1. Design an inverting bandpass op amp amplifier/filter (Figure 1) with a midband voltage gain with a magnitude of 12, a lower −3db frequency of 112 Hz, and an upper −3db frequency of 72 kHz. The circuit shown in Fig. 1 is suggested. Pick the capacitor $C_1 = 0.15 \mu F$ and compute the other components. Perform an ac analysis with Multisim to plot the magnitude of the complex transfer function in db and the phase in degrees as a function of frequency as the frequency ranges from one tenth of the lower critical frequency to ten times the highest. Assume that the op amp is ideal. This is the Bode plot. Also, plot the Bode plots with either Matlab or Mathcad.

![Fig. 1](image1.png)

2. Design an op amp noninverting high pass shelving amplifier/filter (Figure 2). The dc gain is to be 1, the infinite frequency gain 12, and the pole frequency 20 kHz. The circuit shown in Fig. 2 is suggested. Pick $C_1 = 0.15 \mu F$ and solve for the other circuit components. Perform the same analyses as for the circuit in Problem 1.

![Fig. 2](image2.png)