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

\[ \text{Gain DB} \]

\[ \text{Phase Deg} \]

1) 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 \( z \)-plane.
Problem 3 (20 points): This problem considers six transfer functions. These are

\[ H_1(z) = \frac{z - 0.95}{z} \]  \hspace{1cm} (1) 

\[ H_2(z) = \frac{z - 1}{z - 0.8} \]  \hspace{1cm} (2) 

\[ H_3(z) = \frac{10(z - 0.98)}{z - 0.9} \]  \hspace{1cm} (3) 

\[ H_4(z) = \frac{z - 0.9}{10(z - 0.98)} \]  \hspace{1cm} (4) 

\[ H_5(z) = \frac{1 - 2r_1 \cos \Omega_1 + r_1^2}{z^2 - 2r_1 \cos \Omega_1 + r_1^2} \]  \hspace{1cm} (5) 

where \( r_1 = 0.99 \) and \( \Omega_1 = 0.2 \).

\[ H_6(z) = \frac{(1 - 2r_1 \cos \Omega_1 + r_1^2)(z^2 - 2r_2 \cos \Omega_2 + r_2^2)}{(z^2 - 2r_1 \cos \Omega_1 + r_1^2)(1 - 2r_2 \cos \Omega_2 + r_2^2)} \]  \hspace{1cm} (6) 

where \( r_1 = 0.59 \) 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 responses (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.