ĐÁP ÁN ĐỀ THI HK III Môn TTĐKTĐ 11/8/2015

① a) PTĐT

$$1 + 10.\frac{100}{s(s^2+15,6s+56)} = 0$$

$$1 + \frac{100}{s(s^2+15,6s+56)}.Ks = 0$$

$$1 + \frac{1000}{s^3 + s^2 15,6 + (56 + 100K)s} = 0$$

$$\Leftrightarrow s^3 + 15,6s^2 + (56+100K)s + 1000 = 0$$

s^3	1	$56+100K$
s^2	15,6	1000
s^1	$(56+100K) - \frac{1}{15,6}.1000$	
s^0	1000	

1,0

$$\begin{cases} 56+100K > 0 \\ 56+100K - \frac{1}{15,6}.1000 > 0 \end{cases} \Rightarrow \boxed{K > 0,081}$$

b) $G_s(s) = \frac{100}{s(\frac{s}{5,6}+1)(\frac{s}{10}+1)56}$

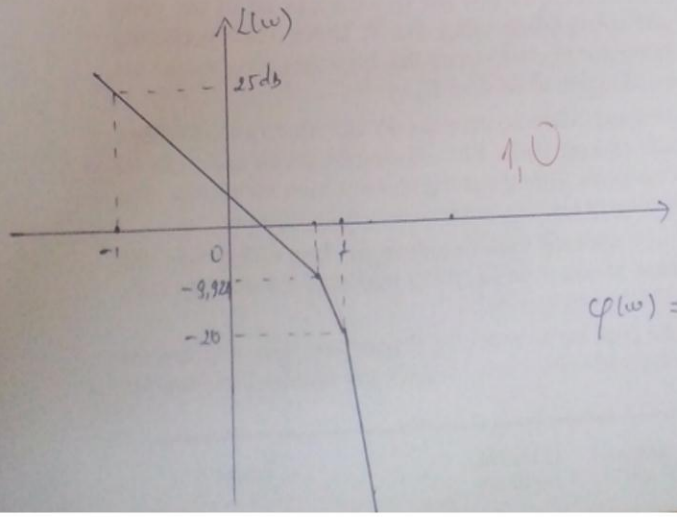
0,5

$K = \frac{25}{14}$ $\quad \alpha = -1$

$\omega_1 = 5,6$ $\quad \lg\omega_1 = 0,748$

$\omega_2 = 10$ $\quad \lg\omega_2 = 1$.

$$\begin{cases} \omega_0 = 0,1 \\ L(\omega_0) = 20\lg\frac{25}{14} + (-1)20\lg 0,1 \\ \quad = 25,036\ dB. \end{cases}$$



1,0

$$\varphi(\omega) = -90° - tg^{-1}\frac{\omega}{5,6} - tg^{-1}\frac{\omega}{10}$$

ω	0	0,1	5,6	10	$+\infty$
$\varphi(\omega)$	-90	-91	-164,25	-195,25	$-270°$

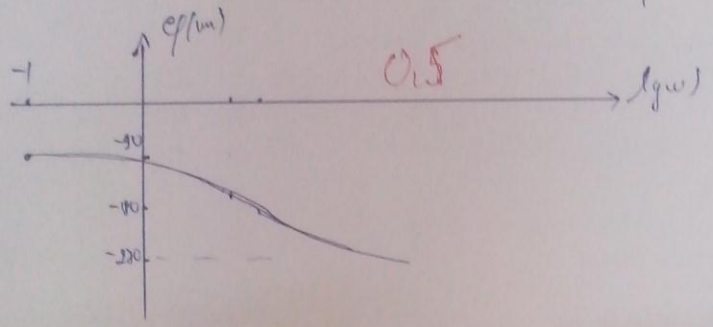
$\omega_{-\pi} = 2,483$ rad/s $\Rightarrow \lg\omega_{-\pi} = 0,874$

$\lg\omega_c = \dfrac{0-25}{-20} - 1 = 0,25 \Rightarrow \omega_c = 1,778$ (rad/s)

$\varphi(\omega_c) = -117,7 \Rightarrow \phi M = 62,3 > 0$

$\dfrac{L(\omega_{-\pi}) - (-9,924)}{0,874 - 0,748} = -40 \Rightarrow L(\omega_{-\pi}) = -14,962$ 1,0

$GM = -L(\omega_{-\pi}) = 14,964$ dB



0,5

$\begin{cases} GM > 0 \\ \phi M > 0 \end{cases} \Rightarrow$ HT ổn định

Câu 2

$X_1(s) = \dfrac{1}{s} X_2(s) \Rightarrow \dot{x}_1(t) = x_2(t)$

$X_2(s) = \dfrac{1}{s+1} X_3(s) \Rightarrow \dot{x}_2(t) = -x_2(t) + x_3(t)$

$X_3(s) = \left[R(s) - K_1 X_1(s) - K_2 X_2(s) - K_3 X_3(s)\right] \dfrac{1}{s+3}$

$\Rightarrow \dot{x}_3(t) = -K_1 x_1(t) - K_2 x_2(t) - (K_3+3) x_3(t) + r(t)$

1,5

pttt

$\begin{cases} \dot{x}(t) = Ax(t) + Br(t) \\ c(t) = Cx(t) \end{cases}$

$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -1 & 1 \\ -K_1 & -K_2 & -(K_3+3) \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

$C = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$

b) Hệ thống điều khiển được vì tín hiệu điều khiển tác động được lên các biến trạng thái (1).

c) Tìm $K = [K_1 \quad K_2 \quad K_3]$

PT đặc trưng mong muốn

$$(s - s_1^*)(s - s_2^*)(s - s_3^*) = 0$$

$$(s + 1 - j)(s + 1 + j)(s + 3) = 0$$

$$(s^2 + 2s + 2)(s + 3) = 0$$

$$\Leftrightarrow s^3 + 5s^2 + 8s + 6 = 0 \quad (1)$$

PTĐT sau hiệu chỉnh.

Ta có $G_1(s) = \dfrac{\frac{1}{s+3}}{1 + \frac{K_3}{s+3}} = \dfrac{1}{s+3+K_3}$

$$G_2(s) = \frac{\frac{1}{s+3+K_3} \cdot \frac{1}{s+1}}{1 + \frac{1}{(s+3+K_3)} \cdot \frac{1}{(s+1)} \cdot K_2} = \frac{1}{s^2 + s(4+K_3) + 3 + K_3 + K_2}$$

PTĐT

$$1 + G_2(s) \cdot \frac{1}{s} \cdot K_1 = 0$$

$$\Leftrightarrow 1 + \frac{K_1}{s^3 + s^2(4+K_3) + (3+K_3+K_2)s} = 0$$

$$\Leftrightarrow s^3 + s^2(4+K_3) + (3+K_3+K_2)s + K_1 = 0 \quad (2)$$

Đồng I hệ số (1) và (2)

$$\begin{cases} 4 + K_3 = 5 \\ 3 + K_3 + K_2 = 8 \\ K_1 = 6 \end{cases} \Rightarrow \begin{cases} K_3 = 1 \\ K_2 = 4 \\ K_1 = 6 \end{cases}$$

Vậy $K = [6 \quad 4 \quad 1]$