

ESC201A Assignment 6

Instructor Abhishek Gupta

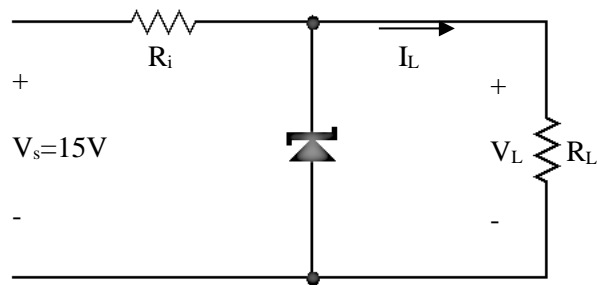
2023-2024 Semester I

Topics

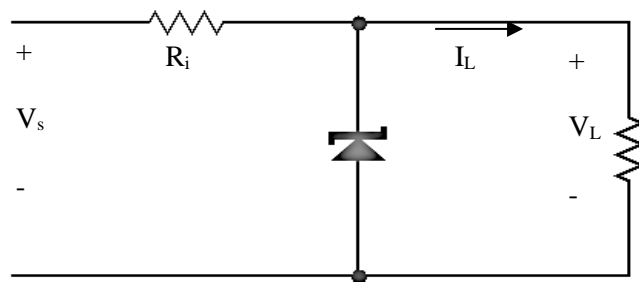
Zener Diodes, Amplifiers model

Questions

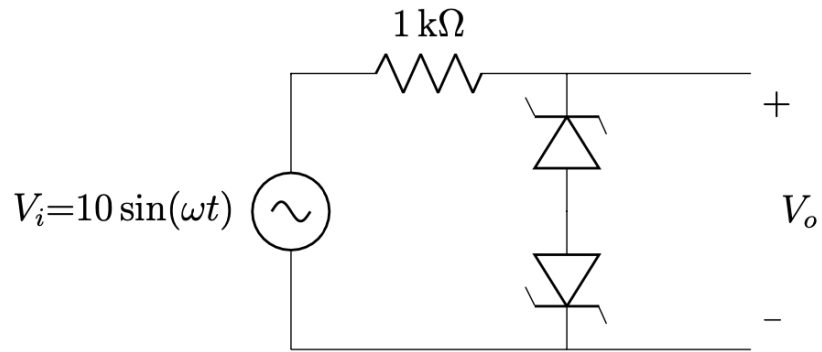
1. The Zener diode in the following circuit has $V_z = 12V$, minimum current $I_{zmin} = 2mA$, and maximum power $P_{zmax} = 0.6W$. Determine the smallest possible R_i such that the voltage across the load is maintained at 12V. With this value of R_i if the diode is operating in the Zener mode, what is the minimum possible value of R_L ? Unless specified otherwise, assume constant voltage drop model for the diode operating in the Zener region.



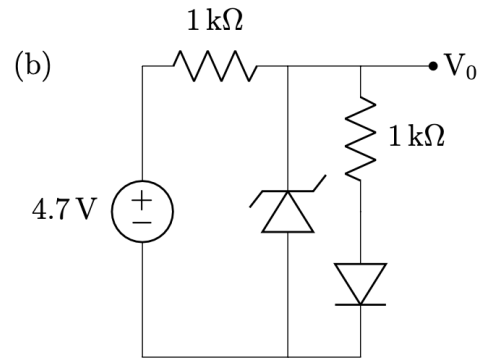
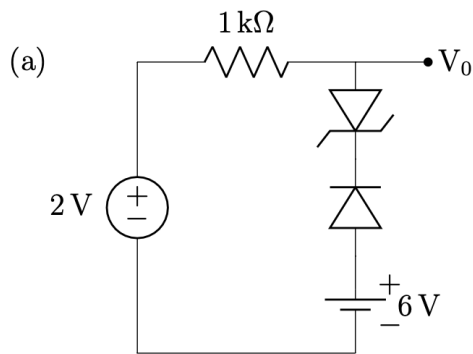
2. In the following circuit, $V_L = 12V$, $V_s = 20V$, and I_L varies from 0 to 100mA. If the diode is operating in the Zener mode, determine the value of R_i such that P_{zmax} of the diode is as small as possible. Determine P_{zmax} for the calculated value of R_i .



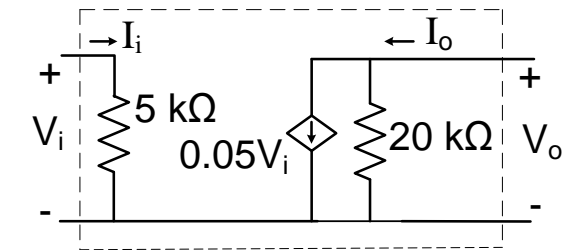
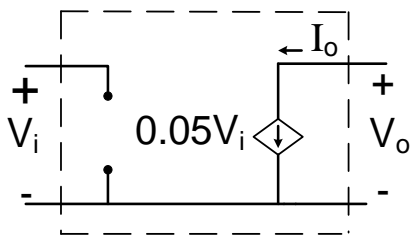
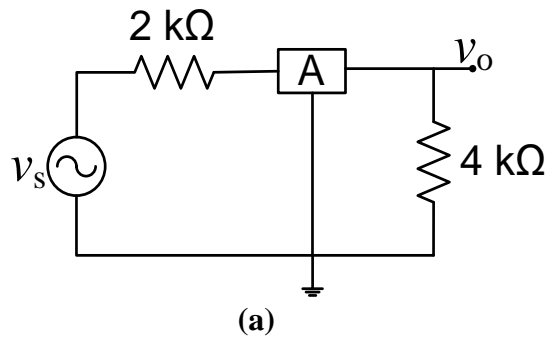
3. The Zener diodes used in the circuit below have the following characteristics: Forward drop = 0.7 V; Zener voltage = - 7 V; R_f (Forward Resistance) = $20\ \Omega$; R_z (Resistance in Zener region) = $10\ \Omega$. Sketch the output waveform V_o with time.



4. Determine the output voltage with reference to ground for the circuits shown below assuming that cut-in voltage of both diode and zener diode is 0.7V and that Zener voltage is 3V .



5. Determine the ac voltage gain of the amplifier 'A' as shown in (a) using the two transistor models shown in (b) and (c) as dotted region. Assume that the device 'A' is biased properly.



6. Carry out DC and AC analysis of the amplifier circuit, with amplifier 'X', whose device characteristics are shown below. Also, sketch V_{iX} , V_{oX} and v_o for $v_s = 0.2 \sin(\omega t)$.

