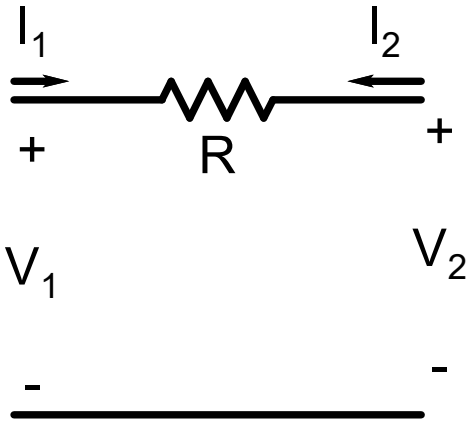
# ESC201T : Introduction to Electronics

## Quiz-3(11/11/2020)

Q.1 Determine the h-parameters for the circuit shown. Show steps of your analysis. Express your final answer as $(h_{11}, h_{12}, h_{21}, h_{22})$ -----2marks

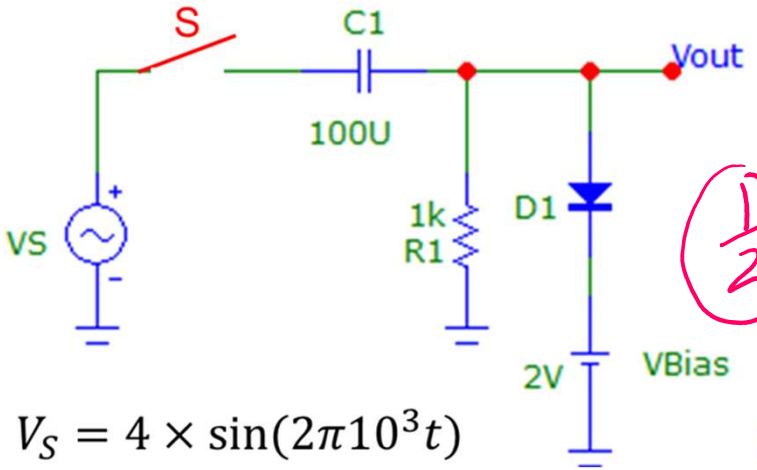



$$V_1 = h_{11}I_1 + h_{12}V_2 \Rightarrow h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2\,=\,0} = R;\ h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0} = 1$$

$$I_2 = h_{21}I_1 + h_{22}V_2 \Rightarrow h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2\,=\,0} = -1;\ h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0} = 0$$

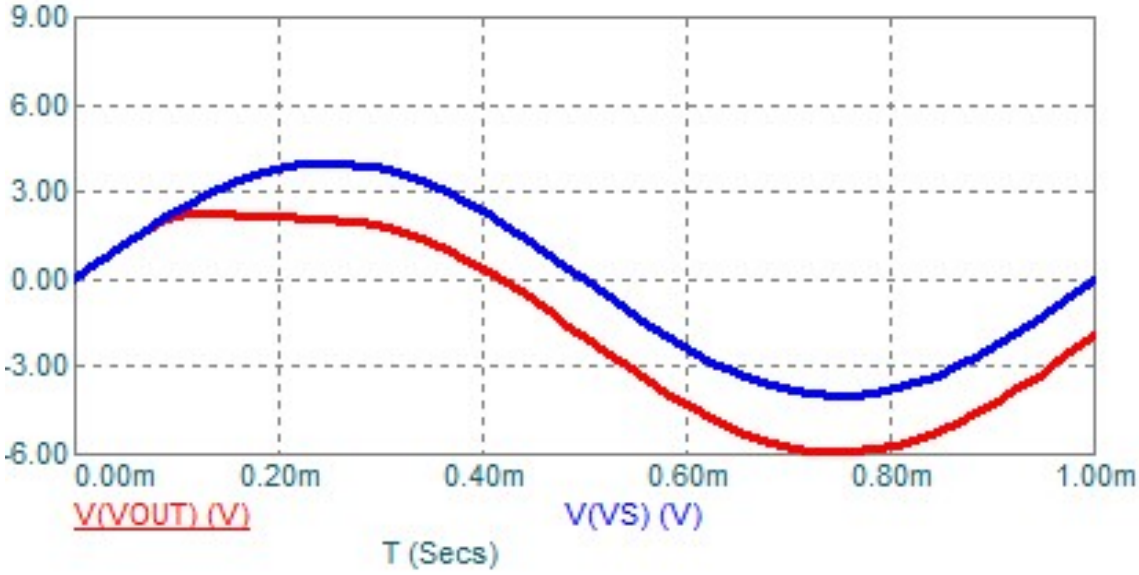
$Ans: (R, 1, -1, 0)$

Q.2 In the circuit shown, the switch S is closed at t = 0. Sketch the output voltage $V_{out}$ for one full sinusoidal cycle after switch is closed. Assume that diode is ideal with negligible forward voltage drop and does not conduct in reverse bias and prior to closing of switch, there is no charge on the capacitor. Label your graphs appropriately and justify your answer. ---3

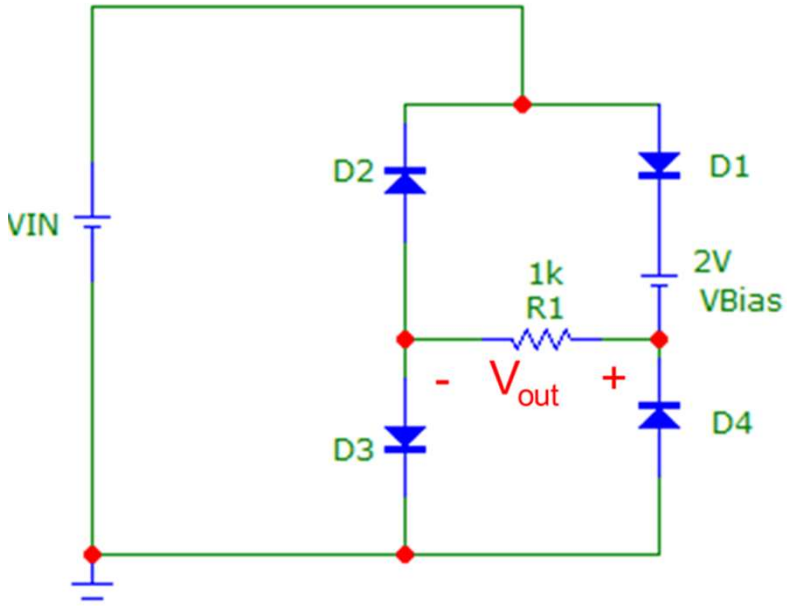



$$V_S = 4 \times \sin(2\pi 10^3 t)$$

Diode D1 will turn ON only when VS exceeds 2V. Till then Vo follows VS but after that saturates to 2V. → ½
Capacitor C1 charges to +2V when VS reaches 4V. ½ ½
After that D1 switches OFF and Vout = VS-2 → 1

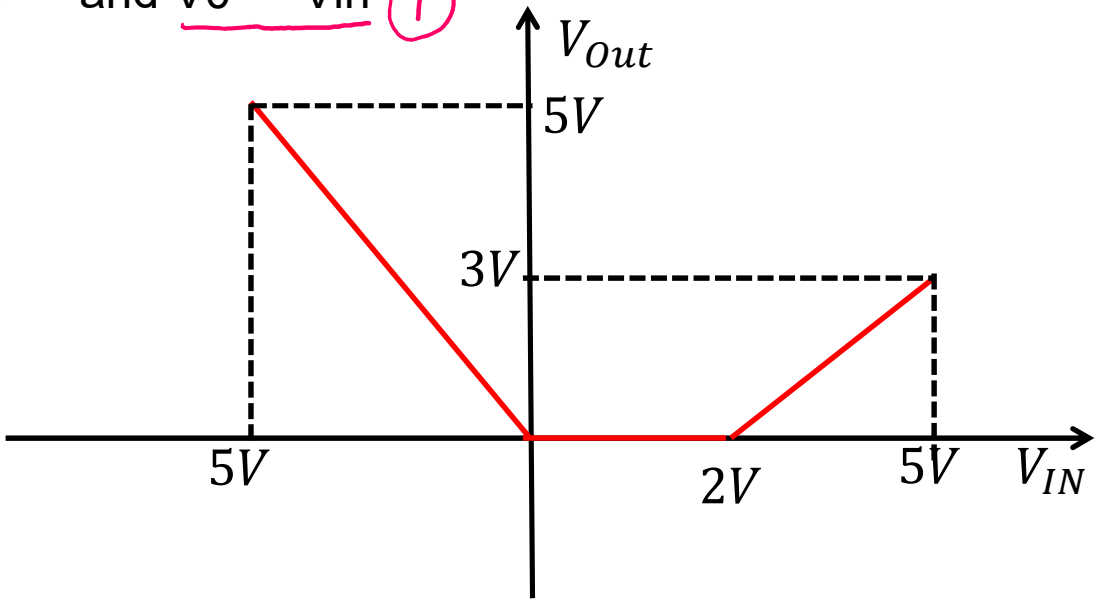


Q.3 For the circuit shown, sketch the output voltage $V_{OUT}$ (across R1) vs. input voltage $V_{IN}$ as it is varied from -5V to +5V. Assume that diodes are ideal with negligible forward voltage drop and do not conduct in reverse bias Label your graphs appropriately and justify your answer. ---2

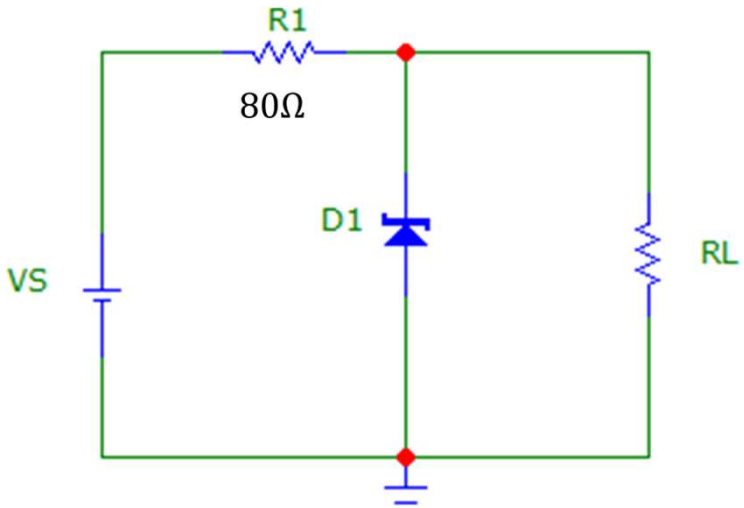



This is a bridge rectifier with some modifications. When Vin is positive, D4-D2 path is inactive and D1-D3 path will become active only when Vin > 2V. Once that happens, Vo = VIN-2. $\frac{1}{2}$ $\frac{1}{2}$

When Vin is negative, D4-D2 path will be active and V0 = -Vin (1)



Q.4 The circuit shown has been designed to deliver a constant voltage of 6V across the load resistor RL which can have any value greater than or equal to 100 ohms . The chosen Zener diode has a breakdown voltage of 6V and can handle a maximum current of 100mA. Identify any potential problems with the design if input voltage VS can vary from 10 to 16 Volts. Justify your answer---3marks




*When zener is operating in breakdown mode*

$$I_Z = \frac{V_S - V_Z}{R_1} - \frac{V_Z}{R_L}$$ (1)

$$I_{Zmax} = \frac{V_{Smax} - V_Z}{R_1} = \frac{16 - 6}{80} = 125mA$$ (1)

This is problematic as it exceeds the current rating

$$I_{Zmin} = \frac{V_{Smin} - V_Z}{R_1} - \frac{V_Z}{100} = \frac{10 - 6}{80} - \frac{6}{100} = -10mA$$ (1)

This is problematic as it implies that Zener will not operate in breakdown mode and output will not be 6V.