

Question 1(a)(i)

$$y(t) = \frac{2}{3}(e^{-2t} - e^{-5t})$$

Question 1(b)(i)

$$A = \begin{bmatrix} 0 & 1 \\ -10 & -7 \end{bmatrix} \text{ and } B = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$$

Question 1(b)(ii)

$$= \frac{1}{s^2 + 7s + 10} \begin{bmatrix} s + 7 & 1 \\ -10 & s \end{bmatrix}$$

Question 2

$$G = \frac{G_1 G_2 G_3}{1 + G_2 H_3 + G_2 G_3 H_2 + G_1 G_2 G_3 H_1}$$

Question 3(a)

$$e(\infty) = \frac{1}{2}$$

$$M_p(\%) = 1.722\%$$

Question 3(b)

$$K = 0.0224, \quad e(\infty) = 0.522$$

Question 4(a)

$$0 < K < 90$$

Question 4(c)

$$s = -1 \pm j1.73$$

Question 5(b)The phase margin = 72.5°

The gain margin = 13 dB

Question 5(c)The phase margin = 32°

The gain margin = 7 dB