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BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – Dip.RA-2022/Dip.RA-2023
Course Name – Robotic Control System
Course Code - ECPC403
(Semester IV)

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 which of the following statements is incorrect for the open control system.

a) Less expensive
b) Re-calibration is not required to maintaining the necessary quality of the output
c) Construction is simple and maintenance easy
d) Errors are caused by disturbances

(ii) Predict the physical mean if the initial conditions for a system are inherently zero.

a) The system is at rest but stores energy
b) The system is working but does not store energy
c) The system is at rest or no energy is stored in any of its part
d) The system is working with zero reference input

(iii) Select from the following: an example of an open-loop control system.

a) Field-controlled D.C. motor
b) Ward Leonard control
c) Metadyne
d) Stroboscope

(iv) Given a unity feedback system with G (s) = K/[s(s+4)], indicate the value of K for a damping ratio of 0.5.

a) 1
b) 16
c) 4
d) 2

(v) 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

(vi) Determine the initial response when the output is not equal to the input.

a) Transient response b) Error response
c) Dynamic response d) None of the option

(vii) Examine the band width of 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

(viii) Indicate the effect of feedback on the overall gain of the system.

a) Increases b) Decreases
c) Zero d) No change

(ix) Determine which matrix in the state space representation describes the dynamics of the system.

a) State matrix b) Input matrix
c) Output matrix d) Direct transmission matrix

(x) If the system is specified by the open loop transfer function G(s)H(s)=k/(s(s - 3)(s - 2)), determine how many root loci proceed to end at infinity.

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

(xi) Identify 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 affect the control output d) None of the option

(xii) Indicate the position and velocity errors of a type 2 system:

a) constant, constant b) constant, infinity
c) zero, constant d) zero, zero

(xiii) Write why a differentiator is usually not part of a control system because it

a) reduces damping. b) reduces the gain margin.
c) increases input noise. d) increases error.

(xiv) The settling time of a control system is explained as the time it takes for the system output to:

a) Reach its peak value b) Reach 100% of its final steady-state value
c) Settle within a specified percentage of the final steady-state value d) Become unstable

(xv) Determine which of the following statements about Bode plots is true.

a) Bode plots cannot be used to analyze stability. b) Bode plots are only applicable to linear systems.
c) Bode plots provide information about a system's frequency response. d) Bode plots represent time-domain behavior of a system.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain the position, velocity, and acceleration error constants. (3)

3. List the elements or components of closed-loop systems. (3)

4. Determine the transfer function $V0(s)/Vi(s)$ for a series RL circuit, where the output is taken across the inductor. (3)

5. Write about the advantages of frequency domain analysis. (3)

6. Explain how you find the stability of the system by using a polar plot. (3)

OR

Conclude the construction steps for the root locus. (3)

Group-C
(Long Answer Type Questions) 5 x 6=30

7. Explain about the standard test inputs used for control system analysis. (5)

8. Define the closed-loop transfer function for a non-unity feedback system. (5)

9. Explain the effect of variation in forward path gain, G(s), on the overall gain, T(s), of a degenerative feedback control system. (5)

10. Explain (a) peak time, (b) peak overshoot, and (c) setting time. (5)

11. Write the types of feedback control systems. (5)

12. Conclude Routh's criteria; also explain the advantages and limitations of Routh's criteria. (5)

OR

Explain the root locus of the system; consider the open-loop transfer function of the unity feedback system as (5)

$$G(S) = \frac{K(S+9)}{S(S^2+4S+11)}$$

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