Class Test No. 16 Thursday 31st Oct 2019 Duration: 10 Minutes Closed notes

Name: _____ Roll No. _____

Choose only one option which is the most appropriate for questions 1 - 5.

1. The angle condition in the context of root locus for a positive feedback closed loop system is

(a) $0^o \pm 180^o$ (2k-1), k = 0, 1, 2 …
(b) $0^o \pm 180^o$ k, k = 1, 3, 5, …
(c) $0^o \pm 360^o$ (2k-1), k = 0, 1, 2, …
(d) $0^o \pm 360^o$ k, k = 0, 1, 2, …

2. For non-minimum phase (i.e. plants with zero in RH s-plane) stable plant, following statement is valid.

(a) Closed loop will always be unstable.
(b) There are no break-away/break-in points.
(c) Closed loop will be stable for a finite range of gain values.
(d) There will never be a finite gain crossover frequency.

3. Proportional control influences

(a) tracking performance alone
(b) transient response alone
(c) all aspects of closed loop response
(d) phase crossover frequency

4. In case of closed loop dominant poles of a 3rd order minimum phase plant, a higher gain generally results in

(a) larger values of both σ and ω_d
(b) larger value of σ and smaller value of ω_d
(c) smaller value of σ and larger value of ω_d
(d) smaller values of both σ and ω_d

5. In P-control design using root locus, we can always exactly satisfy among K_V, σ & ω_d, requirements on

(a) K_V & σ
(b) σ & ω_d
(c) any two of the three
(d) any one of the three

Give short (1 - 2 lines) answer to the questions 6-10

6. Why is P-control simple as well as restrictive in nature?

It has only one design degree-of-freedom.

..... 2 (PTO)

7. Why is the root locus same for unity as well as non-unity feedback structures?

Root locus is same for unity & non-unity feedback systems because both have the same closed loop characteristic equation.

8. Give the value of 'K' for which the given plant has a damping ratio, 'ζ' of 0.707.

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

$$\sigma = 0.5; \quad \zeta = 0.707; \quad \omega_n = 0.707 = \sqrt{K} \rightarrow K = 0.5$$

9. Why is root locus ideally suited for P-control design?

Root locus provides closed loop poles for a given gain, which when inverted, directly gives the proportional gain.

10. Determine the gain, 'K' to achieve a phase margin of 45^o, for the given plant. Is the gain margin finite positive quantity for this gain? Is the closed loop stable?

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

$\tan^{-1}(-\omega) = 135 \rightarrow \omega_{GCO} = 1.0; \quad K = \sqrt{1+1} = 1.414; \quad GM < 0;$ Closed loop stable.