# EPE2165—Analog Electronic Exam #1

14 July, 2022

1. (10 points) Figure 1 depicts an amplifier composed of a cascade of three stages. The amplifier is fed by a signal source with a source resistance of $100\,\mathrm{k\Omega}$ and delivers its output into a load resistance of $100\,\Omega$. The first stage has a relatively high input resistance and a modest gain factor of 10. The second stage has a higher gain factor of 100 but a lower input resistance. Finally, the last, or output, stage has unity gain but a low output resistance. Calculate the overall gain of the amplifier. Express your answer in dB.
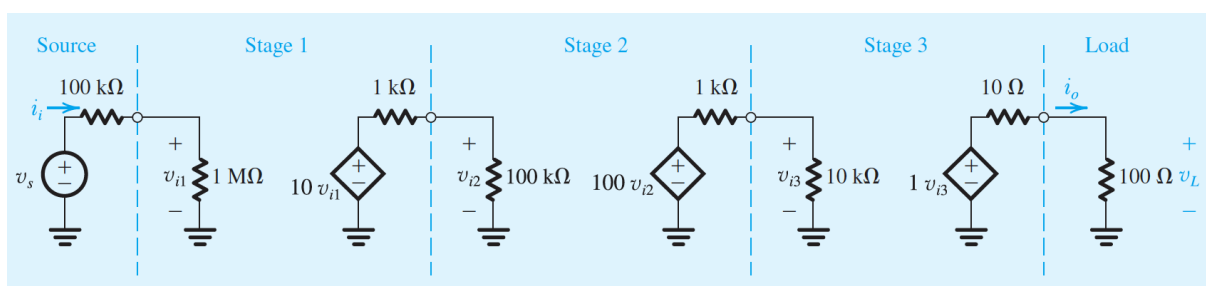
FIGURE 1. Three-stage amplifier

2. Consider a half-wave rectifier circuit shown in Figure 2. Let v_s be a sinusoid with 10V
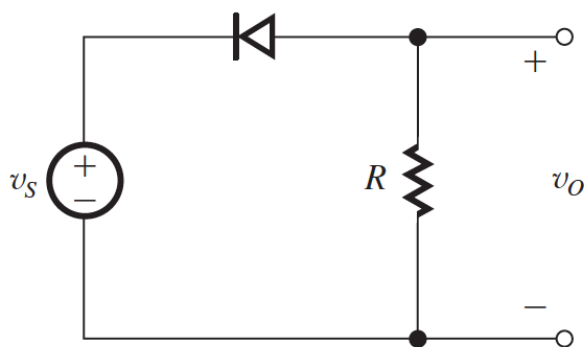
FIGURE 2

peak amplitude, and let $R = 1\,\mathrm{k\Omega}$. Use the constant-voltage-drop diode model with $V_D = 0.7V$ and:

(a) (5 points) Sketch the transfer characteristic.

(b) (5 points) Sketch the waveform of v_O.

(c) (5 points) Find the peak current in the diode.

(d) (5 points) Find the PIV of the diode

3. The transistors in the circuit of Figure 3 have $k_n = k_p = 2mA/V^2$ and $V_{tn} = -Vtp = 0.4V$. Find v_O for each of the following cases:

   (a) (5 points) $v_I = 0V$

   (b) (5 points) $v_I = 1V$

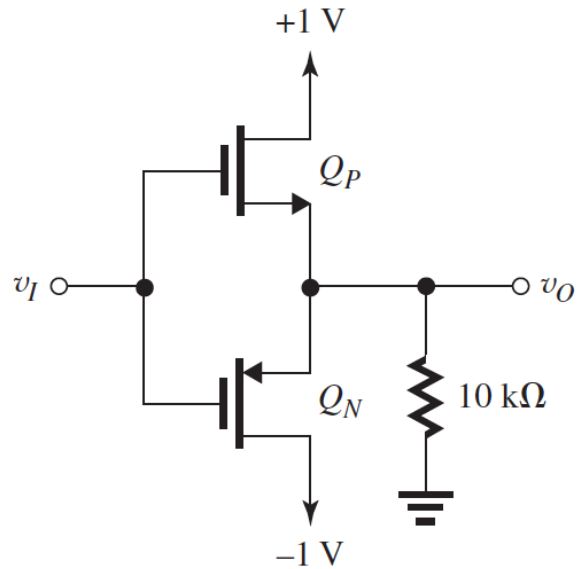   (c) (5 points) $v_I = -1V$

   (d) (5 points) $v_I = -2V$

FIGURE 3