Class Test No. 10   Thursday 26th Sep 2019   Duration: 10 Minutes   Closed notes

Name: _____   Roll No. _____

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

1. Relative stability analysis in s-plane context is concerned with
      (a) number of poles in RH s-plane
      (b) number of poles in LH s-plane
      (c) imaginary part of poles closest to imaginary axis
      <u>(d) real part of poles closest to imaginary axis</u>

2. Modified Routh's method provides the margin for a stable system by shifting
      (a) real axis upwards
      (b) imaginary axis to the right
      <u>(c) imaginary axis to the left</u>
      (d) real axis downwards

3. For a plant having stable closed loop, the Nyquist plot intersection with real axis is
      (a) to the left of -1 + j0
      <u>(b) to the right of -1 + j0</u>
      (c) at -1 + j0
      (d) at -∞

4. In the Nyquist plot context, a system is said to have crossed over when its
      (a) magnitude is 1 and phase is 90°
      (b) magnitude is -1 and phase is 180°
      <u>(c) magnitude is 1 and phase is 180°</u>
      (d) magnitude is -1 and phase is 90°

5. At the crossover point for a stable closed loop
      (a) gain and phase crossover frequencies are the same
      (b) some poles lie on the imaginary axis in s-plane
      (c) gain crossover frequency is higher than phase crossover frequency
      <u>(d) phase crossover frequency is higher than gain crossover frequency</u>

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

6. How does the modified Routh's method provide the stability margin?

      Modified Routh's method provides the stability margin by ensuring occurrence of '0' in the 1st column of the Routh's tabulation.

<div align="right">..... 2 (PTO)</div>

7. Give the general procedure to extract actual stability margin with modified Routh's method.

Actual stability margin is extracted from modified Routh's method by replacing 's' with 'z - σ' in D(s) and solving for 'σ' by enforcing the condition of '0' in all 1st column entries.

8. What is the relation between the grid lines with respect to $j\omega$ axis in s-plane and Nyquist plot with respect to -1 + j0 in G(jω) plane, in a qualitative sense?

As the grid lines move closer to 'jω' axis, the Nyquist plot also moves closer to -1 + j0.

9. How can we obtain the gain cross over frequency from the Nyquist plot?

Gain crossover frequency can be obtained from Nyquist plot by drawing a phasor of unit length and determining the point on Nyquist plot where it touches the plot.

10. Determine the gain cross over frequency and phase at this frequency for the following plant.

$$G(s) = \frac{10}{s+10}$$

$$\left| G(j\omega) \right| = \left| \frac{10}{j\omega+10} \right| = 1 \rightarrow 100 = \omega^2 + 100 \rightarrow \omega = 0; \quad \angle G(j0) = 0$$