\right)$$ 1 1/2

ω	(a) H_{dB}	(b) $\angle H(j\omega)$
1	-40	89.40°
10	-20	84.09°
100	-3	43.09°
1000	-0.5	-12.72°
10000	-10	-72.72°
100000	-30	-88.22°

(C) Nature :- Band pass filter (10) (4)
ORDER :- 2 (3)
State :- Passive (3)

(D) ω_L = 100 rad/sec ; ω_H = 3000 rad/sec (4)
pass Band :- $\omega_L < \omega_p < \omega_H$ (10) (3)
Stop Band :- $\omega_s < \omega_L$; $\omega_s > \omega_H$

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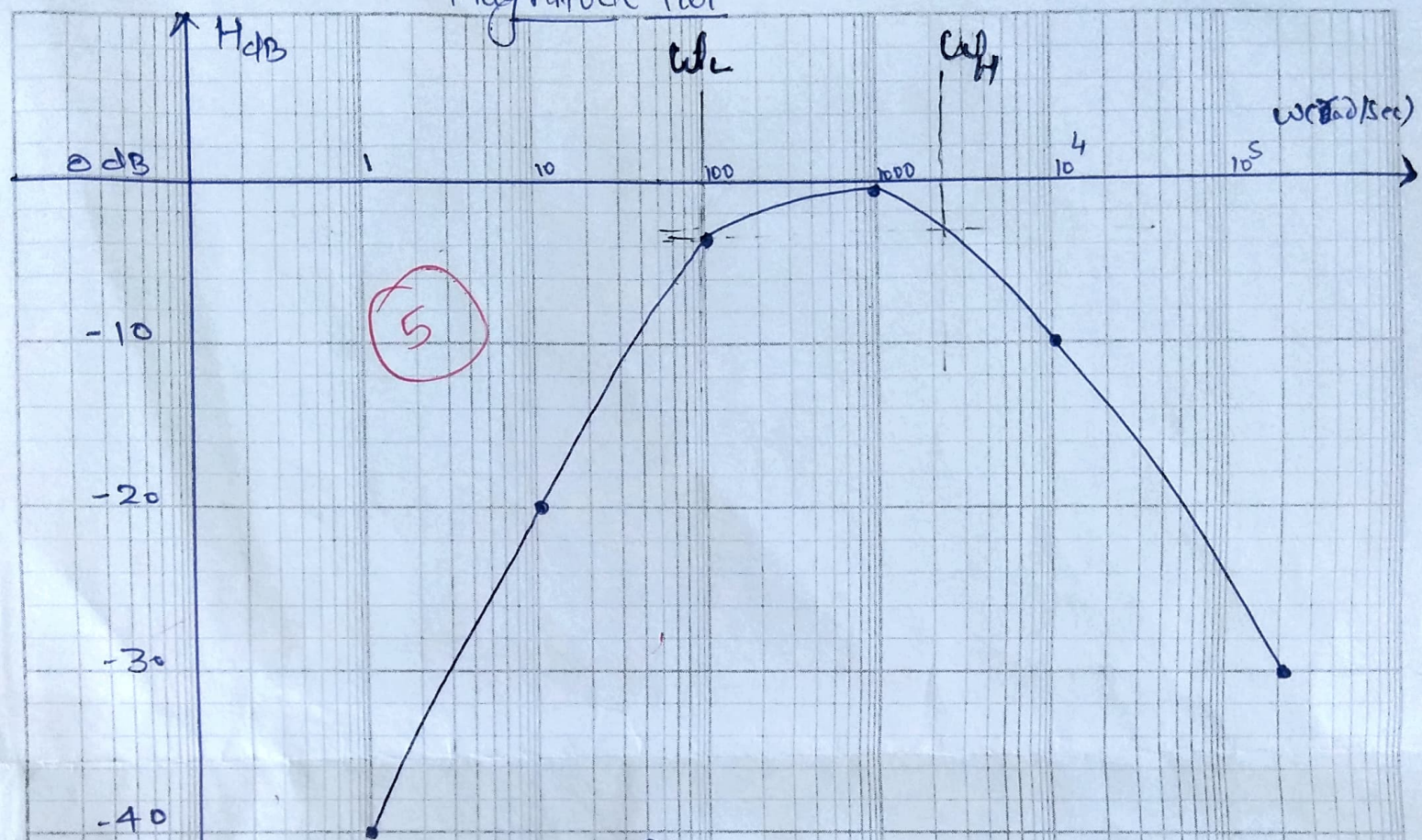
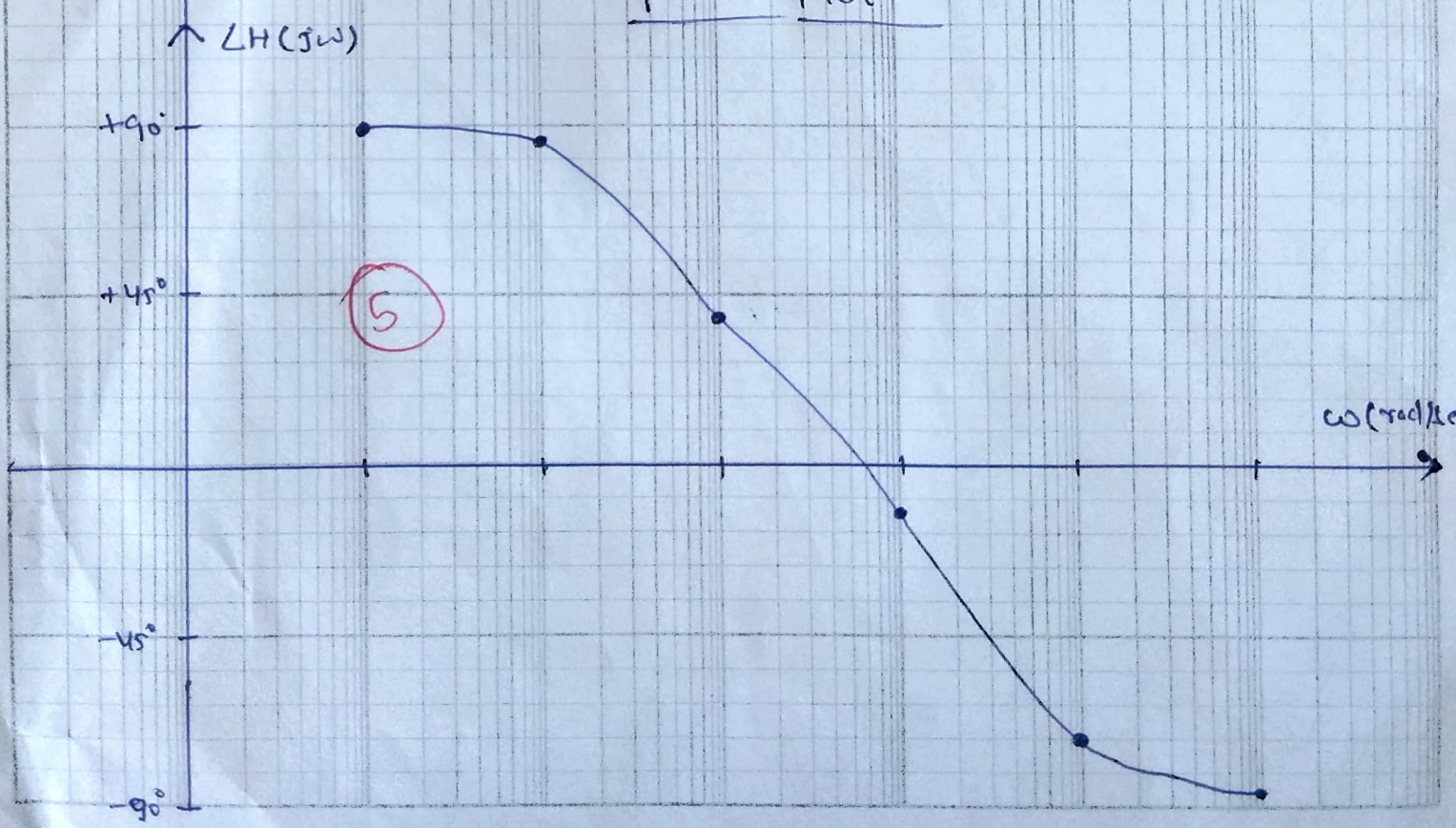
Magnitude Plot



Phase Plot