EE303 - Problem Set

Problem 1

For the circuits in Figure P4.95, each utilizing an ideal diode (or diodes), sketch the output for the input shown. Label the most positive and most negative output levels. Assume CR >>T.

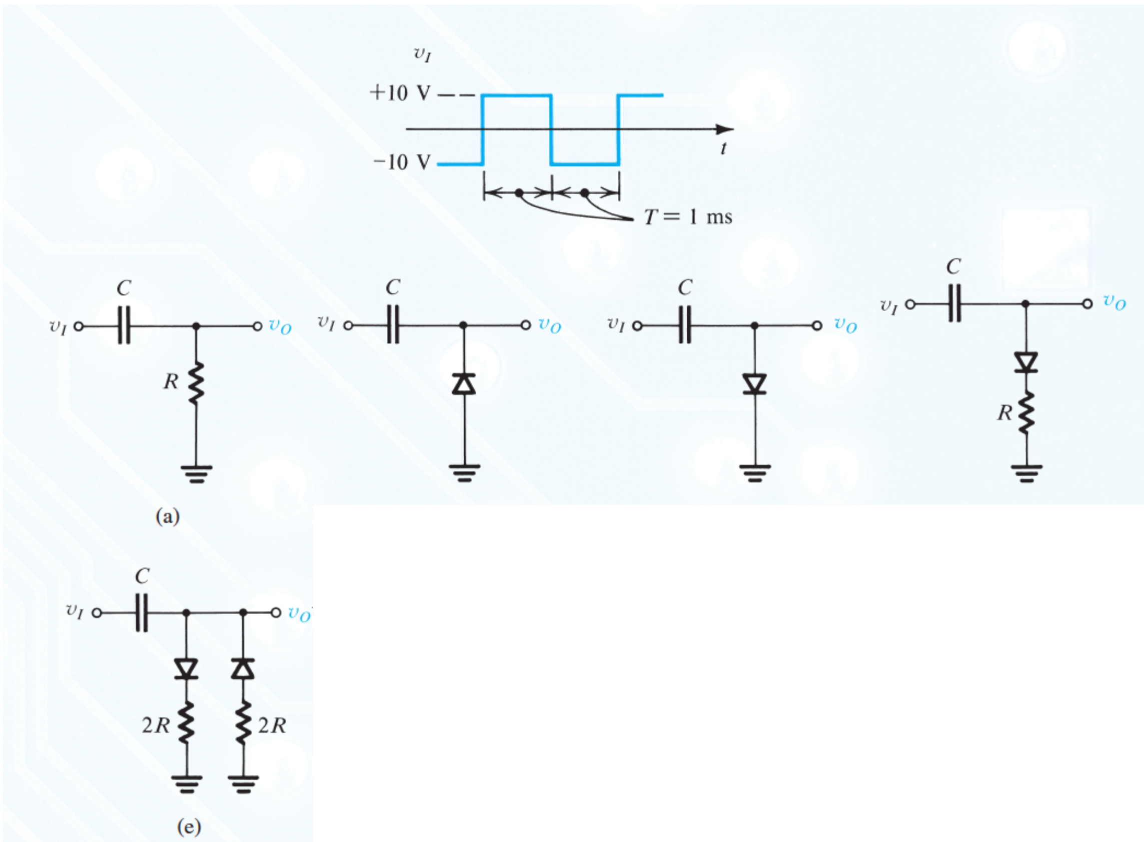


Figure P4.95

Problem 2

A clamped capacitor using an ideal diode with cathode grounded is supplied with a sine wave of 10-V rms. What is the average (dc) value of the resulting output?

Problem 3

Design limiter circuits using only diodes and 10-kΩ resistors to provide an output signal limited to the range:

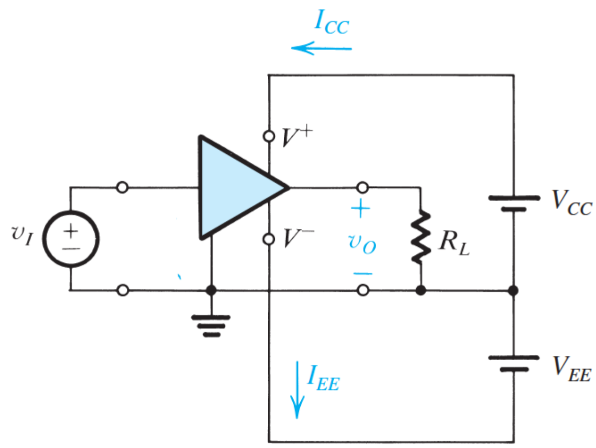
(a) −0.7 V and above

(b) −2.1 V and above

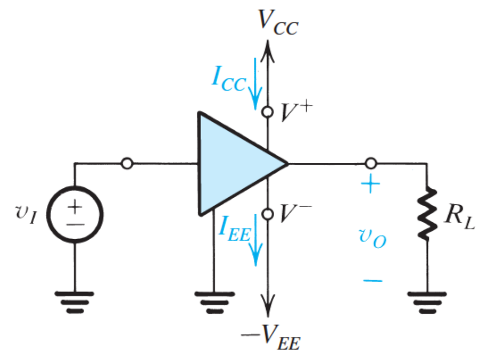
(c) ± 1.4 V

Assume that each diode has a 0.7-V drop when conducting.

Problem 4



(a)



(b)

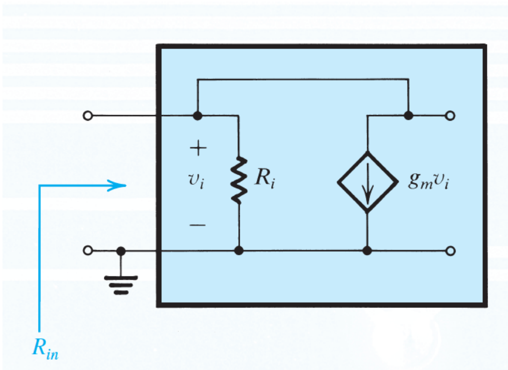
Consider the amplifier in figure is operating from ± 10V power supplies. It is fed with a sinusoidal voltage having 1 V peak and delivers a sinusoidal voltage output of 9 V peak to a 1-kΩ load. The amplifier draws a current of 9.5 mA from each of its two power supplies. The input current of the amplifier is found to be sinusoidal with 0.1 mA peak. Find the voltage gain, the current gain, the power gain P_O/P_I, the power drawn from the dc supplies P_{DC}, the power dissipated in the amplifier, and the amplifier efficiency η ($\eta=P_{DC}/P_L$).

Problem 5

An amplifier with 40 dB of small-signal, open-circuit voltage gain, an input resistance of 1 MΩ, and an output resistance of 10 Ω, drives a load of 100 Ω. What voltage and power gains (expressed in dB) would you expect with the load connected? If the amplifier has a peak output-current limitation of 100 mA, what is the rms value of the largest sine-wave input for which an undistorted output is possible? What is the corresponding output power available?

Problem 6

The following figure shows a transconductance amplifier whose output is fed back to its input. Find the input resistance R_{in} of the resulting one-port network. (Hint: Apply a test voltage vx between the two input terminals, and find the current ix drawn from the source. Then $R_{in} = v_x/i_x$)



Problem 7

Find the transfer function of the circuit in Fig. P1.78. Show that the transfer function can be made independent of frequency if the condition $C_1R_1 = C_2R_2$ applies. Under this condition, the circuit is called a compensated attenuator and is frequently employed in the design of oscilloscope probes. Find the transmission of the compensated attenuator in terms of R_1 and R_2.

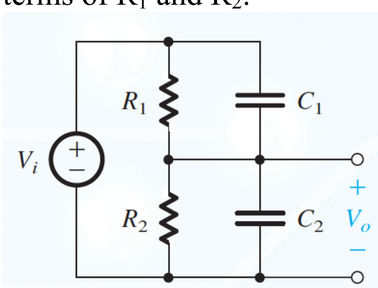


Figure P1.78