ECE-320,

Practice Quiz #4

For problems 1-3, consider a closed loop system with transfer function

$$G_0(s) = \frac{s+a}{s^2 + bs + k}$$

- 1) The sensitivity to variations in k, $S_k^{G_0}(s)$, is
- a) $\frac{k}{s^2 + bs + k}$ b) $\frac{-k}{s^2 + bs + k}$ c) 1 d) $\frac{k}{s + a} \frac{k}{s^2 + bs + k}$ e) none of these
- **2)** The sensitivity to variations in b, $S_b^{G_0}(s)$, is
- a) $\frac{-b}{s^2 + bs + k}$ b) $\frac{-bs}{s^2 + bs + k}$ c) 1 d) $\frac{b}{s + a} \frac{bs}{s^2 + bs + k}$ e) none of thes
- **3)** The sensitivity to variations in a, $S_a^{G_0}(s)$, is
- a) $\frac{a}{s^2 + bs + k}$ b) $\frac{-a}{s^2 + bs + k}$ c) 1) d) $\frac{a}{s + a}$ e) none of these
- 4) Assume we compute the sensitivity of a system with nominal value a = 4 to be

$$S_a^{G_0}(s) = \frac{1}{s+a}$$

For what frequencies will the sensitivity function be less than $\frac{1}{\sqrt{32}}$?

- a) $\omega < 4 \text{ rad/sec b}$) $\omega > 4 \text{ rad/sec c}$) $\omega > 16 \text{ rad/sec d}$) $\omega < 16 \text{ rad/sec e}$) none of these
- **5**) Assume we compute the sensitivity of a system with nominal value a = 3

to be

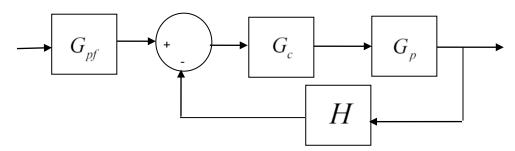
$$S_a^{G_0}(s) = \frac{s+2}{s+1+a}$$

1

For what frequencies will the sensitivity function be less than $\sqrt{\frac{10}{16}}$?

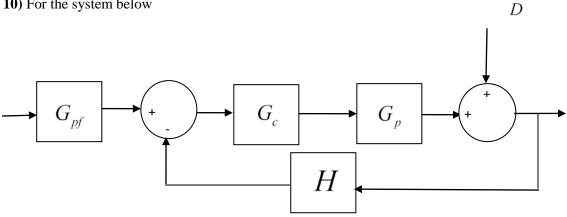
a) $\omega < 4 \text{ rad/sec b}$) $\omega > 4 \text{ rad/sec c}$) $\omega > 16 \text{ rad/sec d}$) $\omega < 16 \text{ rad/sec e}$) none of these

Problems 6-9 refer to the following system



- **6)** To reduce the sensitivity of the closed loop transfer function variations in the plant G_p , we should
- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make $G_{\it pf}$ large d) do nothing, we cannot change the sensitivity
- 7) To reduce the sensitivity of the closed loop transfer function to variations in the prefilter $G_{\it pf}$, we should
- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make G_{pf} small d) do nothing, we cannot change the sensitivity
- 8) To reduce the sensitivity of the closed loop transfer function to variations in the controller G_c we should
- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make $|H(j\omega)|$ large d) do nothing, we cannot change the sensitivity
- $\mathbf{9}$) To reduce the sensitivity of the closed loop transfer function to variations in the sensor H, we should
- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make $G_{\it pf}$ large d) do nothing, we cannot change the sensitivity

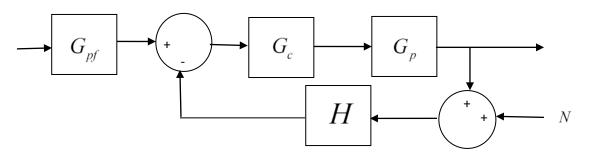
10) For the system below



to reduce the effects of the external disturbance D on the system output, we should

- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make G_{pf} large d) do nothing, we cannot change the sensitivity

11) For the system below



to reduce the effects of sensor noise N on the closed loop system , we should

- a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small
- c) make $|H(j\omega)|$ large d) do nothing, we cannot change the sensitivity

Answers: 1-b, 2-b, 3-d, 4-b, 5-a, 6-a, 7-d, 8-a, 9-b, 10-a, 11-b