قائمة الاسئلة

نظم تحكم تماثلي- كلية الهندسة - قسم الطبية الحيوية - المستوى الثالث - 3ساعات - درجة هذا الاختبار (60)

د.محمد العلفي

1) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Find the number of zeros:

a) 1
b) 2
c) 3
d) 4

1) + a
2) - b
3) - c
4) - d

2) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Find the number of poles:

a) 1
b) 2
c) 3
d) 4

1) - a
2) + b
3) - c
4) - d

3) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Find the number of SL:

a) $SL = 2$
b) $SL = 1$
c) $SL = 3$
d) $SL = 0$

1) + a
2) - b

3) - c
4) - d

4) In the root locus method, if the characteristics equation is given by:

$$1+\frac{K(s+10)}{(s+1)(s+4)}=0$$

Calculate the value of α:

a) 1
b) 2
c) 3
d) 4

1) + a
2) - b
3) - c
4) - d

5) In the root locus method, if the characteristics equation is given by:

$$1+\frac{K(s+10)}{(s+1)(s+4)}=0$$

How many segments on the real axis?

a) 1
b) 2
c) 3
d) 4

1) - a
2) + b
3) - c
4) - d

6) In the root locus method, if the characteristics equation is given by:

$$1+\frac{K(s+10)}{(s+1)(s+4)}=0$$

The center of asymptotes lines

a) 5
b) -5
c) -2
d) 10

1) - a
2) + b
3) - c
4) - d

7) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Angles of asymptotes lines

a) 45^o
b) 90^o
c) 135^o
d) 180^o

1) - a
2) - b
3) - c
4) + d

8) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Cross points with imaginary axis

a) $\pm 2j$
b) $\pm 3j$
c) $\pm 6j$
d) None

1) - a
2) - b
3) - c
4) + d

9) In the root locus method, if the characteristics equation is given by:

$$1 + \frac{K(s+10)}{(s+1)(s+4)} = 0$$

Break-in and Break-out

a) -3.45 & - 15.35
b) 2.65 & 17.37
c) -2.65 & -17.37
d) -2.65 & 17.37

1) - a
2) - b
3) + c
4) - d

10)

In the root locus method, if the characteristics equation is given by:

$$1+\frac{K(s+10)}{(s+1)(s+4)}=0$$

If we have complex poles in characteristics equation, the equation of departure angles.

a) $\theta_d=\sum\theta_p-\sum\theta_z+180^o$
b) $\theta_d=\sum\theta_z-\sum\theta_p+180^o$
c) $\theta_d=\sum\theta_p-\sum\theta_z+180^0$
d) $\theta_d=\sum\theta_p-\sum\theta_z-180^0$

1)	-	a
2)	+	b
3)	-	c
4)	-	d

11) Consider the third-order control system:

$$\dot{x}(t)=\begin{bmatrix}0&1&0\\0&0&1\\-1&-2&-4\end{bmatrix}x(t)+\begin{bmatrix}0\\0\\1\end{bmatrix}u(t) \quad \& \quad y(t)=\begin{bmatrix}1&0&0\end{bmatrix}x(t)$$

The determinant of controllability matrix is equal

a) 1
b) -1
c) 0.9
d) *1.9*

1)	-	a
2)	+	b
3)	-	c
4)	-	d

12) Consider the third-order control system:

$$\dot{x}(t)=\begin{bmatrix}0&1&0\\0&0&1\\-1&-2&-4\end{bmatrix}x(t)+\begin{bmatrix}0\\0\\1\end{bmatrix}u(t) \quad \& \quad y(t)=\begin{bmatrix}1&0&0\end{bmatrix}x(t)$$

The determinant of observability matrix is equal

a) 1.2
b) -1.3
c) -1
d) 1

1)	-	a
2)	-	b
3)	-	c
4)	+	d

13)

Consider the third-order control system:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -4 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t) \quad \& \quad y(t) = [1 \quad 0 \quad 0]\, x(t)$$

Determine the desired characteristic equation to such the closed-loop poles of the system are located at $s_1 = -1 + j2$, $s_2 = -1 - j2$ and $s_3 = -4$.

a) $s^3 + 6s^2 + 13s + 20 = 0$
b) $s^3 + 6s^2 + 3s + 20 = 0$
c) $s^3 + 6s^2 + 13s + 5 = 0$
d) $s^3 + 6s^2 - 13s + 20 = 0$

1) + a
2) - b
3) - c
4) - d

14) Consider the third-order control system:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -4 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t) \quad \& \quad y(t) = [1 \quad 0 \quad 0]\, x(t)$$

Determine the feedback gain matrix K so as to locate the closed loop poles of the system at $s_1 = -1 + 2j$, $s_2 = -1 - 2j$, and $s_3 = -4$.

a) $K = [19 \quad 7 \quad 2]$
b) $K = [16 \quad 10 \quad 4]$
c) $K = [19 \quad 10 \quad 2]$
d) $K = [16 \quad 7 \quad 4]$

1) - a
2) - b
3) + c
4) - d

15) Consider the third-order control system:

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -4 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t) \quad \& \quad y(t) = [1 \quad 0 \quad 0]\, x(t)$$

Design a full-order observer (L matrix) such that the error signal will exhibit a dead-beat response to an arbitrary initial error (s1=s2=s3=0).

a) $L = \begin{bmatrix} -4 \\ 13 \\ -41 \end{bmatrix}$
b) $L = \begin{bmatrix} 4 \\ -1 \\ 41 \end{bmatrix}$
c) $L = \begin{bmatrix} -4 \\ -13 \\ 1 \end{bmatrix}$
d) $L = \begin{bmatrix} -4 \\ 13 \\ 10 \end{bmatrix}$

1) + a
2) - b
3) - c

4) - d

16) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio ***ζ = 0.5,*** the setting time equal ***0.6*** second, and the steady-state error to ramp input must be ***1%***.

The dominant closed loop poles are equal

a) $-\zeta\omega_n \pm j\omega_n\sqrt{1-\zeta^2}$

b) $-\zeta\omega_n \pm j\omega_n\sqrt{\zeta^2-1}$

c) $\zeta\omega_n \pm j\omega_n\sqrt{\zeta^2-1}$

d) $-\zeta\omega_n \pm j\omega_d\sqrt{\zeta^2-1}$

1) - a
2) + b
3) - c
4) - d

17) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio ***ζ = 0.5,*** the setting time equal ***0.6*** second, and the steady-state error to ramp input must be ***1%***.

By using the root-locus method, find system dominant closed loop poles will have a damping ratio ***ζ = 0.5,*** and the setting time equal ***0.6*** second.

a) $s_1, s_2 = -6.7 \pm j11.5$

b) $s_1, s_2 = -7.7 \pm j15.5$

c) $s_1, s_2 = -0.7 \pm j1.5$

d) $s_1, s_2 = 16 \pm j11.5$

1) + a
2) - b
3) - c
4) - d

18) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio ***ζ = 0.5,*** the setting time equal ***0.6*** second, and the steady-state error to ramp input must be ***1%***.

The phase should be added by controller is equal

a) -56°

b) 24°

c) -46°

d) 46°

1) - a
2) + b

3) - c
4) - d

19) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio $\zeta = 0.5$, the setting time equal *0.6* second, and the steady-state error to ramp input must be *1%*.

If the system is needed to controller. Determine the type of controller.

a) Phase-lead
b) Phase-lag
c) Phase-leg
d) PI

1) + a
2) - b
3) - c
4) - d

20) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio $\zeta = 0.5$, the setting time equal *0.6* second, and the steady-state error to ramp input must be *1%*.

Determine the θ_p & θ_z of controller

a) $\theta_p = 66^o$ & $\theta_z = 90^o$
b) $\theta_p = 46^o$ & $\theta_z = 90^o$
c) $\theta_p = 60^o$ & $\theta_z = 90^o$
d) $\theta_p = 66^o$ & $\theta_z = 100^o$

1) + a
2) - b
3) - c
4) - d

21) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio $\zeta = 0.5$, the setting time equal *0.6* second, and the steady-state error to ramp input must be *1%*.

Design the suitable controller for this system.

a) $G_c(s) = \frac{93(s+6.7)}{(s+11.3)}$
b) $G_c(s) = \frac{936(s+6.7)}{(s+11.8)}$
c) $G_c(s) = \frac{936(s+67)}{(s+11.8)}$
d) $G_c(s) = \frac{936(s+6.7)}{(s+118)}$

1) - a

2) + b
3) - c
4) - d

22) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio *ζ = 0.5*, the setting time equal *0.6* second, and the steady-state error to ramp input must be *1%*.

After the controller is designed, determine the static velocity error constant k_v.

a) $K_v = 4$
b) $K_v = 90$
c) $K_v = 9$
d) $K_v = 19$

1) - a
2) - b
3) + c
4) - d

23) Consider the tilt system is represented by transfer function:

$$G(s) = \frac{12}{s(s+10)(s+70)}$$

By using the root-locus method, design a suitable controller to obtain, damping ratio *ζ = 0.5*, the setting time equal *0.6* second, and the steady-state error to ramp input must be *1%*.

how to satisfy the steady-state error to ramp input must be *1%*?.

a) $G_{c1}(s) = \frac{(s+0.1)}{(s+0.0009)}$
b) $G_{c1}(s) = \frac{(s+0.1)}{(s+0.9)}$
c) $G_{c1}(s) = \frac{(s+0.1)}{(s+0.009)}$
d) $G_{c1}(s) = \frac{(s+0.1)}{(s+0.09)}$

1) - a
2) - b
3) + c
4) - d

24)

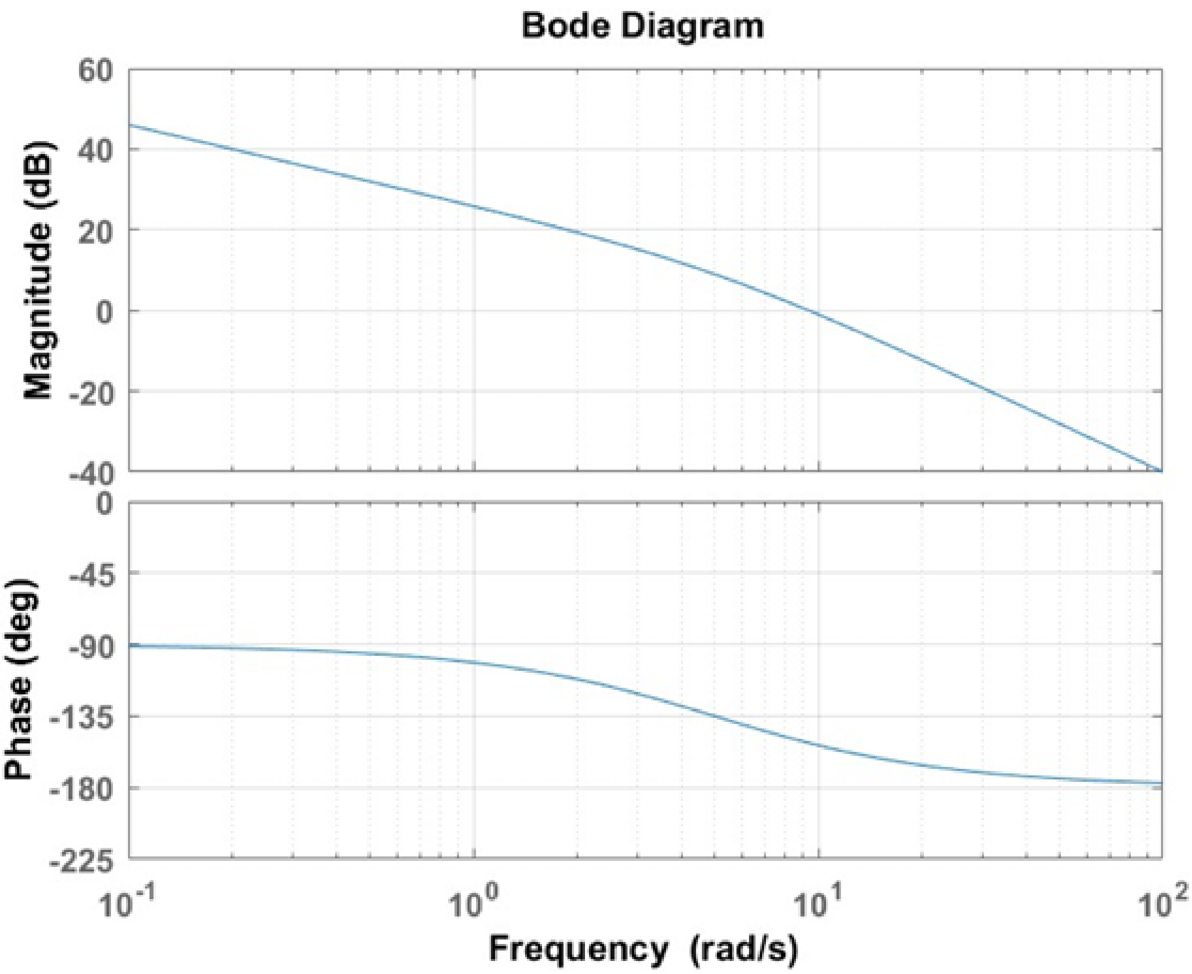

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are (k_v = *20*, **gain margin ≥ 10 dB**, **phase margin = 50°**, answer the following questions:

If the k_v=*20*, determine the gain ***k*** of controller.

a) $k = 10$
b) $k = 20$
c) $k = 5$
d) $k = 20$

1)	+	a
2)	-	b
3)	-	c
4)	-	d

25)

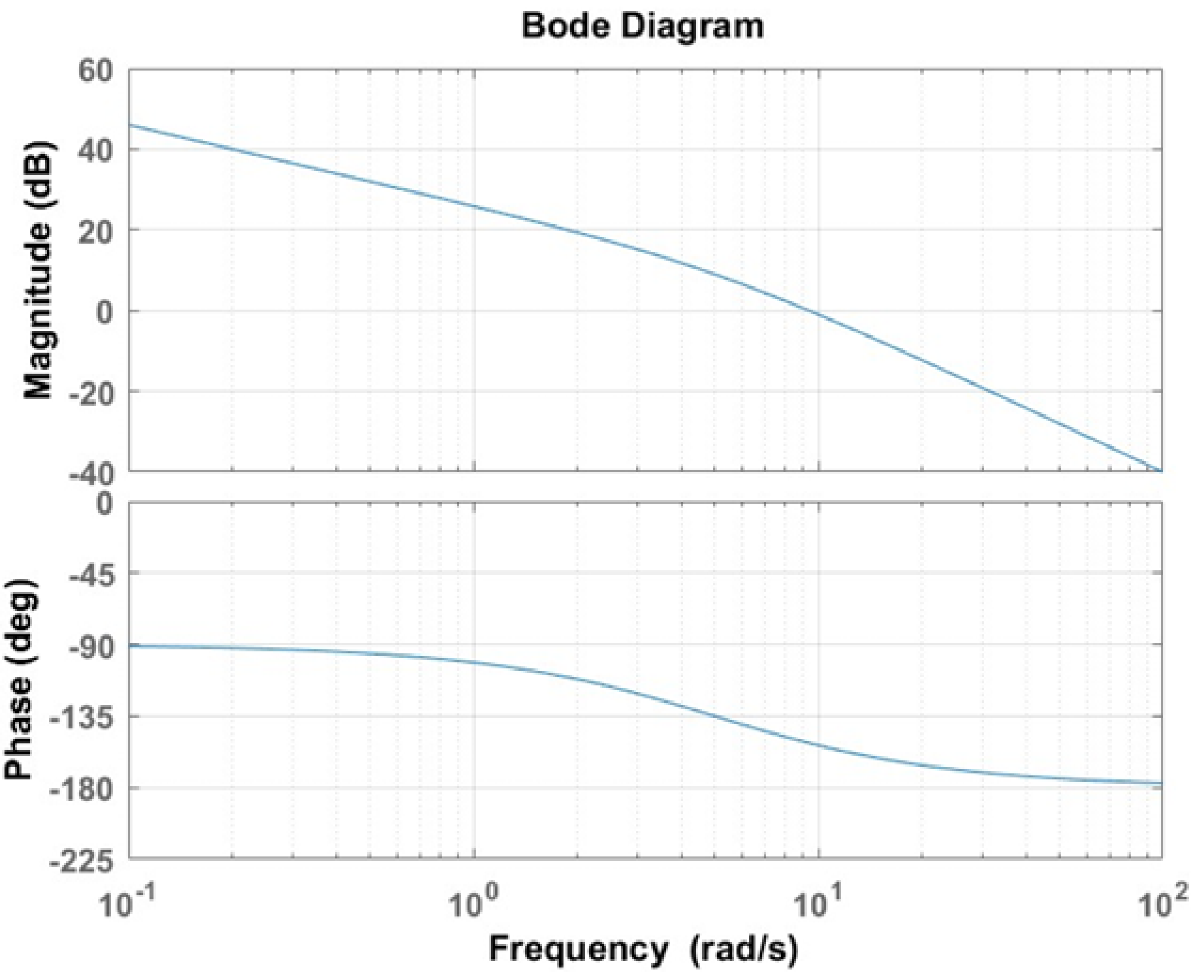

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are ($k_v = 20$, **gain margin** $\geq$ **10 dB**, **phase margin = 50°**, answer the following questions:

Determine the ***G(s)*** has been sketch in bode diagram

a) $G(s) = \frac{50}{s(s+5)}$

b) $G(s) = \frac{500}{s(s+5)}$

c) $G(s) = \frac{100}{s(s+5)}$

d) $G(s) = \frac{10}{s(s+5)}$

1)	-	a
2)	-	b
3)	+	c
4)	-	d

26)

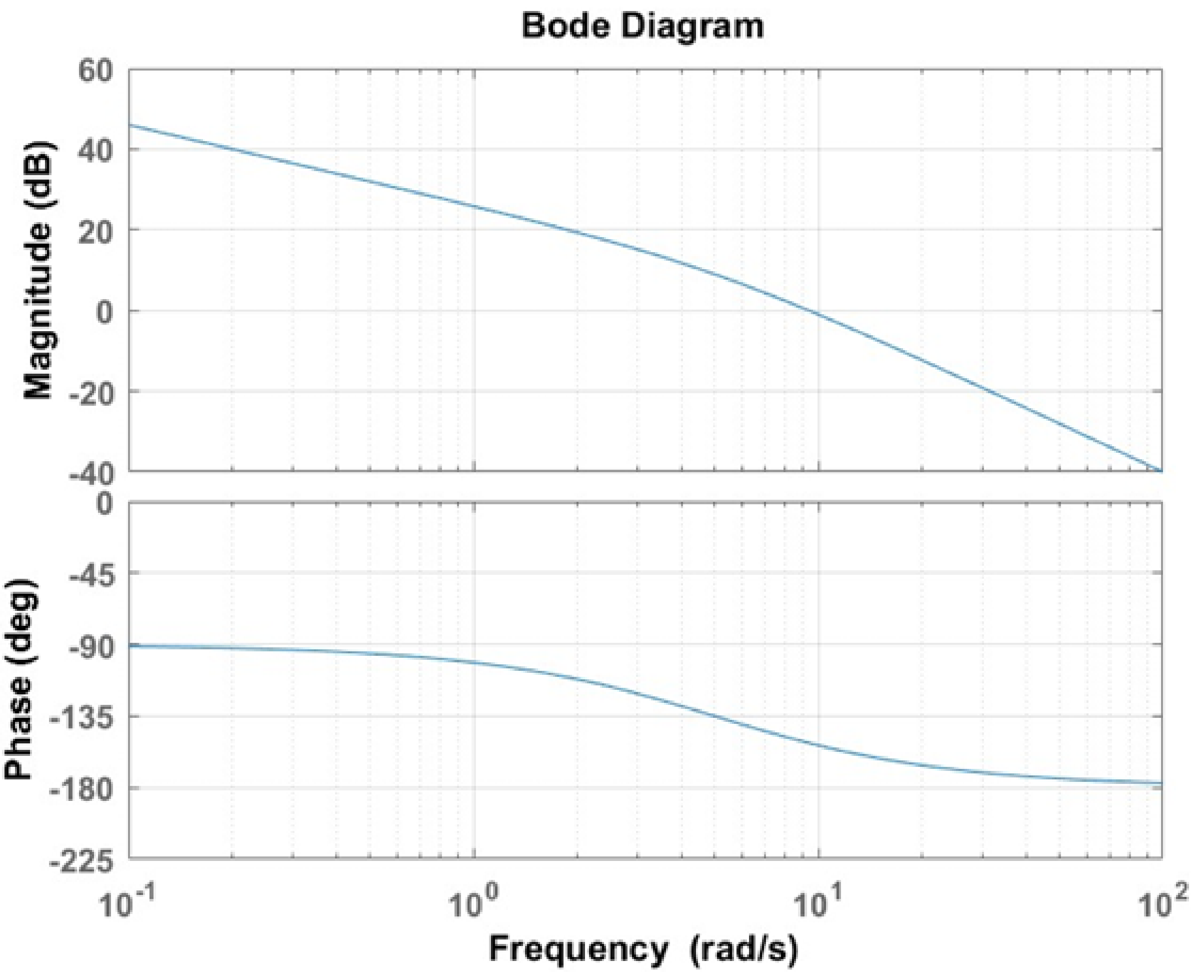

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are (k_v = *20*, **gain margin ≥ 10 dB**, **phase margin = 50º**, answer the following questions:

From the bode diagram figure (1) below, find the gain margin.

a) $G_m = 10$
b) $G_m = 24$
c) $G_m = 16$
d) $G_m = infinity$

1)	-	a
2)	-	b
3)	-	c
4)	+	d

27)

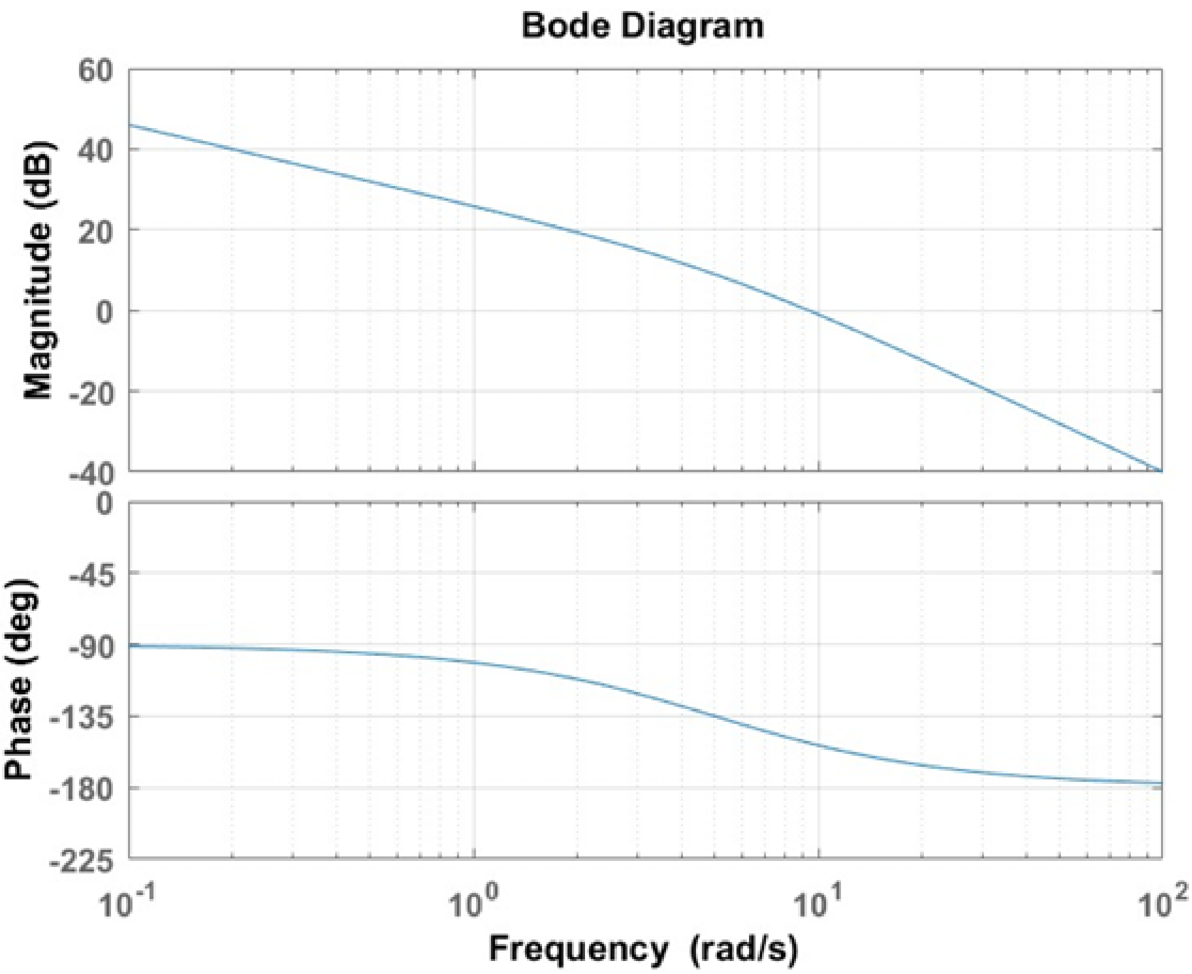

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are (k_v = *20*, **gain margin ≥ 10 dB**, **phase margin = 50°**, answer the following questions:

From the bode diagram figure (1) below, find the phase margin.

a) $Ph_m = 40^{\circ}$

b) $Ph_m = 28^{\circ}$

c) $Ph_m = 11^{\circ}$

d) $Ph_m = 9^{\circ}$

1)	-	a
2)	+	b
3)	-	c
4)	-	d

28)

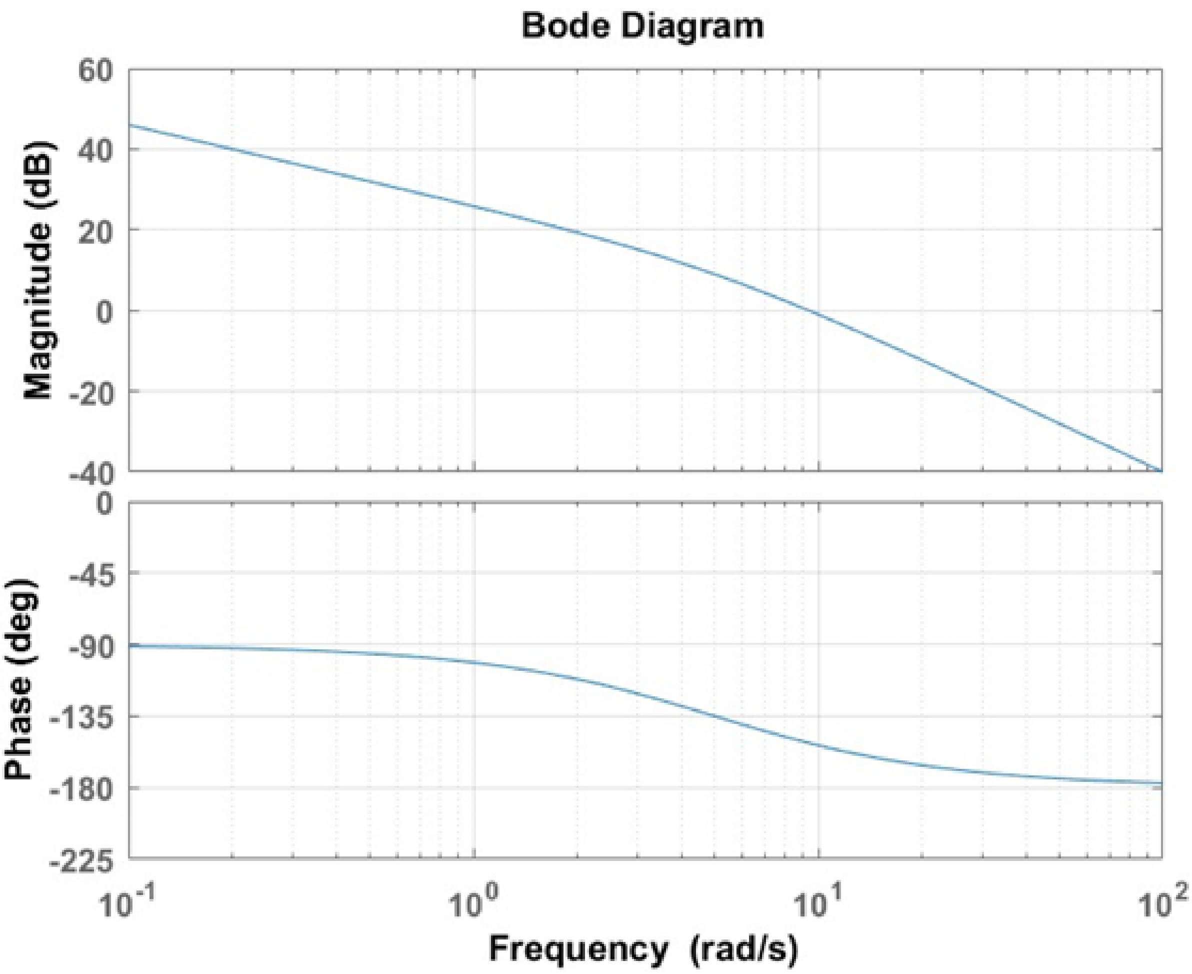

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are (k_v = *20*, **gain margin ≥ 10 dB**, **phase margin = 50°**, answer the following questions:

Identify the type of analog controller to meet the following specifications.

(k_v = *20*, **gain margin ≥ 20 dB**, **phase margin = 50°**.

a) *Phase − lead*

b) *PI*

c) *Phase − leg*

d) *Phase − lag*

1)	+	a
2)	-	b
3)	-	c
4)	-	d

29)

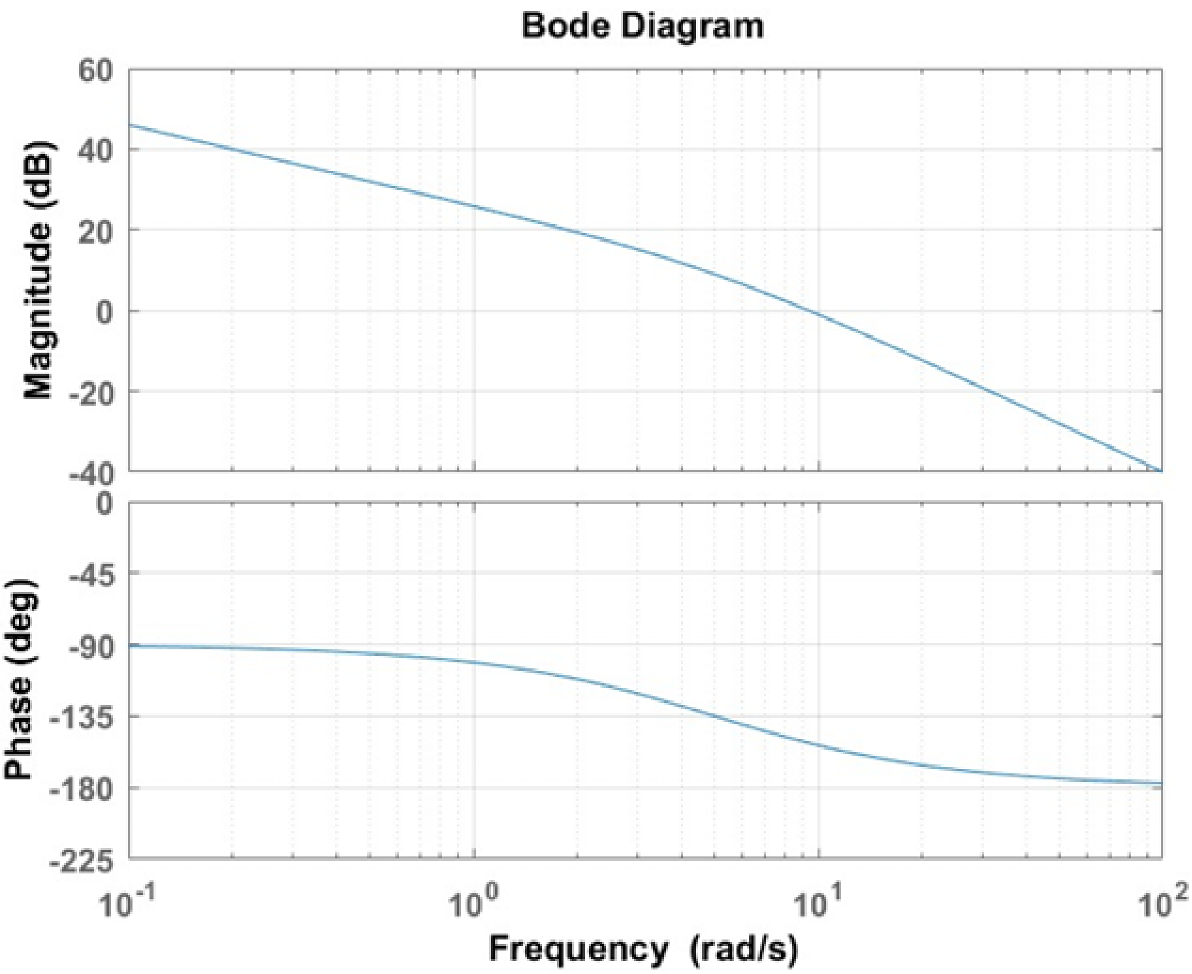

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are (k_v = *20*, **gain margin** ≥ **10 dB**, **phase margin** = **50°**, answer the following questions:

Design a suitable analog controller by using the bode diagram to meet the following specifications. (k_v = *20*, **gain margin** ≥ **10 dB**, **phase margin** = **50°**).

a) $G_c(s) = \frac{5.6(1+\frac{s}{8.2})}{(1+\frac{s}{14.7})}$

b) $G_c(s) = \frac{20(1+\frac{s}{8.2})}{(1+\frac{s}{14.7})}$

c) $G_c(s) = \frac{50(1+\frac{s}{14.7})}{(1+\frac{s}{8.2})}$

d) $G_c(s) = \frac{10(1+\frac{s}{2})}{(1+\frac{s}{10})}$

1)	+	a
2)	-	b
3)	-	c
4)	-	d

30)

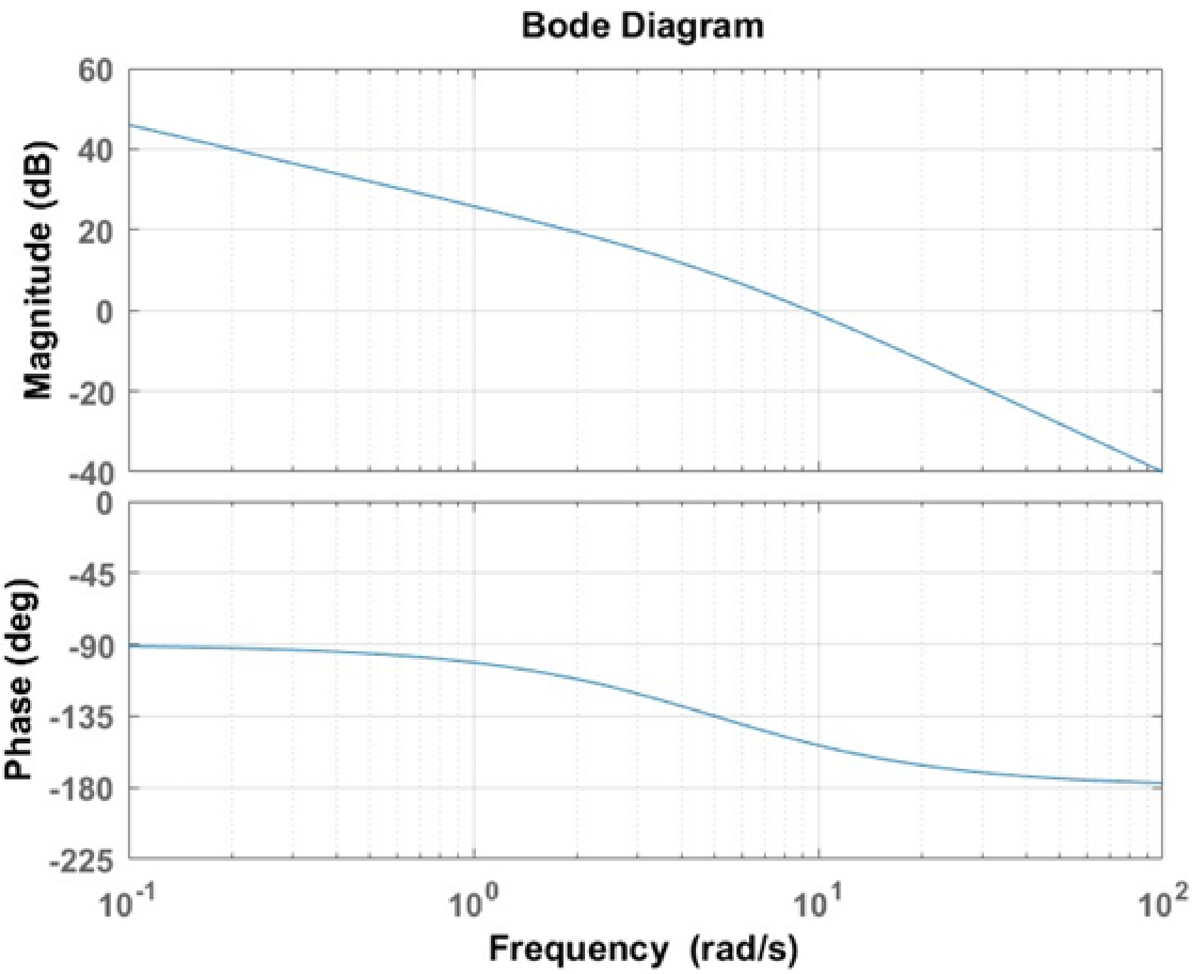

Figure (1)

The plant dynamic of a chemical process is represented by transfer function:

$$G(s) = \frac{10}{s(s+5)}$$

by using the frequency response method and bode diagram in figure (1). If the desired specifications of system are ($k_v = 20$, **gain margin ≥ 10 dB**, **phase margin = 50°**, answer the following questions:

The final form of analog controller $G_c(s)$

a) $G_c(s) = \frac{2(s+0.2)}{(s+0.05)}$

b) $G_c(s) = \frac{10(s+8.2)}{(s+14.7)}$

c) $G_c(s) = \frac{50(s+8.2)}{(s+14.7)}$

d) $G_c(s) = \frac{20(s+14.7)}{(s+8.2)}$

1)	-	a
2)	+	b
3)	-	c
4)	-	d