

Dr. Shiva Kant Mishra  
Dept. of Physics  
H. D. Jain College Ara

M. Sc. Sem III  
Paper - MPHY CC-12  
Electronics II

———— X —————



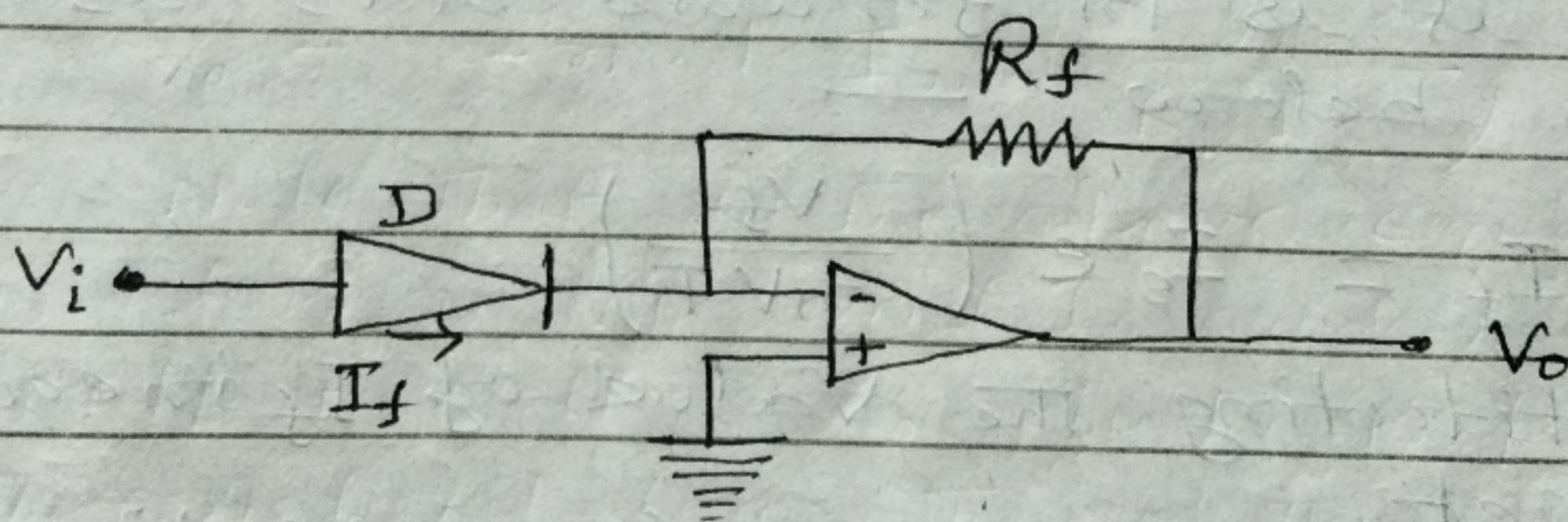


An anti-logarithmic amplifier or an anti-log amplifier is an electronic circuit that produces an output, i.e. proportional to the anti-logarithm of the applied input.

This section discusses about the OP-amp based anti-logarithmic amp. in detail.

An OP-amplifier based anti-logarithmic amplifier produces a voltage at the output, which is proportional to the anti-logarithm of the voltage i.e. applied to the diode connected to its inverting terminal.

The circuit diagram of an OP-amplifier based anti-logarithmic amplifier is shown in the following figure.



In the circuit above, the non-inverting input terminal of the OP-amp. is connected to ground. It means zero volts is applied to its non-inverting input terminal.



According to the virtual short concept the voltage at the inverting input terminal of OP-amplifier will be equal to the voltage present at its non-inverting input terminal. So, the voltage at its inverting input terminal will be zero volts.

The nodal equation at the inverting input terminal node is

$$-I_f + 0 - V_o = 0$$

$$\Rightarrow -\frac{V_o}{R_f} = I_f$$

$$\Rightarrow V_o = -R_f I_f \quad \text{--- (1)}$$

We know that the equation for the current flowing through a diode, when it is in forward bias, is as given below

$$I_f = I_s e^{\left(\frac{V_f}{nVT}\right)}$$

Substituting the value of  $I_f$  in equ<sup>n</sup> (1) we get,

$$V_o = -R_f \left\{ I_s e^{\left(\frac{V_f}{nVT}\right)} \right\}$$

$$V_o = -R_f I_s e^{\left(\frac{V_f}{nVT}\right)} \quad \text{--- (2)}$$

The KVL equation at the input side of the inverting terminal of the OP-amplifier will be





VKSU  $V_i - V_f = 0$

$V_f = V_i$

Substituting, the value of  $i$  in the equation we get

$$V_o = -R_f I_s e^{(V_i / nV_T)}$$

Note that in the above eqn<sup>n</sup> the parameters  $n$ ,  $V_T$  and  $I_s$  are constants. So, the output voltage  $V_o$  will be proportional to the anti-natural logarithm (exponential) of the input voltage  $V_i$  for a fixed value of feedback resistance  $R_f$ .

Therefore, the OP-amplifier based anti-logarithmic amplifier circuit discussed above will produce an output, which is proportional to the anti-natural (exponential) of the input voltage  $V_i$ ,

when  $R_f I_s = 1V$ .

observe that the output voltage  $V_o$  is having a -ve sign. which indicates that there exists a  $180^\circ$  phase difference between the input and the output.