# BRAINWARE UNIVERSITY

**Term End Examination 2024-2025**
**Programme – B.Tech.(RA)-2022/B.Tech.(RA)-2023**
**Course Name – Control Systems**
**Course Code - ESCR302**
**( Semester III )**

**Full Marks : 60** **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

## Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the appropriate one for 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 option

(ii) Determine the effect of adding a zero to a transfer function.
a) It increases the system's stability
b) It affects the gain and phase characteristics
c) It decreases the system's bandwidth
d) It eliminates oscillations completely

(iii) Determine the significance of zeros in a transfer function.
a) They indicate system stability
b) They are the frequencies at which the output is zero
c) They represent the gain of the system
d) They affect the phase response of the system

(iv) The transfer function of a system is used to identify which of the following.
a) The order of the system
b) The time constant
c) The output for any given input
d) The steady state gain

(v) Indicate the band width in a feedback amplifier.
a) remains unaffected
b) decreases by the same amount as the gain increase
c) increases by the same as the gain decrease
d) decreases by the same amount as the gain decrease

(vi) A closed-loop system is distinguished from an open-loop system; select the appropriate one.
a) Servomechanism
b) Feedback
c) Output pattern
d) Input pattern

(vii) Represent controllability in state space analysis.

a) The ability to measure the output of the system
b) The ability to drive the state of the system to any desired value
c) The stability of the system
d) The system's response to disturbances

(viii) Determine the formula to calculate the centroid of the asymptotes for a root locus plot calculated.

a) (Sum of poles – Sum of zeros) / (n - m)
b) (Sum of poles – Sum of zeros) / (n + m)
c) Sum of poles / n
d) (Sum of poles + Sum of zeros) / n

(ix) To find breakaway points on the real axis, choose what mathematical condition is used.

a) Use the Routh-Hurwitz Criterion.
b) Analyze the angle condition at the zeros.
c) Evaluate the gain at the poles.
d) Set the derivative of the characteristic equation equal to zero.

(x) Determine when a conditionally stable system exhibits poor stability.

a) low frequencies
b) reduced values of open loop gain
c) increased values of open loop gain
d) none of the option

(xi) If the system is specified by the open loop transfer function G(s)H(s)=k/[s(s+3)(s+2)], identify how many root loci proceed to end at infinity.

a) 2
b) 3
c) 5
d) 6

(xii) Identify the correct option for the first-order control system, which is well designed.

a) it has small bandwidth
b) it has negative time constant
c) it has large negative transfer function pole
d) none of the option

(xiii) If the eigenvalues of the matrix A are all negative, determine what can be inferred about the state transition matrix Φ(t) as t→∞.

a) It approaches zero
b) It oscillates indefinitely
c) It approaches infinity
d) It remains constant

(xiv) Determine the addition of zeros in the transfer function causes which of the following.

a) Lead-compensation
b) Lag-compensation
c) Lead-lag compensation
d) None of the option

(xv) A phase lag lead network predicts how introduces in the output.

a) lag at all frequencies
b) lag at high frequencies and lead at low frequencies
c) lag at low frequencies and lead at high frequencies
d) none of the option

## Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain the Root locus. (3)

3. Explain the phase cross-over frequency and gain cross-over frequency of a system. (3)

4. Compare open-loop systems and closed-loop systems. (3)

5. Describe the linear system. (3)

6. Explain the force-voltage analogous equations relating to the mechanical and electrical systems for a simple mass-spring-damper system. (3)

Conclude the force-voltage analogy.

OR



(3)

## Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain constant M-circles for unity feedback systems. (5)

8. Draw the root locus of the feedback system and explain whose open-loop transfer function is given by (5)

$$G(s)H(s) = \frac{K}{s(s+1)}$$

9. Determine the steady-state response of a system due to a sinusoidal input. (5)

10. Describe the ramp response of a first-order system. (5)

11. Define the control system design process. (5)

12. Draw the Bode magnitude and phase plot of the following open-loop transfer function and solve for the gain margin, phase margin, and absolute stability. (5)

$$G(s)H(s) = \frac{1}{s(s+1)}$$

OR

Draw the Bode magnitude and phase plot of the following open-loop transfer function and solve for the gain margin, phase margin, and absolute stability. (5)

$$G(s)H(s) = \frac{1}{s(s+2)(s+4))}$$