Class Test No. 15 Thursday 24th 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 integral gain for the PID structure based on gain 'K' and zero locations, 'z_1 & z_2' is given by

(a) $K (z_1 + z_2)$
(b) K
(c) $K z_1 z_2$
(d) $(K z_1)/z_2$

2. The condition for obtaining the break-away point for a normal root locus is

(a) n + m odd to the right
(b) $dK/ds = 0$
(c) $|G(s)| = 1$
(d) $\sum\theta - \sum\phi = \pm 180^o$

3. Presence of asymptotes in normal root locus indicates that

(a) n + m is even
(b) n + m is odd
(c) $n - m > 0$
(d) $n - m < 0$

4. The quantity which determines the angle of departure from complex poles for negative feedback (K > 0) root locus is

(a) n + m
(b) $\pm 180^o/(n - m)$
(c) $|G(s)|$
(d) $\sum\theta - \sum\phi \pm 180^o$

5. Routh's method can be used to determine closed loop gain parameter, 'K' if we specify

(a) ζ
(b) σ
(c) ω_n
(d) ω_d

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

6. What is root locus?

Root locus is a plot of closed loop poles of a plant when gain is increased from 0 to ∞.

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7. Give the primary condition that line segments must satisfy in order to be part of the root locus of a plant, G(s).

$\angle G(s) = \pm 180^{o} (2k+1)$; k = 0, 1, 2, ...

8. Determine the number and location of the break-away points in the root locus for the following plant for K > 0.

$$G(s) = \frac{K}{s^2(s+1)(s-1)}$$

$$K(s) = s^4 - s^2 \rightarrow \frac{dK}{ds} = 4s^3 - 2s = 0 \rightarrow s = 0, \quad \pm\frac{1}{\sqrt{2}}$$

'0' is invalid (Corresponds to K = 0.); $Two \rightarrow \pm\frac{1}{\sqrt{2}}$

9. Show that for a plant expressed as 'K [N(s)/D(s)]', roots of N(s) = 0 are the closed loop poles as $K \rightarrow \infty$

$$K\frac{N(s)}{D(s)} = -1 \rightarrow N(s) = -\frac{D(s)}{K} = 0 \text{ as } K \rightarrow \infty$$

10. What is the main advantage of the root locus?

Root locus provides a complete map of the closed loop response features, including the dominant behaviour and relative stability.