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Sheet (3) : Analog ICs ELE322
Oscillators

1- In a particular oscillator characterized by the structure of figiure (1), the frequency-selective network exhibits a loss of 20 dB and a phase shift of 180^o at ω_o. What is the minimum gain and the phase shift that the amplifier must have for oscillations to begin?

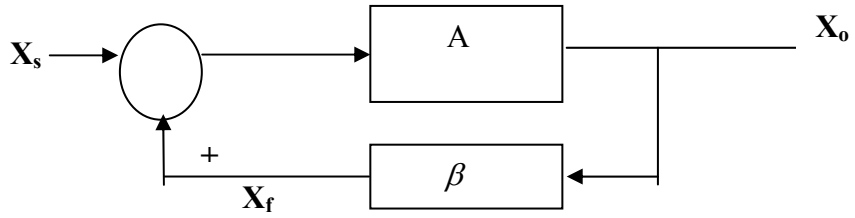


Figure (1)

2- For the comparator circuit shown in figure (2) find suitable values for all resistors so that the comparator levels are ± 6V and so that the slope of the limiting charactarestic is 0.1.
Use V_{CC} = 10V, V_D =0.7V.

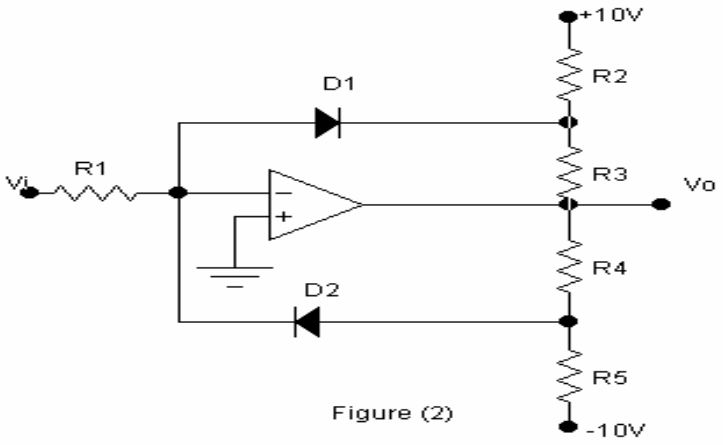


Figure (2)

3- For the circuits shown in figure (3) assuming V_{fwd} = 0.7V , and Zener voltages to be V_{Z1} and V_{Z2} , sketch and clearly label the transfer function characteristics V_o –V_i assuming ideal op-amps.

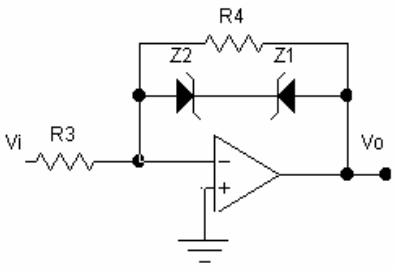


Fig. 3-a

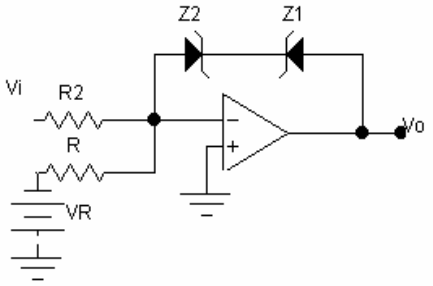


Fig. 3-b

4- For the circuit shown in figure (4) find L(s), L(jω), the frequency for zero loop phase, and R_2/R_1 for oscillation.

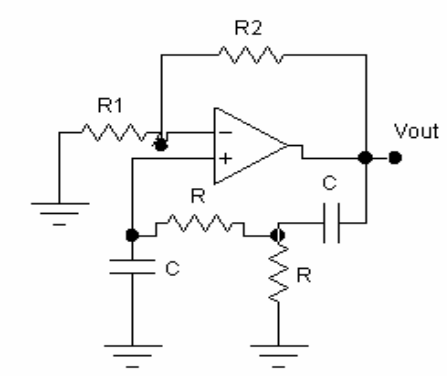
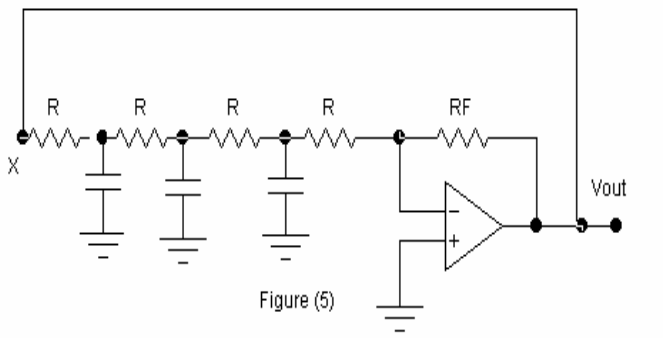


Figure (4)



5- For the circuit of figure (5), brake the loop at node X and find the loop gain (working backword for simplicity to find V_x in terms of V_o). For R = 10 kΩ, find C and R_f to obtain sinusoidal oscillations at 10 kHz.

6- Consider the bistable circuit of figure (6)

a) **Derive expressions for the threshold voltages V_{TL} and V_{TH} in terms of op-amp saturation levels L_+ and L_- , R_1, R_2 and V_R.**

b) **If $L_+ = -L_-$, R_1 = 10 kΩ, find R_2 and V_R that results in the threshold voltages of 0 and V/10 .**

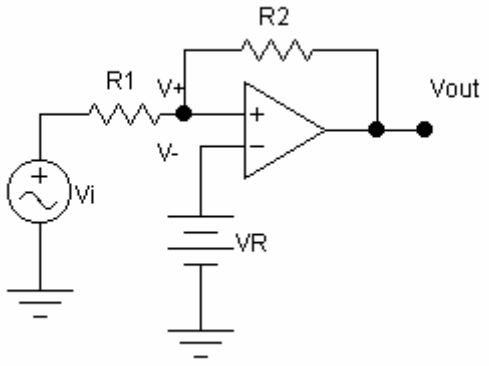


Figure (6)

7- Figure (7) shows a monostable multivibrator circuit. In the stable state, V_o = L+, V_A = 0, and V_B = - V_{ref} . The circuit can be triggered by applying a positive input impulse of hight greater than Vref . For normal operation C1R1 << CR. Show the resulting waveforms of Vo and VA. Also, show that the pulse generated at the output will have a width T given by

$$T = CR\left(\frac{L_+ - L_-}{V_{ref}}\right)$$

8- Consider the 555 circuit of figure (8) when the threshold and the trigger input terminals are joined together and connected to an input voltage V_i . Verify that the transfer characteristic V_o –V_i is that of an inverting bistable circuit with thresholds V_{TL} = 1/3 Vcc and V_{TH} = 2/3 V_{CC} and output levels of 0 and V_{CC}.

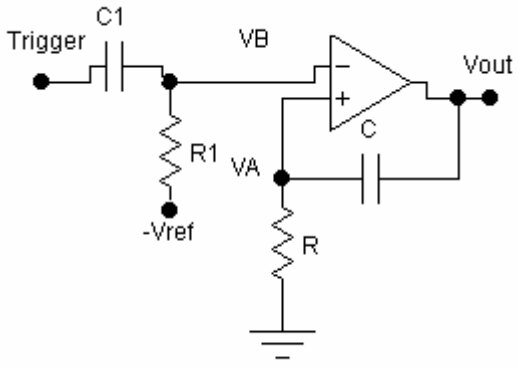


Figure (7)

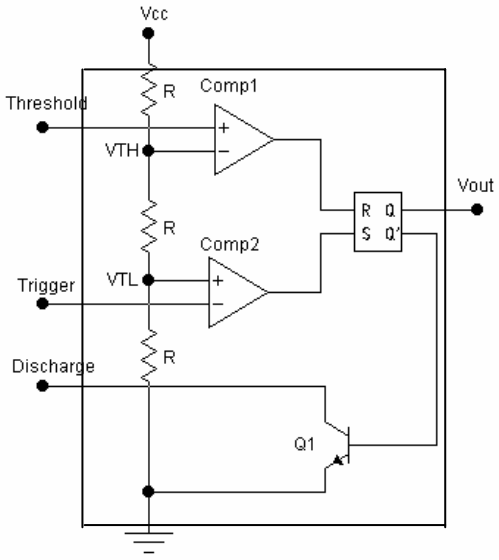


Figure (8)