For each circuit below, find the transfer function $H(s) = \frac{V_0(s)}{V_i(s)}$ and design the circuit to satisfy the listed specifications. Sketch the magnitude Bode frequency response.

1. Design a modified 1st-order lowpass filter with cutoff frequency 1,000 rad/s and high frequency gain -20 dB.

![Circuit Diagram]

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**Circuit Diagram**

[Diagram of a modified 1st-order lowpass filter with R1, R2, and C connected as described in the text.]
2. Design the circuit below to have dc gain of -20 dB and a high-pass cutoff frequency of 1,000 rad/s. Determine all component values and sketch the frequency response in the figure below. Use a 1 μF capacitor.
3. Design a 2nd-order Butterworth highpass filter to have cutoff frequency 500 Hz. Use a 1 \( \mu F \) capacitor. Draw the circuit, specify all component values, and sketch the frequency response in the figure below.
4. Design a 2nd-order bandpass filter for the frequency range [100, 10,000] rad/s. Draw the circuit, specify all component values, and determine the filter bandwidth, quality factor, and center frequency. Sketch the magnitude Bode plot in the figure below.