

6.24 a)

b) The original transfer function is $H(z) = 1/(1 - b_1 z^{-1} - b_2 z^{-2})$

There are two complex conjugate poles at $z = r e^{\pm j\theta}$. We add two poles and zeros at $z = r e^{\pm j\theta + j2\pi/3}$ and at $z = r e^{\pm j\theta - j2\pi/3}$. We get

$$\begin{aligned} H(z) &= (1 + b_1 z^{-1} + (b_1^2 + b_2)z^{-2} - b_1 b_2 z^{-3} + b_2^2 z^{-4}) / (1 - (b_1^3 + b_1 b_2)z^{-3} - b_2^3 z^{-6}) = \\ &= (z^6 + b_1 z^5 + (b_1^2 + b_2)z^4 - b_1 b_2 z^3 + b_2^2 z^2) / (z^6 - (b_1^3 + b_1 b_2)z^3 - b_2^3) \end{aligned}$$