Problem 1

The circuit drawn below is excited by a sinusoidal voltage source operating at 1 MHz with 10-V peak-to-peak amplitude. Find $v_o(t)$ in the sinusoidal steady state.

![Circuit Diagram](Image)

Problem 2

You have a circuit that is modeled as a resistor and capacitor in series, but you do not know the specific values of $R$ and $C$. When you place a 100-kHz sinusoidal voltage source with 10-V peak-to-peak amplitude across the circuit, the measured current amplitude is 7.827 mA. When you double the operating frequency, the current amplitude increases to 9.292 mA. What are the values for $R$ and $C$?
Problem 3
Design a first-order high-pass filter with -32-dB attenuation at 500 kHz.

Problem 4
Design a first-order active low-pass filter with 25-dB gain in the passband and 60° phase shift at 100 kHz.

Problem 5
Design a second-order $RLC$ high-pass filter with 200-kHz cutoff and $Q = 1.5$.

Problem 6
The circuit drawn below is the ac model for a MOSFET tuned amplifier. Complete the design so that

- The maximum voltage gain ($v_o/v_i$) is -20.
- The center frequency (for maximum voltage gain) is 120 MHz.
- The bandwidth is 20 MHz.

Assume $g_m = 5 \times 10^{-3}$ $\Omega$.

![Circuit Diagram]