

1. What is the primary purpose of compensation in control systems?

1 point

- ☐ A) To increase the system's complexity
- ☒ B) To stabilize a system and improve performance
- ☐ C) To decrease the bandwidth of the system
- ☐ D) To limit feedback control actions

2. Which type of compensation utilizes changes made to the output before it is disturbed by external factors? 1 point

- ☐ A) Cascade Compensation
- ☐ B) Feedback Compensation
- ☒ C) Feed-Forward Compensation
- ☐ D) Passive Compensation

3. Which controller is classified as a type of active compensation?

1 point

- ☐ A) Phase-lead Controller
- ☐ B) Phase-lag Controller
- ☒ C) PID Controller
- ☐ D) Phase lag-lead Controller

4. What is a key feature of a Proportional-Derivative (PD) controller?

1 point

- ☐ A) It introduces a pole at zero
- ☒ B) It does not affect system type
- ☐ C) It eliminates steady-state errors
- ☐ D) It decreases system bandwidth

5. Which controller improves steady-state performance by increasing the system type?

1 point

- ☐ A) PD Controller
- ☒ B) PID Controller
- ☐ C) Phase-lag Controller
- ☐ D) Phase-lead Controller

6. In the context of passive compensation controllers, which configuration typically aims to improve transient response without affecting steady-state performance?

1 point

- ☒ A) Phase-lead Controller
- ☐ B) Phase-lag Controller
- ☐ C) Feed-Forward Compensation
- ☐ D) Passive Compensation

7. What are the effects of employing a phase-lag controller in a control system?

1 point

- ☐ A) Increases system stability
- ☐ B) Reduces noise significantly
- ☐ C) Improves the rise time of the response
- ☒ D) Eliminates steady-state error in first-order systems

8. How do active compensators generally compare to passive compensators?

1 point

- ☐ A) Active compensators are simpler to design
- ☐ B) Active compensators respond slower to disturbances
- ☒ C) Active compensators provide greater control over system dynamics
- ☐ D) Active compensators are always less expensive

9. What is the primary purpose of using root-locus design in control systems? 1 point

- ☐ A) To determine the system's steady-state error
- ☒ B) To adjust system gain for satisfactory closed-loop behavior
- ☐ C) To define the transfer function of a system
- ☐ D) To find the time constant of a system

10. Which type of controller combines proportional gain with the integral of the error? 1 point

- ☐ A) PD Controller
- ☒ B) PI Controller
- ☐ C) PID Controller
- ☐ D) Phase-Lag Controller

11. In a phase-lead compensator, what is the relationship between the zero and pole? 1 point

- ☒ A) The zero is greater than the pole
- ☐ B) The zero is less than the pole
- ☐ C) The zero and pole are equal
- ☐ D) The pole is located at the origin

12. When designing a PD compensator, which of the following is typically the goal? 1 point

- ☐ A) To increase the steady-state error
- ☒ B) To improve the transient response of the system
- ☐ C) To completely eliminate overshoot
- ☐ D) To decrease the system's gain

13. How do phase-lag compensators primarily affect the root-locus plot?

1 point

- ☒ A) They shift the root-locus to the right
- ☐ B) They reduce the overshoot of the system
- ☐ C) They add positive phase to the system
- ☐ D) They have no effect on the root-locus plot

14. What is a key characteristic of a PID controller?

1 point

- ☐ A) It uses only proportional control
- ☐ B) It improves stability without affecting response time
- ☒ C) It combines proportional, integral, and derivative actions
- ☐ D) It has no impact on steady-state error

15. Which command in MATLAB is used to plot the root locus of a system?

1 point

- ☐ A) step()
- ☒ B) rlocus()
- ☐ C) plot()
- ☐ D) tf()

16. In the design of a compensator, what does the angular criterion help determine?

1 point

- ☐ A) The speed of the response
- ☐ B) The location of poles on the real axis
- ☒ C) The positions of zeros and poles in the s-plane
- ☐ D) The steady-state error of the system

17. What does the term "breakaway point" refer to in root-locus design?

1 point

- ☐ A) The point at which the response changes from stable to unstable
- ☒ B) The location on the root locus where multiple trajectories diverge
- ☐ C) The point indicating no response to input changes
- ☐ D) The point of maximum overshoot in a step response

18. What is the effect of increasing the controller gain in a P-controller?

1 point

- ☐ A) Increases error
- ☐ B) Increases system stability
- ☒ C) Improves transient response at the risk of overshoot
- ☐ D) No effect on the system response

19. What is the function of a compensator in the context of root-locus design?

1 point

- ☐ A) To simplify the transfer function of a system
- ☒ B) To reshape the root-locus plot for desired performance
- ☐ C) To measure system frequency response
- ☐ D) To enhance system noise immunity

20. What effect does a PD controller have on overshoot in transient response?

1 point

- ☐ A) It increases overshoot
- ☐ B) It eliminates overshoot entirely
- ☒ C) It can reduce overshoot
- ☐ D) It has no effect on overshoot

21. For a control system using a PID controller, which action is responsible for eliminating steady-state error?

1 point

- ☐ A) Proportional action
- ☐ B) Derivative action
- ☒ C) Integral action
- ☐ D) None of the above

22. When designing a phase-lead compensator, what must you consider regarding the placement of the compensator pole?

1 point

- ☐ A) It must be placed at the origin
- ☐ B) It should be far from the zero to avoid instability
- ☒ C) It should satisfy the angle criterion
- ☐ D) It must be equal to the zero for stability

23. What is the purpose of the graphical root-locus design method?

1 point

- ☐ A) To determine the frequency response of a system
- ☒ B) To select points in the s-plane for closed-loop poles
- ☐ C) To linearize nonlinear systems
- ☐ D) To derive the state-space representation

24. During root-locus design, what does the term "dominant poles" refer to?

1 point

- ☒ A) Poles that contribute most significantly to the system's behavior
- ☐ B) Poles found on the imaginary axis
- ☐ C) The poles that have negligible impact on system dynamics
- ☐ D) Poles that are located in the right half of the s-plane
- ☐ Option 5

25. How would you describe the behavior of a system with a gain that is too high? 1 point

- ☐ A) It leads to faster response times
- ☐ B) It enhances stability
- ☒ C) It can cause instability
- ☐ D) It has no effect on the system response

26. In a PID controller, adjusting which parameter first is recommended to achieve quick response? 1 point

- ☐ A) Integral gain (K_I)
- ☐ B) Derivative gain (K_D)
- ☒ C) Proportional gain (K_P)
- ☐ D) All gains should be set simultaneously

27. What does the integral action of a PID controller primarily address

1 point

- ☐ A) Transient response
- ☐ B) Overshoot
- ☒ C) Steady-state error
- ☐ D) Damping of oscillations

28. What is the role of the angle criterion in root-locus design?

1 point

- ☐ A) To determine system type
- ☐ B) To calculate the magnitude of gain
- ☒ C) To establish the phase contribution of poles and zeros
- ☐ D) To plot the root locus on a graph

29. With regard to the filtering capacity the lead compensator and lag compensator are respectively:

1 point

- ☐ A) Low pass and high pass filter
- ☒ B) High pass and low pass filter
- ☐ C) Both high pass filter
- ☐ D) Both low pass filter

30. What is the effect of phase lag compensation on the performance of a servo system?

1 point

- ☒ A) For a given relative stability, the velocity constant is increased
- ☐ B) For a given relative stability, the velocity constant is decreased
- ☐ C) The bandwidth of the system is increased
- ☐ D) The time response is made faster

31. A composite R-C network yielded the following transfer function when calculated from its components:

1 point

$T(s) = \frac{1+21s+20s^2}{1+11s+10s^2}$. This network can be used as which one of the

following?

- ☒ A) Phase lead compensator
- ☐ B) Phase lag compensator
- ☐ C) Lag lead compensator
- ☐ D) None of the mentioned

32. The open loop transfer function of a plant is given as, $G(s) = 1/s^2 - 1$. If the plant is operated in unity feedback configuration, then the lead compensator that can stabilize the control system is:

1 point

- ☒ A) $10(s-1)/(s+2)$
- ☐ B) $10(s+4)/(s+2)$
- ☐ C) $10(s+2)/(s+1)$
- ☐ D) $10(s+2)/(s+1)$

33. What does a Bode plot represent?

1 point

- ☐ A) Time-domain response of a system
- ☒ B) Frequency response of a system
- ☐ C) Stability of a system
- ☐ D) Root locus of a system

34. Which axes are used in a Bode plot?

1 point

- ☐ A) Linear scale for magnitude and phase, log scale for frequency
- ☒ B) Log scale for magnitude and frequency, linear scale for phase
- ☐ C) Log scale for both magnitude and frequency
- ☐ D) Linear scale for both magnitude and phase

35. What is the formula to convert gain G into decibels (dB)?

1 point

- ☐ A) $\text{dB} = 10 \log_{10} G$
- ☒ B) $\text{dB} = 20 \log_{10} G$
- ☐ C) $\text{dB} = 10 G$
- ☐ D) $\text{dB} = 20 G$

36. What is the phase margin in a Bode plot?

1 point

- ☐ A) The distance from the 0 dB point to the gain crossover frequency
- ☒ B) The distance from -180 degrees to the phase at the gain crossover frequency
- ☐ C) The difference between gain margin and phase angle
- ☐ D) The maximum phase that can be achieved before instability

37. How can high-order transfer functions be effectively plotted using Bode plots?

1 point

- ☒ A) By plotting each term separately and adding them graphically
- ☐ B) By calculating numeric values at discrete points
- ☐ C) By fitting a polynomial curve
- ☐ D) By converting them to state-space form

38. What type of response does a Bode plot specifically analyze?

1 point

- ☐ A) Step response
- ☐ B) Transient response
- ☐ C) Steady-state response
- ☒ D) Frequency response

39. Which of the following parameters does a Bode plot not directly provide information about? 1 point

- ☐ A) Gain crossover frequency
- ☒ B) Time constant
- ☐ C) Phase crossover frequency
- ☐ D) Stability margins

40. In Bode plots, how is a first-order system represented in terms of its slope on the magnitude plot? 1 point

- ☐ A) 10 dB/decade
- ☒ B) 20 dB/decade
- ☐ C) 30 dB/decade
- ☐ D) 40 dB/decade

41. When is a Bode plot considered to indicate a stable system?

1 point

- ☐ A) When the gain margin is greater than 1
- ☒ B) When the phase margin is positive
- ☐ C) When the output does not vary
- ☐ D) When the magnitude plot approaches infinity
- ☐ Option 5

42. What is the corner frequency in a Bode plot?

1 point

- ☐ A) The frequency at which the gain is maximum
- ☐ B) The frequency at which the phase shift is -90 degrees
- ☒ C) The frequency at which the slope of the magnitude plot changes
- ☐ D) The frequency at which the gain crosses 0 dB

43. In a Bode plot, what effect does adding a zero at the origin have on the magnitude plot? 1 point

- ☐ A) No effect
- ☒ B) Increases slope by 20 dB/decade
- ☐ C) Decreases slope by 20 dB/decade
- ☐ D) Flattens the slope

44. According to the principle of log-scales, if the ratio between two points is same, then the two points get _____ equally. 1 point

- ☐ A) United
- ☒ B) Separated
- ☐ C) Multiplexed
- ☐ D) Mixed

45. What does the term 'gain margin' refer to in a Bode plot?

1 point

- ☐ A) The frequency response beyond the cutoff frequency
- ☒ B) The maximum gain that a system can tolerate before becoming unstable
- ☐ C) The slope of the magnitude plot at the bandwidth
- ☐ D) The average gain over all frequencies

46. How does a second-order system appear on a Bode plot?

1 point

- ☐ A) As a constant value
- ☒ B) With a slope that changes at two distinct frequencies
- ☐ C) With a single continuous line
- ☐ D) As two separate straight lines

47. in a bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system?

1 point

- ☒ A) -80dB/decade
- ☐ B) -40 dB/decade
- ☐ C) 40 dB/decade
- ☐ D) 80 dB/decade

48. In a Bode plot, what does the slope of the magnitude plot indicate?

1 point

- ☐ A) The system's bandwidth
- ☐ B) The stability margins
- ☒ C) The order of the system
- ☐ D) The damping ratio of the system

49. The system is said to be marginally stable, if gain margin is:

1 point

- ☐ A) 0
- ☒ B) 1
- ☐ C) $+\infty$
- ☐ D) None of the above

50. At which frequency does the magnitude of the system becomes zero dB? 1 point

- ☐ A) Resonant frequency
- ☐ B) Cut-off frequency
- ☒ C) Gain crossover frequency
- ☐ D) Phase crossover frequency

51. Phase lag controller:

1 point

- ☐ a) Improvement in transient response
- ☒ b) Reduction in steady state error
- ☐ c) Reduction in settling time
- ☐ d) Increase in damping constant

52. Addition of zero at origin:

1 point

- ☒ a) Improvement in transient response
- ☐ b) Reduction in steady state error
- ☐ c) Reduction in settling time
- ☐ d) Increase in damping constant

53. Lag compensation leads to:

1 point

- ☐ a) Increases bandwidth
- ☒ b) Attenuation
- ☐ c) Increases damping factor
- ☐ d) Second order

54. Lead compensation leads to:

1 point

- ☒ a) Increases bandwidth
- ☐ b) Attenuation
- ☐ c) Increases damping factor
- ☐ d) Second order

55. Lag-lead compensation is a:

1 point

- ☐ a) Increases bandwidth
- ☐ b) Attenuation
- ☐ c) Increases damping factor
- ☒ d) Second order.

56. Rate compensation :

1 point

- ☐ a) Increases bandwidth
- ☐ b) Attenuation
- ☒ c) Increases damping factor
- ☐ d) Second order

57. Negative exponential term in the equation of the transfer function causes the transportation lag.

1 point

- ☒ a) True
- ☐ b) False.

58. A phase lead compensation leads to:

1 point

- ☐ a) Increase in overshoot
- ☐ b) Reduction in bandwidth of closed loop system
- ☒ c) Reduction in rise time of closed loop system
- ☐ d) Reduction in gain margin

59. PD controller is used to compensate system. Compared to the uncompensated system, the compensated system has:

1 point

- ☐ a) A higher type number
- ☐ b) Reduced damping
- ☒ c) Higher noise amplification
- ☐ d) Large transient overshoot

60. P+D controller:

1 point

- ☐ a) Introduces offset
- ☒ b) Increases bandwidth
- ☐ c) Increases margin of stability
- ☐ d) Reduces velocity constant

61. Proportional controller:

1 point

- ☒ a) Introduces offset
- ☐ b) Increases bandwidth
- ☐ c) Increases margin of stability
- ☐ d) Reduces velocity constant

62. The transfer function of a lead controller is $1+20s/1+5s$. The high frequency magnitude of the lead controller is

1 point

- ☐ a) 1
- ☐ b) 2
- ☐ c) 3
- ☒ d) 4

63. Controllers play the following role in control system:

1 point

- ☐ a) They amplify the signals going to the actuator
- ☐ b) They act on the error signal coming out of the summing junction and output a suitable to the actuator
- ☐ c) They try to reduce steady state error optimizes overshoot.
- ☒ d) All of the mentioned

64. The transfer function of the compensator is $s+4/s+16$. The maximum phase lead frequency and the corresponding phase is :

1 point

- ☐ a) 6 rad/sec, 36.87°
- ☒ b) 8 rad/sec, 36.87°
- ☐ c) 6 rad/sec, -36.87°
- ☐ d) 8 rad/sec, -36.87°

65. Response to error is very fast for integral controller.

1 point

☐ a) True

☒ b) False

66. Rate mode controller is also known as controller mode.

1 point

☐ a) Anticipatory

☐ b) Delay

☐ c) Integral

☒ d) Derivative

67. The input of a controller is

1 point

- ☐ a) Sensed signal
- ☒ b) Error signal
- ☐ c) Desired variable value
- ☐ d) Signal of fixed amplitude not dependent on desired variable value

68. If the constant 'k' is positive, then what would be its contribution on the phase plot? 1 point

- ☒ a. 0°
- ☐ b. 45°
- ☐ c. 90°
- ☐ d. 180°

69. If the unity feedback system is given by the open loop transfer function $G(s) = ks^2 / [(1 + 0.3s)(1 + 0.05s)]$, what would be the initial slope of magnitude plot? 1 point

- ☐ a. 20 dB/decade
- ☒ b. 40 dB/decade
- ☐ c. 60 dB/decade
- ☐ d. Unpredictable

70. If the phase angle at gain crossover frequency is estimated to be -105° , what will be the value of phase margin of the system? 1 point

- ☐ a. 23°
- ☐ b. 45°
- ☐ c. 60°
- ☒ d. 75°

71. The frequency at which the phase of the system acquires ____ is known as 'Phase crossover frequency'.

1 point

- ☐ a. 90°
- ☐ b. -90°
- ☐ c. 180°
- ☒ d. -180°

72. If a pole is located at origin, how does it get represented on the magnitude plot?

1 point

- ☐ a. $-10 \log(\omega)$ dB
- ☒ b. $-20 \log(\omega)$ dB
- ☐ c. $-40 \log(\omega)$ dB
- ☐ d. $-60 \log(\omega)$ dB
- ☐ Option 5

73. In an octave frequency band, the ratio of f_2 / f_1 is equivalent to

1 point

- ☒ a. 2
- ☐ b. 4
- ☐ c. 8
- ☐ d. 10

74. Which unit is adopted for magnitude measurement in Bode plots?

1 point

- ☐ a. Degree
- ☐ b. Decimal
- ☒ c. Decibel
- ☐ d. Deviation

75. A system has poles at 0.01 Hz, 1 Hz and 80Hz, zeroes at 5Hz, 100Hz and 200Hz. The approximate phase of the system response at 20 Hz is : 1 point

- ☒ a. -90°
- ☐ b. 0°
- ☐ c. 90°
- ☐ d. -180°

76. Frequency range of bode magnitude and phases are decided by : 1 point

- ☒ a. The lowest and higher important frequencies of dominant factors of the OLTF
- ☐ b. The lowest and highest important frequencies of all the factors of the open loop transfer function
- ☐ c. Resonant frequencies of the second factors
- ☐ d. None of the above

77. OLTF contains one zero in right half of s-plane then

1 point

- ☐ a. Open loop system is unstable
- ☐ b. Close loop system is unstable
- ☒ c. Close loop system is unstable for higher gain
- ☐ d. Close loop system is stable

78. The critical value of gain for a system is 40 and gain margin is 6dB. The system is operating at a gain of:

1 point

- ☒ a. 20
- ☐ b. 40
- ☐ c. 80
- ☐ d. 120

79. The roots of the characteristic equation of the second order system 1 point
in which real and imaginary part represents the :

- ☐ a. Damped frequency and damping
- ☒ b. Damping and damped frequency
- ☐ c. Natural frequency and damping ratio
- ☐ d. Damping ratio and natural frequency

80. Frequency range of bode magnitude and phases are decided by : 1 point

- ☒ a. The lowest and higher important frequencies of dominant factors of the OLTF
- ☐ b. The lowest and highest important frequencies of all the factors of the open loop transfer function
- ☐ c. Resonant frequencies of the second factors
- ☐ d. None of the above

81. If a Zero is located at origin, how does it get represented on the Phase plot?

1 point

- ☐ a. -90°
- ☐ b. 0°
- ☒ c. 90°
- ☐ d. -180°

82. If a Zero is S^2 , how does it get represented on the Phase plot?

1 point

- ☒ a. 180°
- ☐ b. 0°
- ☐ c. 90°
- ☐ d. -180°

83. If a pole is located at origin, how does it get represented on the Phase plot?

1 point

- ☒ a. -90°
- ☐ b. 0°
- ☐ c. 90°
- ☐ d. -180°

84. If a pole is $1/S^2$, how does it get represented on the Phase plot?

1 point

- ☐ a. -90°
- ☐ b. 0°
- ☐ c. 90°
- ☒ d. -180°

85. In a Bode plot, what does the slope of the magnitude plot indicate?

1 point

- ☐ a. The system's bandwidth
- ☐ b. The stability margins
- ☒ c. The order of the system
- ☐ d. The damping ratio of the system