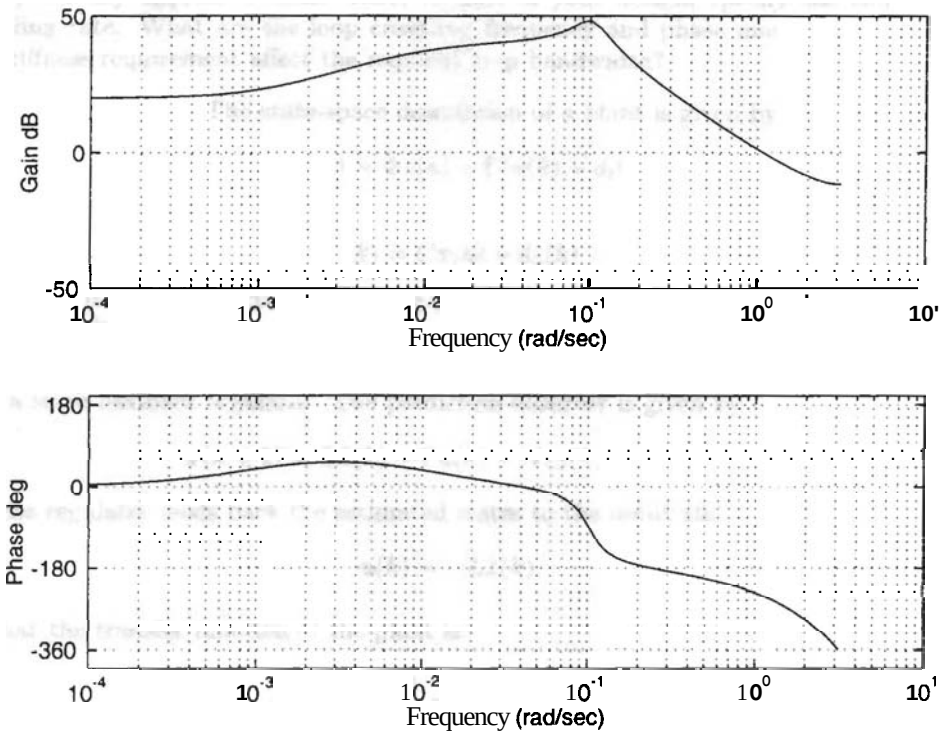
Problem 2 (15 points): The Bode plot of a stable discrete-time filter is shown below.



a) What is the transfer function $G(z)$ of this filter? Explain how you estimated the filter transfer function from the given Bode plot. Sketch the filter poles and zeros on the zplane.

Problem 3 (20 points): This problem considers six transfer functions. These are

$$H_1(z) = \frac{z - 0.95}{z} \tag{1}$$

$$H_2(z) = \frac{z - 1}{z - 0.8} \tag{2}$$

$$H_3(z) = \frac{10(z - 0.98)}{z - 0.9} \tag{3}$$

$$H_4(z) = \frac{z - 0.9}{10(z - 0.98)} \tag{4}$$

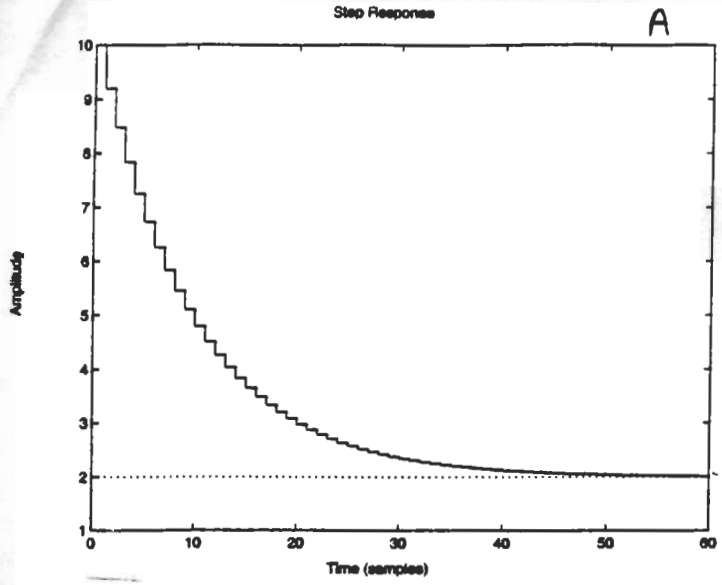
$$H_5(z) = \frac{1 - 2r_1 \cos \Omega_1 + r_1^2}{z^2 - z2r_1 \cos \Omega_1 + r_1^2} \tag{5}$$

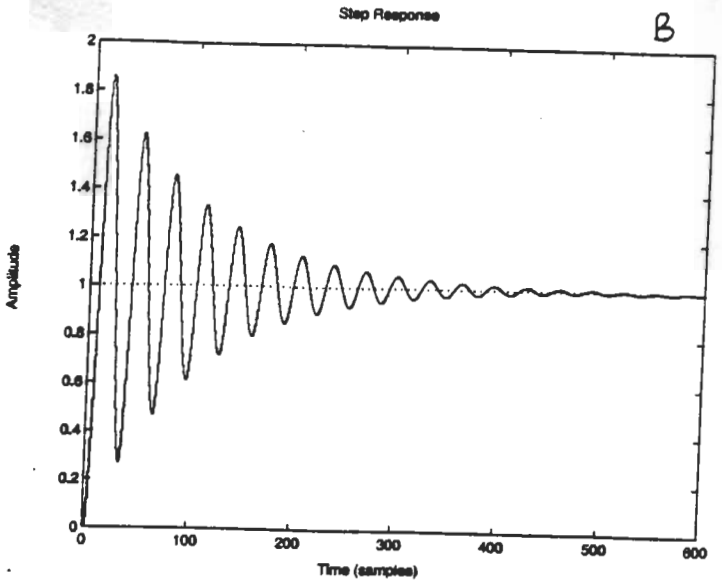
where $r_1 = 0.99$ and $\Omega_1 = 0.2$.

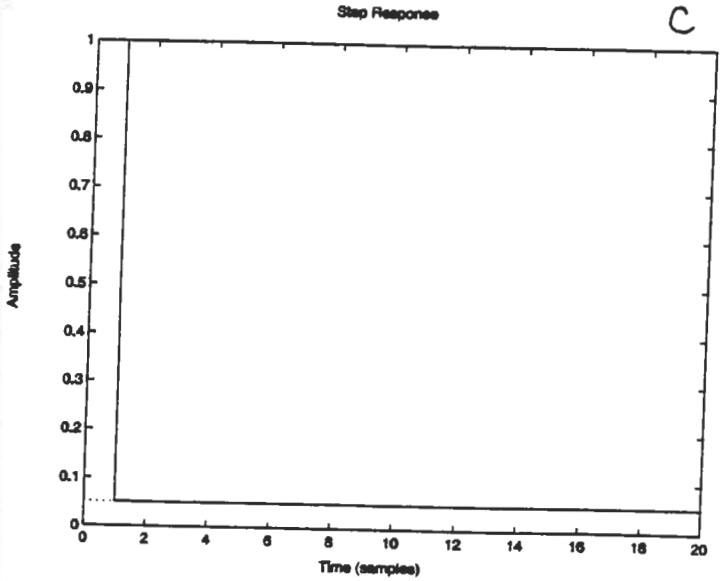
$$H_6(z) = \frac{(1 - 2r_1 \cos \Omega_1 + r_1^2)(z^2 - z2r_2 \cos \Omega_2 + r_2^2)}{(z^2 - z2r_1 \cos \Omega_1 + r_1^2)(1 - 2r_2 \cos \Omega_2 + r_2^2)} \tag{6}$$

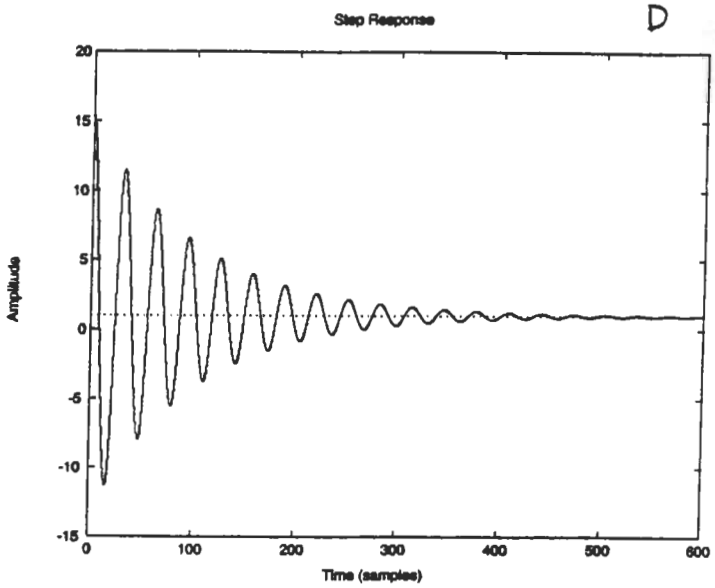
where $r_1 = 0.99$ and $\Omega_1 = 0.2$, as before, and $r_2 = 0.99$ and $\Omega_2 = 0.05$.

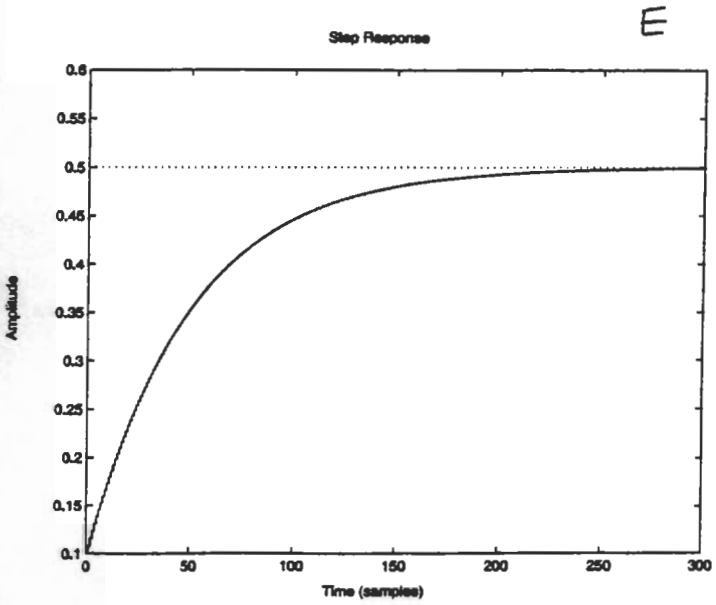
On two pages attached to the end of this exam are six step responses and six frequency response (Bode) plots. These plots are labeled A, B, C, D, E, F; and I, II, III, IV, V, VI; respectively. For each of the transfer functions above, indicate which are the corresponding step and frequency responses. Your answer should take the form of a number from 1-6 for each transfer function followed by a capital letter indicating the corresponding step response, followed by a Roman numeral indicating the corresponding frequency response. Wrong answers will count as zero; no partial credit will be given in this problem.

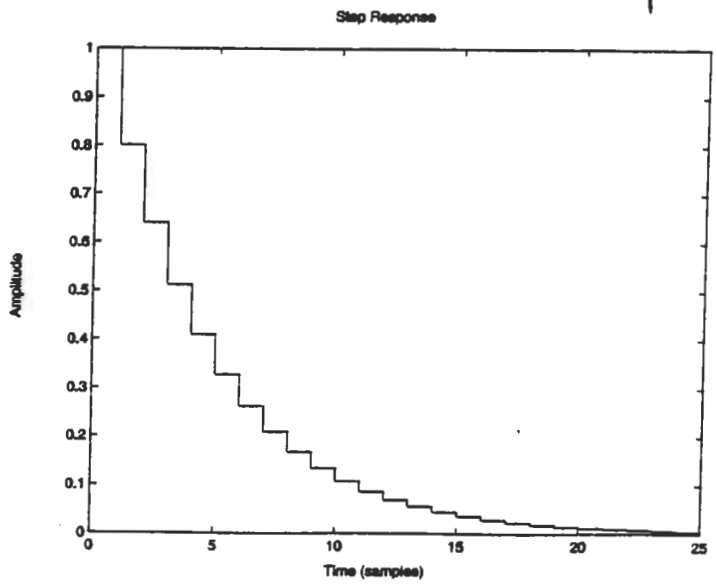

Step Response
A
Amplitude
Time (samples)

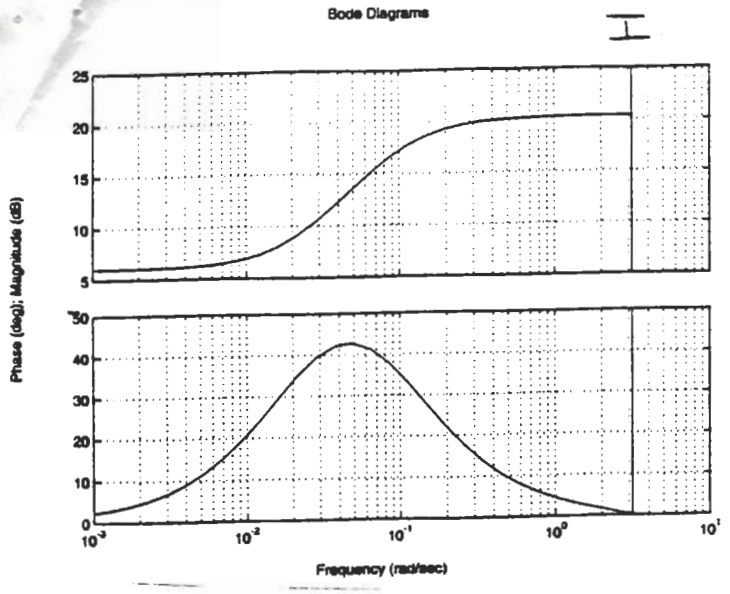

Step Response
B
Amplitude
Time (samples)

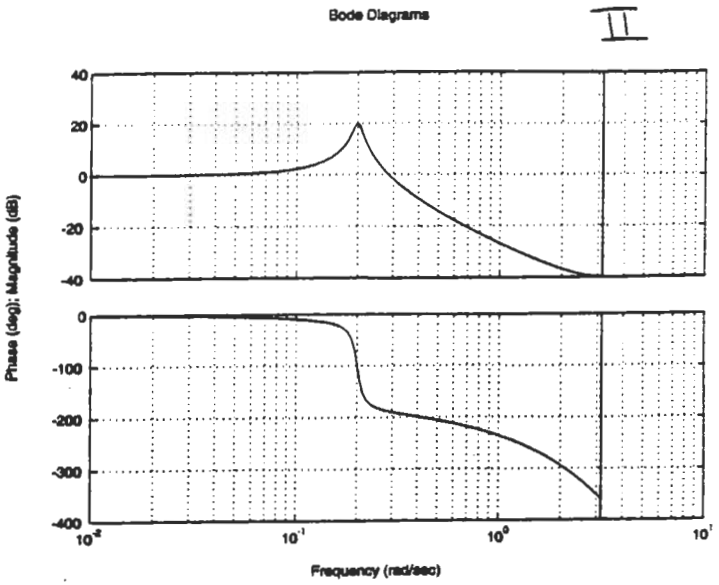

Step Response
C
Amplitude
Time (samples)

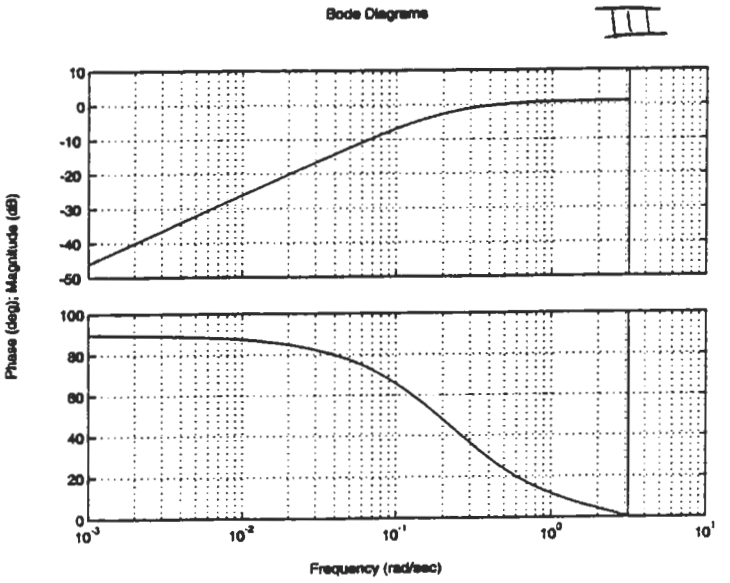

Step Response
D
Amplitude
Time (samples)

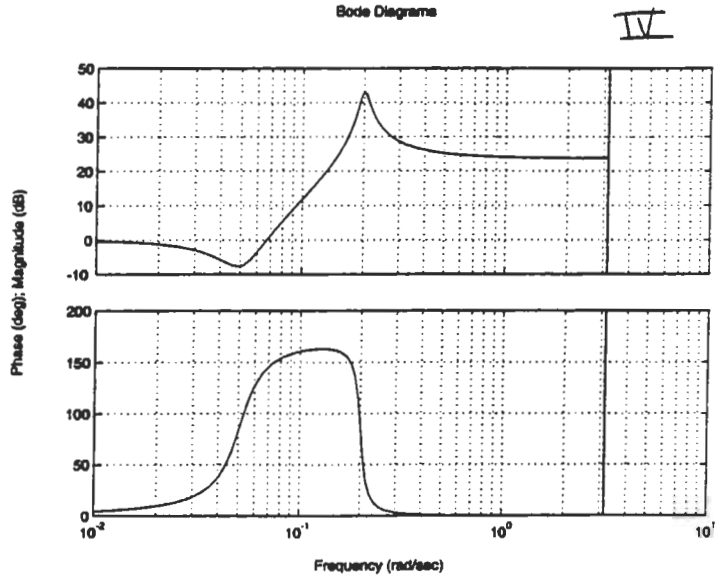

Step Response
E
Amplitude
Time (samples)

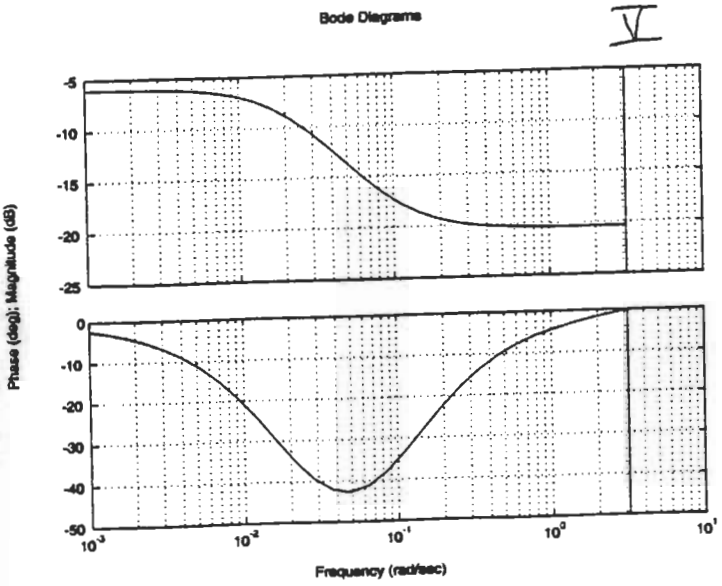

Step Response
F
Amplitude
Time (samples)

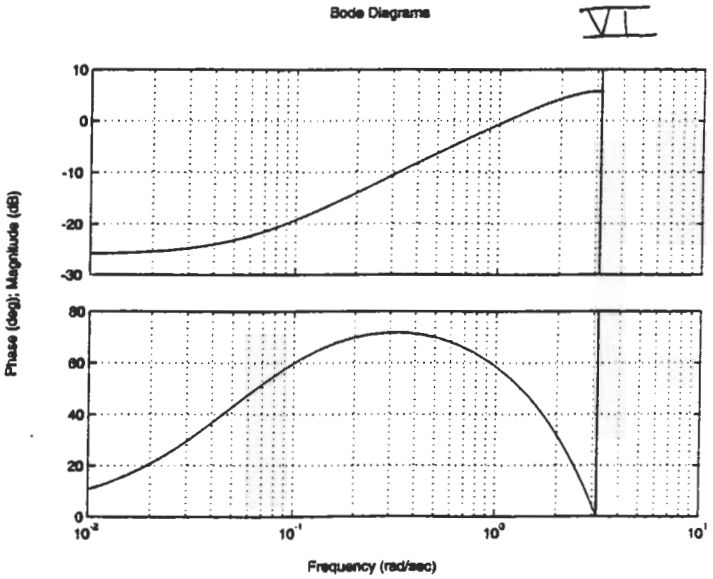

Bode Diagrams
I
Phase (deg); Magnitude (dB)
Frequency (rad/sec)


Bode Diagrams
II
Phase (deg); Magnitude (dB)
Frequency (rad/sec)


Bode Diagrams
III
Phase (deg); Magnitude (dB)
Frequency (rad/sec)


Bode Diagrams
IV
Phase (deg); Magnitude (dB)
Frequency (rad/sec)


Bode Diagrams
V
Phase (deg); Magnitude (dB)
Frequency (rad/sec)


Bode Diagrams
VI
Phase (deg); Magnitude (dB)
Frequency (rad/sec)