

# Control Engineering Fundamentals Tutorials -2024-2025

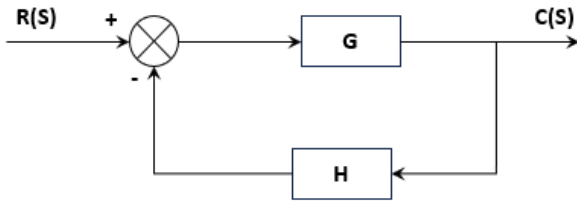
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1. What is the primary function of a control system?
  - a) To amplify signals
  - b) To filter noise
  - c) To provide the desired response by controlling the output
  - d) To generate input signals
2. In a closed-loop control system, what is the role of the feedback signal?
  - a) To amplify the input signal
  - b) To decrease the input signal
  - c) To provide a reference signal
  - d) To reduce the error between the desired output and the actual output
3. What is the practical way to determine the end of the transient period?
  - a) Waiting for an infinite amount of time.
  - b) Observing the system until it stops changing.
  - c) Waiting for five times the system's time constant.
  - d) Using a specific formula to calculate the exact time.
4. What is the purpose of a controller in a control system?
  - a) To generate the error signal
  - b) To amplify the input signal
  - c) To generate a control signal to manipulate the plant
  - d) To measure the output of the plant
5. What is the significance of the term "GH" in the context of feedback control systems?
  - a) It represents the product of the open-loop gain and the feedback path gain.
  - b) It is the transfer function of the closed-loop system.
  - c) It is the error signal in the system.
  - d) It is the desired output of the system.
6. What is the effect of negative feedback on system stability?
  - a) Increases system instability.
  - b) Increases system stability.
  - c) Does not affect system stability.
  - d) May increase or decrease stability depending on the feedback value.
7. What is the transfer function of a system?
  - a) The ratio of the Laplace transforms of the output to the Laplace transform of the input, assuming zero initial conditions.
  - b) The time domain response of the system to a unit impulse input.
  - c) The frequency response of the system.
  - d) None of the above.
8. A second-order differential equation can be represented in the s-domain as:
  - a) A first-order polynomial in s.
  - b) A second-order polynomial in s.
  - c) A third-order polynomial in s.
  - d) A transcendental function of
9. What is Control System?
  - a) Control system is a system in which the output is controlled by varying the input
  - b) Control system is a device that will not manage or regulate the behavior of other devices using control loops
  - c) Control system is a feedback system that can be both positive and negative
  - d) Control System is a system in which the input is controlled by varying the output.
10. The output of the feedback control system must be a function of.....
  - a) Output and feedback signal
  - b) Input and feedback signal
  - c) Reference input
  - d) Reference output
11. The overall transfer function from block diagram reduction for Parallel blocks is:
  - a) Sum of individual gain
  - b) Product of individual gain
  - c) Difference of individual gain
  - d) Division of individual gain
12. Routh Hurwitz criterion gives:
  - a) Number of roots in the right half of the s-plane.
  - b) Value of the roots.
  - c) Number of roots in the left half of the s-plane.
  - d) Number of roots in the top half of the s-plane.
13. An unstable system has:
  - a) All poles in the left half-plane.

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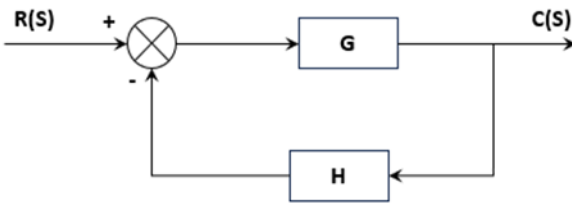
- b) At least one pole in the right half-plane or multiple poles on the imaginary axis.
- c) Only imaginary axis poles of multiplicity one.
- d) No poles in the right half-plane

14. The transfer function model of the following positive control system is given as:



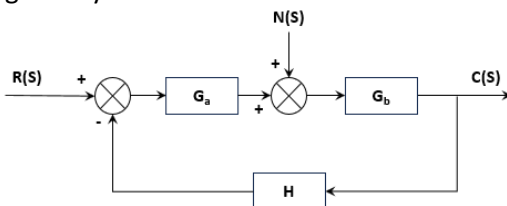
- a)  $G/1 + GH$
- b)  $G/1 - GH$
- c)  $H/1 + GH$
- d)  $GH/1 + GH$

15. The following negative control system will be unstable when:  $GH = \dots$



- a) -1
- b) 1
- c) 0
- d)  $\infty$

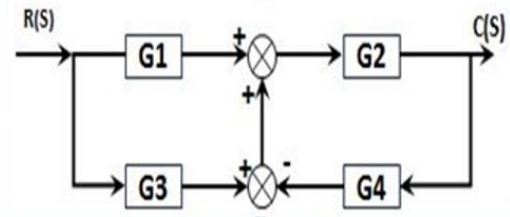
16. The ratio of  $C(s)$  to  $N(s)$  in the following figure is given by:



- a)  $C(s) / N(s) = G_b / 1 + G_a G_b H$
- b)  $C(s) / N(s) = G_b / 1 + G_b H$
- c)  $C(s) / N(s) = G_a / 1 + G_a G_b H$
- d)  $C(s) / N(s) = G_a G_b / 1 + G_a G_b H$

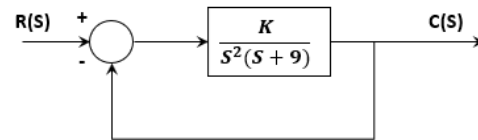
17. Consider the block diagram If the transfer function of the system is given by:

$$T(s) = G_1 G_2 + G_2 G_3 / 1 + X. \text{ Then } X \text{ is:}$$



- a)  $G_2 G_3 G_4$
- b)  $G_2 G_4$
- c)  $G_1 G_2 G_4$
- d)  $G_2 G_4 + G_1 G_2 + G_2 G_3$

18. Find the type and order:



- a) 2, 3
- b) 2, 2
- c) 3, 3
- d) None of the above.

19.  $G(s) = 2/S(S + 3)$ . Obtain an expression for unit step response:

- a)  $1 + 2e^{-t} + e^{-2t}$
- b)  $1 + e^{-t} - 2e^{-2t}$
- c)  $1 - e^{-t} + 2e^{-2t}$
- d)  $1 - 2e^{-t} + e^{-2t}$

20. The characteristic equation of a system is given as:  $S^3 + 18S^2 + 77S + 15 = 0$ . What is the number of the roots in the right half s\_plane and the imaginary axis respectively?

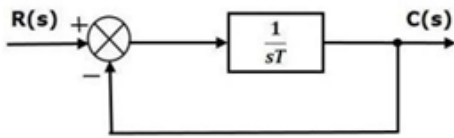
- a) 1, 1
- b) 0, 0
- c) 2, 1
- d) 1, 2

21. If the characteristic equation of the closed loop system is:  $S^2 + 2S + 1 = 0$ . Then the system is:

- a) Over damped
- b) Critically damped
- c) Undamped
- d) Underdamped

22. Consider a unit impulse signal ( $\delta(t)$ ) applied as the input to the first-order system. What is the Laplace transform of the unit impulse response,  $c(t)$ ?

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- a)  $1/s$
- b)  $s$
- c)  $1/(sT + 1)$
- d)  $e^{(-t/T)}$

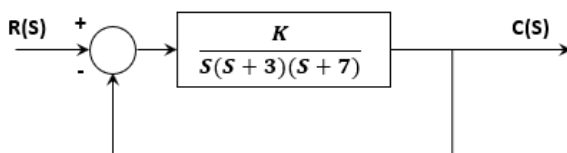
23. What is the characteristic of the unit impulse response  $c(t)$  for positive values of  $t$  in a first order system?

- a) Constant value
- b) Sinusoidal oscillation
- c) Exponential decay
- d) Linearly increasing

24. A system with a closed-loop transfer function having poles at  $-2, -3, j2$  is:

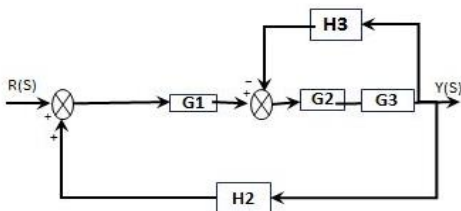
- a) Stable
- b) Unstable
- c) Marginally Stable
- d) Cannot be determined

25. For the closed-loop system, Find the ranges of the values of  $K$  for stability:



- a)  $K < 0$
- b)  $k > 210$
- c)  $0 < k < 210$
- d)  $K > 0$

26. Find the transfer function of the following figure:



- a)  $G_1(G_2G_3/1 + G_2G_3H_3)$
- b)  $G_1G_2G_3/1 + G_2G_3H_3 - G_1G_2G_3H_2$
- c)  $G_1G_2G_3/1 + G_2H_3$
- d)  $G_2G_3/1 + G_2H_3$

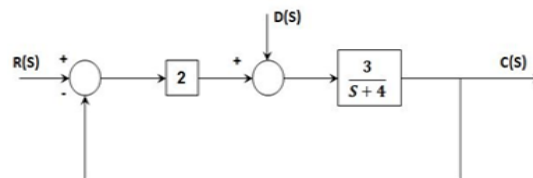
27. If:  $S^3 + 3S^2 + 4S + A = 0$ . The roots of the characteristic equation lie in the left if of the  $s$ -plane. Then the value of the  $A$  is said to be:

- a)  $0 < A < 12$
- b)  $5 < A < 12$
- c)  $A > 12$
- d)  $A < 12$

28. Which of the following statements accurately describes the difference between an open-loop control system and a closed-loop control system?

- a) An open-loop control system uses feedback to correct errors, while a closed-loop system does not.
- b) A closed-loop control system is more sensitive to external disturbances compared to an open-loop control system.
- c) A closed-loop control system uses feedback to correct errors, making it more accurate and stable than an open-loop control system.
- d) Both systems have the same level of accuracy and stability.

29. Find transfer function  $C(s)$  to  $D(s)$ :



- a)  $3/s + 10$
- b)  $2/3s + 1$
- c)  $6/3s + 7$
- d)  $2/3s + 6$

30. What is the mathematical representation of the transient response as time approaches infinity?

- a)  $\lim_{t \rightarrow \infty} ctr(t) = \infty$
- b)  $\lim_{t \rightarrow 0} ctr(t) = \infty$
- c)  $\lim_{t \rightarrow 0} ctr(t) = 0$
- d)  $\lim_{t \rightarrow \infty} ctr(t) = 0$

31. The characteristic equation of a system is given as:  $3s^4 + 10s^3 + 5s^2 + 2 = 0$ . This system is :

- a) Stable
- b) Marginally stable

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c) Unstable

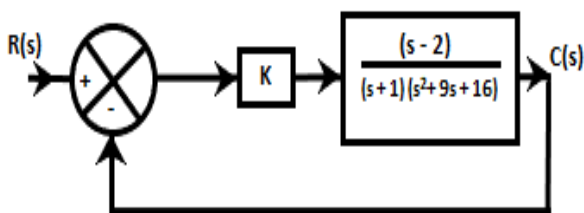
32. If the characteristic equation of the closed loop system is  $s^2 + 2s + 2 = 0$ , then the system is:

- a) Over damped
- b) Critically damped
- c) Underdamped

33. The transfer function of a system is given as  $81/(s^2 + 16s + 81)$ . Find the undamped natural frequency, damping ratio, and peak time for a unit step input.

- a) 9, 0.889, 0.762
- b) 9, 0.559, 0.762
- c) 9, 0.889, 0.187

34. For the given closed-loop system, the ranges of the values of K for stability is:



- a)  $K > -19.5$
- b)  $k > 8$
- c)  $-19.5 < k < 8$

35. The transfer function of the system is:  $G(s) = 100/(s+1)(s+100)$ . For a unit step input to the system the approximate settling time for 2% criterion is:

- a) 100 sec
- b) 4 sec
- c) 1 sec

36. For a second-order system with the closed-loop transfer function:  $T(s) = 9/(s^2 + 4s + 9)$  the settling time for 2-percnt band, in seconds, is:

- a) 1.5
- b) 2.0
- c) 3.0

37. What is Control System?

- a) Control system is a system in which the output is controlled by varying the input
- b) Control system is a device that will not manage or regulate the behavior of other devices using control loops

c) Control system is a feedback system that can be both positive and negative

d) Control System is a system in which the input is controlled by varying the output.

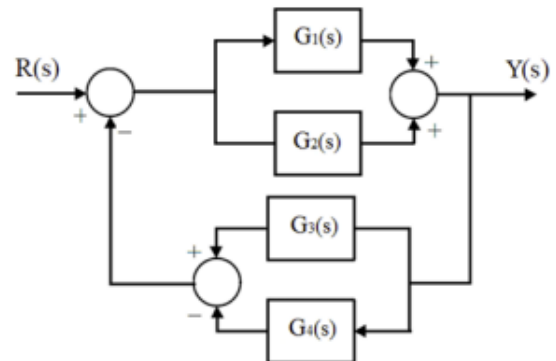
38. The output of the feedback control system must be a function of. \_\_\_\_\_

- a) Output and feedback signal
- b) Input and feedback signal
- c) Reference input
- d) Reference output

39. The necessary condition for the stability of the linear system is that all the coefficients of characteristic equation  $1+G(s)H(s)=0$ , be real and have the :

- a) Positive sign
- b) Negative sign
- c) Same sign
- d) Both positive and negative

40. The overall transfer function is given by :



- a)  $\frac{G1+G2}{1+(G1G3-G1G4+G2G3-G2G4)}$
- b)  $\frac{G1+G2}{1+(G1G3-G1G4-G2G3+G2G4)}$
- c)  $\frac{G1}{1-(G1G4+G2G3-G2G4)}$

41. The order of the auxiliary polynomial is always:

- a) Even
- b) Odd
- c) May be even or odd
- d) None of the mentioned

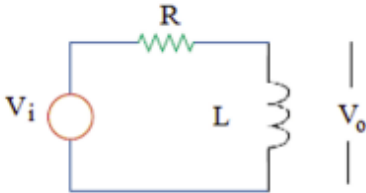
42. The error constants described are the ability to reduce the steady state errors.

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- a) True
  - b) False
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43. Find the Transfer Function ( $V_o/V_i$ ) for the two systems shown below:



- a)  $LS / R+LS$  b)
  - b)  $(R+LS)/LS$
  - c)  $(R+LS)/R$
  - d)  $(R+LS)$
- 

44. The overall transfer function from block diagram reduction for cascaded blocks is :

- a) Sum of individual gain
- b) Product of individual gain
- c) Difference of individual gain
- d) Division of individual gain

45. If the damping factor of a control system is unity it will give

- a) No response
  - b) Critically damped response
  - c) Undamped response
  - d) Oscillatory response
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46. In an open loop control system

- (a) Output is independent of control input
  - (b) Output is dependent on control input (
  - c) Only system parameters have effect on the control output
  - (d) None of the above
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