

A C.5

$$(a) \quad y[n] = \sum_{m=1}^R a_m y[n-m] + x[n] \quad p < N$$

$$Y[k] = \sum_{m=1}^R a_m \cdot Y[k] \cdot e^{-j \frac{2\pi k}{N} \cdot m} + X[k]$$

$$Y[k] \cdot \left\{ 1 - \sum_{m=1}^R a_m e^{-j \frac{2\pi k}{N} \cdot m} \right\} = X[k]$$

$$A[k] = \sum_{n=0}^{N-1} a[n] e^{-j \frac{2\pi k}{N} n}, \quad a[n] = \begin{cases} 1 & n=0 \\ -a_n & 1 \leq n \leq p \\ 0 & p < n \leq N-1 \end{cases}$$

$$H[k] = \frac{1}{A[k]}$$

$$(b) \quad y[n] = \sum_{m=1}^R a_m y[n-m] + \sum_{m=0}^q b_m x[n-m]$$

$$Y[k] = \sum_{m=1}^R a_m Y[k] e^{-j \frac{2\pi k}{N} m} + \sum_{m=0}^q b_m X[k] e^{-j \frac{2\pi k}{N} m}$$

$$Y[k] \left\{ 1 - \sum_{m=1}^R a_m e^{-j \frac{2\pi k}{N} m} \right\} = X[k] \cdot \sum_{m=0}^q b_m e^{-j \frac{2\pi k}{N} m}$$

$$H[k] = \frac{B[k]}{A[k]}$$

$$B[k] = \sum_{n=0}^{N-1} b[n] e^{-j \frac{2\pi k}{N} n}, \quad b[n] = \begin{cases} b_n & 0 \leq n \leq q \\ 0 & q < n \leq N-1 \end{cases}$$

$$\max(p, q) < N$$