Soln (a) (b) $G_p = \frac{5}{s^2+3s+2}$, $G_d = \frac{1}{5s+1}$

$$G_c = \frac{G_d}{G_p}$$

$$= \frac{\frac{1}{5s+1}}{\frac{5}{s^2+3s+2}} = \frac{s^2+3s+2}{5(5s+1)}$$

↳ Physically unrealisable b'coz numerator is a higher order polynomial than denominator

(c) $G_p = 10e^{-0.1s}$ $\quad G_d = \frac{2}{2s+1}$

$$G_c = \frac{2}{\frac{2s+1}{10e^{-0.1s}}} = \frac{2(2s+1)}{(2s+1)(10e^{-0.1s})}$$

$$= \frac{2}{10e^{-0.1s}} = \frac{2}{10}e^{0.1s}$$

↳ Physically unrealizable b'coz the term $e^{+0.1s}$ is a -ve time delay

(d) $G_p = \frac{e^{-0.5s}}{(s+1)(3s+1)}$ $\quad G_d = \frac{e^{-s}}{s+1}$

$$\Rightarrow G_c = \frac{\frac{e^{-s}}{s+1}}{\frac{e^{-0.5s}}{(s+1)(3s+1)}} = \frac{e^{-s}(s+1)(3s+1)}{(s+1)e^{-0.5s}}$$

$$= \frac{e^{-s+0.5s}(s+1)(3s+1)}{(s+1)}$$

$$= e^{-s+0.5s}(3s+1)$$

Is Physical or realizable.