THE HONG KONG POLYTECHNIC UNIVERSITY

HONG KONG COMMUNITY COLLEGE

Subject Title : Flight Control Systems **Subject Code** : CCN2297

Session : Semester Two, 2016/17

Numerical Answers

Question A1

(c) Type 0 and second order

Question A2

$$sF(s) = \frac{0.9s^2 + 0.9s}{2.1s^2 + 6s + 16}$$

$$Hence, \lim_{s\to\infty} sF(s) = \frac{0.9}{2.1}$$

Question A4

(a) Opened loop transfer function:

C(s) / R(s) = $\frac{10K}{s^2 + 10s + 10K}$

(b) Transfer function has the format of:

$\omega_n^2 / (s^2 + 2\zeta\omega_n s + \omega_n^2)$

Damping factor $\zeta = 1$

$(\omega_n)^2 = 10K$ and $2\omega_n = 10$ → $K = 2.5$

Question B2

(a)(i) $G_K(s) = \frac{8}{s(s+2)}$

(a)(ii) $\Rightarrow \begin{cases} \omega_n^2 = 8 \\ 2\zeta\omega_n = 2 \end{cases} \Rightarrow \begin{cases} \omega_n = 2\sqrt{2} \\ \zeta = \frac{\sqrt{2}}{4} \end{cases}$

(a)(iii) $G_K(s) = \frac{8}{s(s+4)}$

Type 1 system $K_V = 4$ $\Rightarrow e_{ss} = \frac{1}{K_V} = 0.25$

(b) (i)

$$G_K(s) = \frac{8}{s[s + 2(1 + 4k_d)]}$$

$$\Rightarrow \begin{cases} \omega_n^2 = 8 \\ 2\xi\omega_n = 2(1 + 4k_d) \\ \xi = 0.707 \end{cases} \Rightarrow \begin{cases} \omega_n = 2\sqrt{2} = 2.83 \\ k_d = \frac{1}{4} \end{cases}$$

(b) (ii) $G_K(s) = \frac{4}{s(\frac{1}{2}s + 1)}$

Type 1 system $K_V = 2, \Rightarrow e_{ss} = \frac{1}{K_V} = 0.5$