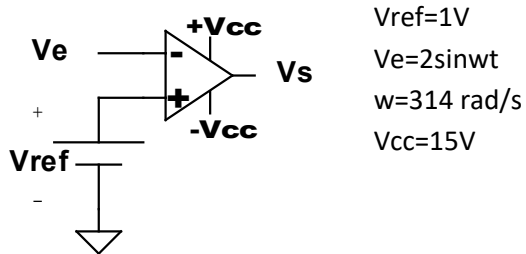


ANALOG ELECTRONICS

UNIT 8. Non-linear Functions with Operational Amplifiers

QUESTIONS VIDEO 1. Comparator without hysteresis

1. Represent the time course of V_e and V_s , as well as the transfer function for the circuit of the Figure:

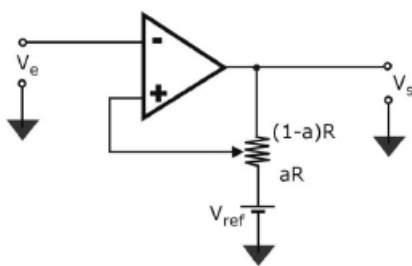


2. Same exercise as 2, but switch V_e and V_{ref} . V_e is now connected to the positive terminal of the OA and V_{ref} to the negative terminal of the OA.

QUESTIONS VIDEO 2. Comparator with hysteresis

1. Indicate the methodological steps to analyze a comparator with hysteresis.

2. Dado el circuito de la Figura y utilizando la metodología anterior,



DATOS: Alimentación simétrica del AO ($V_{cc}=\pm 15$ V); ($\pm V_{sat}=\pm 13$ V); $V_{ref}=5$ V; $a=0.1$; $R=1$ k Ω .

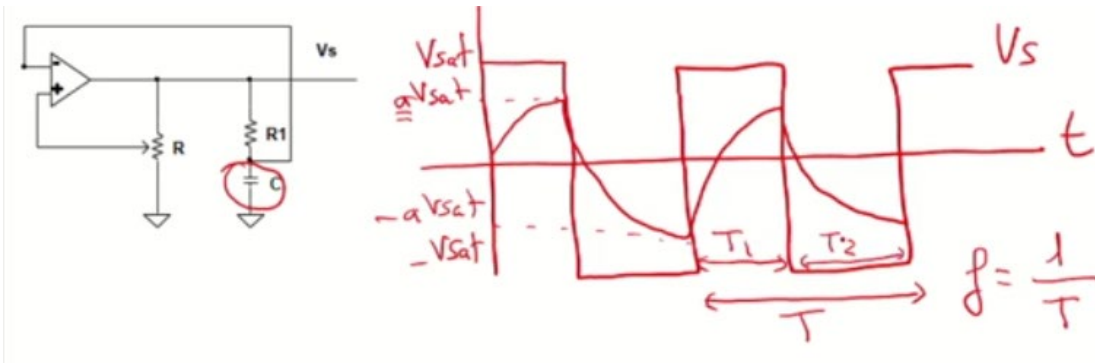
a. Dibujar la función de transferencia (diagrama tensión de salida V_s , frente a tensión de entrada V_e) indicando el valor exacto de los puntos de corte con los ejes de abscisas y ordenadas.

b. Dibujar la forma de onda de salida $V_s(t)$ si la señal de entrada (V_e) es una triangular de 3 V de amplitud (6 voltios pico-pico) y un nivel de continua de 3 V (frecuencia de 100Hz).

QUESTIONS VIDEOS 3 & 4. Multivibrator.

Note: Try to answer this Question after watching the video, but without looking at the video, to make sure you have understood the analysis.

1. For the circuit of the Figure:

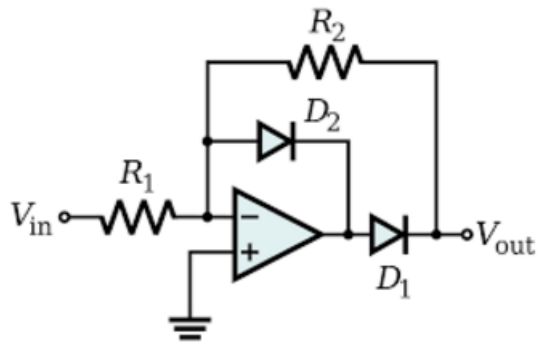


a. Write the differential equation of charge of C and solve it to obtain the temporal evolution of V_c , the exponential voltage of the capacitor. Note: choose properly the initial and final conditions of V_c .

b. Calculate the time T_1 of charge, using the equation for V_c obtained in a.

QUESTIONS VIDEO 5. Rectifier.

1. For the circuit of the Figure:



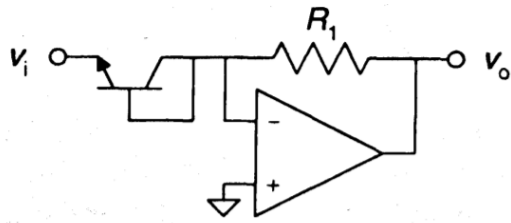
a. Analyze the circuit considering ideal diodes and $R_1=R_2$.

b. Represent the temporal evolution of V_{in} and V_{out} considering V_{in} as a sinusoidal wave of 1V peak.

c. Represent the transfer function.

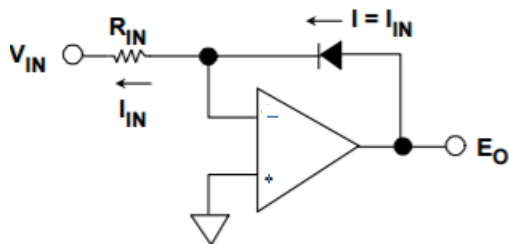
QUESTIONS VIDEO 6. Logarithmic Converter.

1. For the circuit of the Figure:



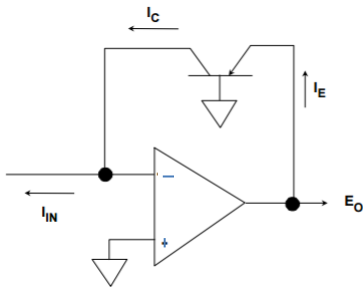
Express V_o as a function of V_i , R_1 and the parameters of the transistor.

2. For the circuit of the Figure:



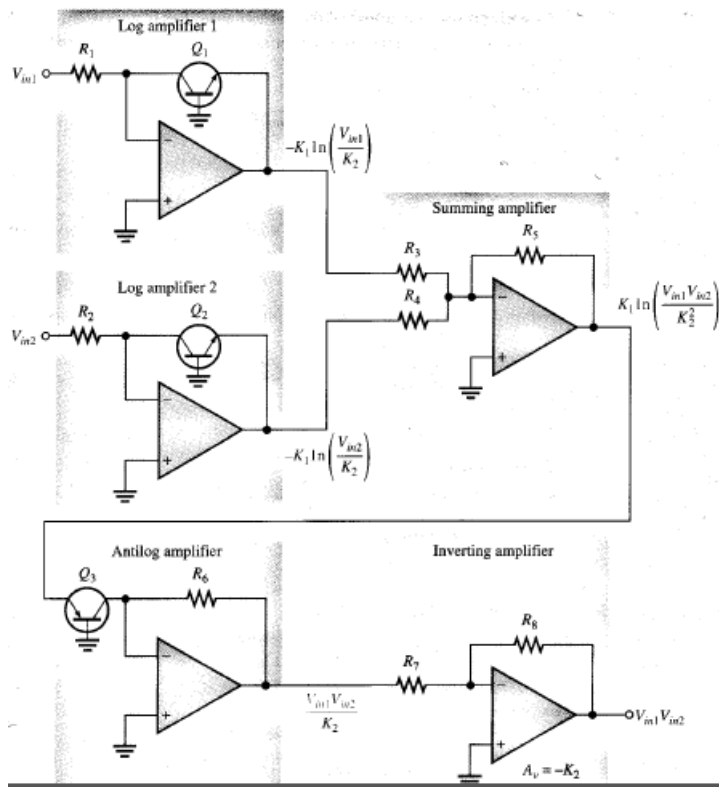
Express E_o as a function of V_{in} , R_{in} and the parameters of the diode.

3. For the circuit of the Figure:



Express E_o as a function of I_{in} and the parameters of the transistor.

4. For the circuit of the Figure:



Analyze it and demonstrate that it is a multiplier of signals V_{in1} and V_{in2} . Data: $R_1=R_2=R_3=R_4=R_5=R_6$.