Function Generator

-By

INTRODUCTION

- A function generator is usually a piece of electronic test equipment or software used to generate different types of electrical waveforms over a wide range of frequencies.

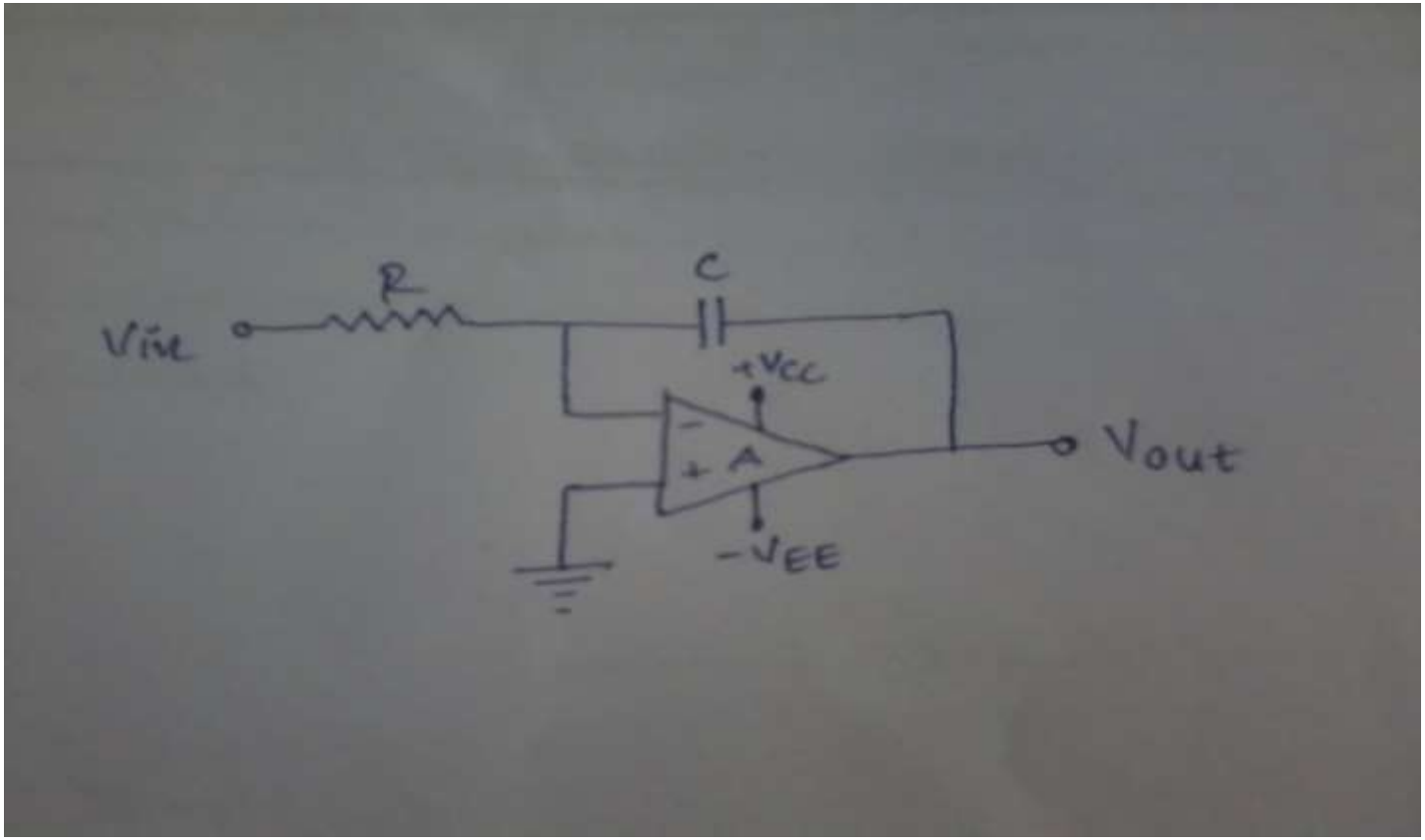
- **Function Generator used to generate various kind of waveform like……**

1) Triangular Wave
2) Sine Wave
3) Square Wave
4) Saw tooth Wave etc…

Triangle wave

- Simple function generators usually generate triangular waveform whose frequency can be controlled smoothly as well as in steps.
- This triangular wave is used as the basis for all of its other outputs. The triangular wave is generated by repeatedly charging and discharging a capacitor from a constant current source.
- This produces a linearly ascending or descending voltage ramp. As the output voltage reaches upper and lower limits, the charging and discharging is reversed using a comparator, producing the linear triangle wave.
- By varying the current and the size of the capacitor, different frequencies may be obtained.

Integrator circuit to produce the Triangle wave

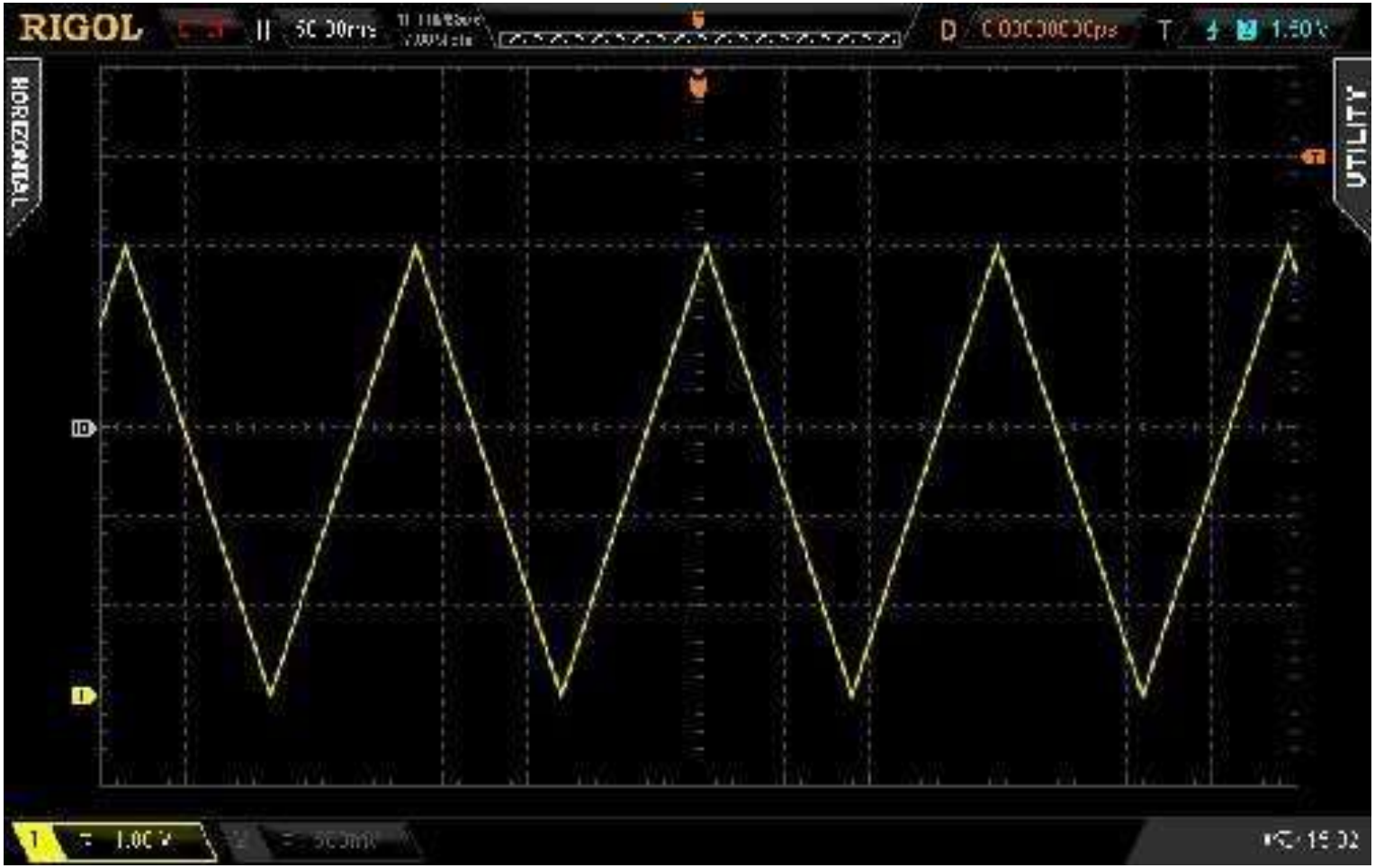


Procedure:

- In this circuit capacitor is used as a feedback element.
- The circuit connection is shown in figure.

- As before the negative feedback of the op-amp ensures that the inverting input will be held at 0 volts(virtual ground). If the input voltage is exactly 0 volts there will be no current through the resistor. Therefore no charging of the capacitor , and there output voltage will be not change. We cannot guarantee what voltage will be at output with respect to ground in this condition but we can say that output voltage is constant.

- If we apply a constant positive voltage to the input, the op-amp output will not fall negative at a linear rate, in attempt to produced the changing voltage across the capacitor necessary to maintain the current established by the voltage difference across the resistor. A constant negative voltage at the input result in linear, rising voltage at the output. The output voltage rate of change will be proportional to the value of the input voltage.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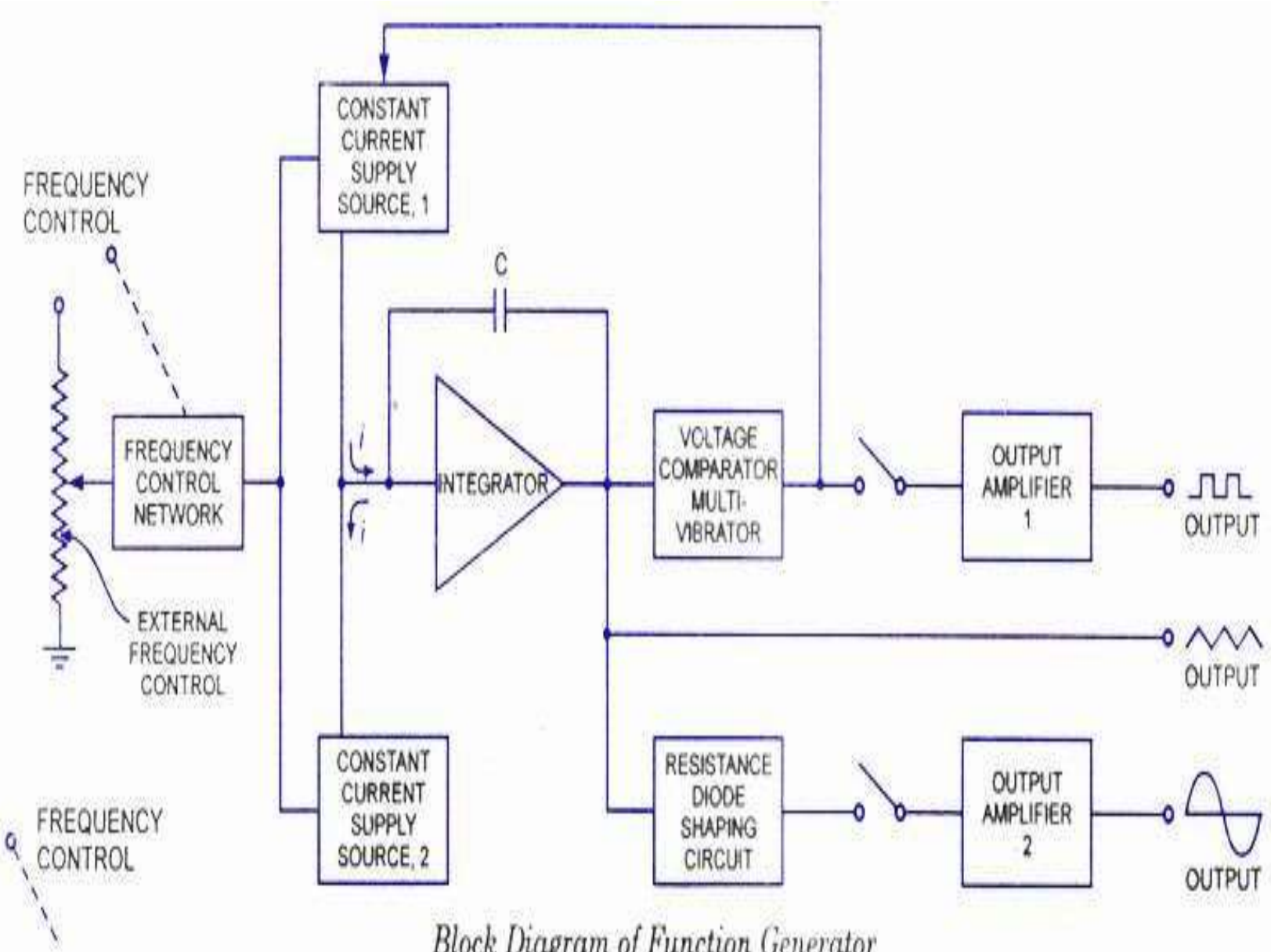


Block Diagram of Function Generator

SQUARE WAVE GENERATOR

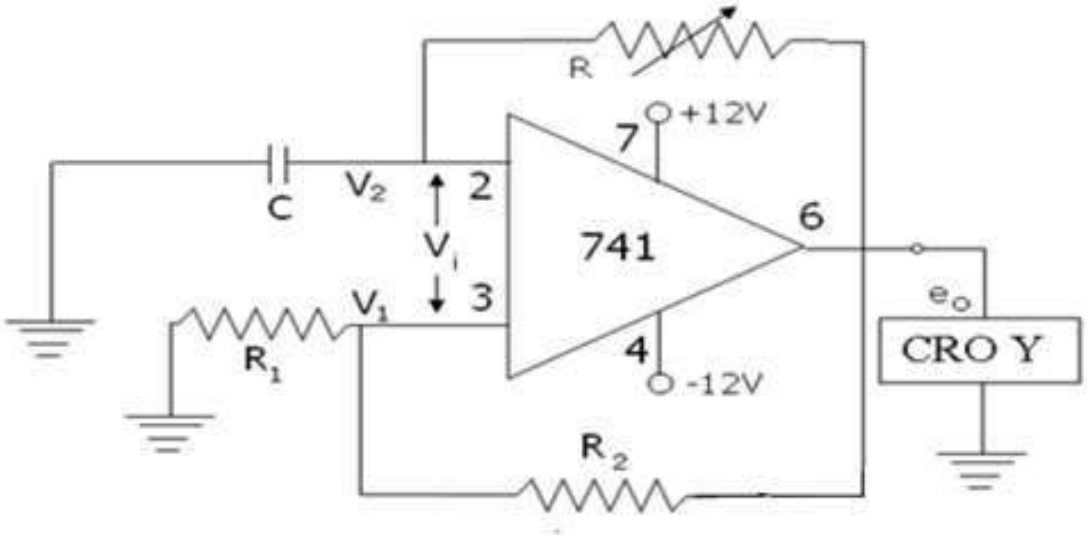


Fig. Multivibrator

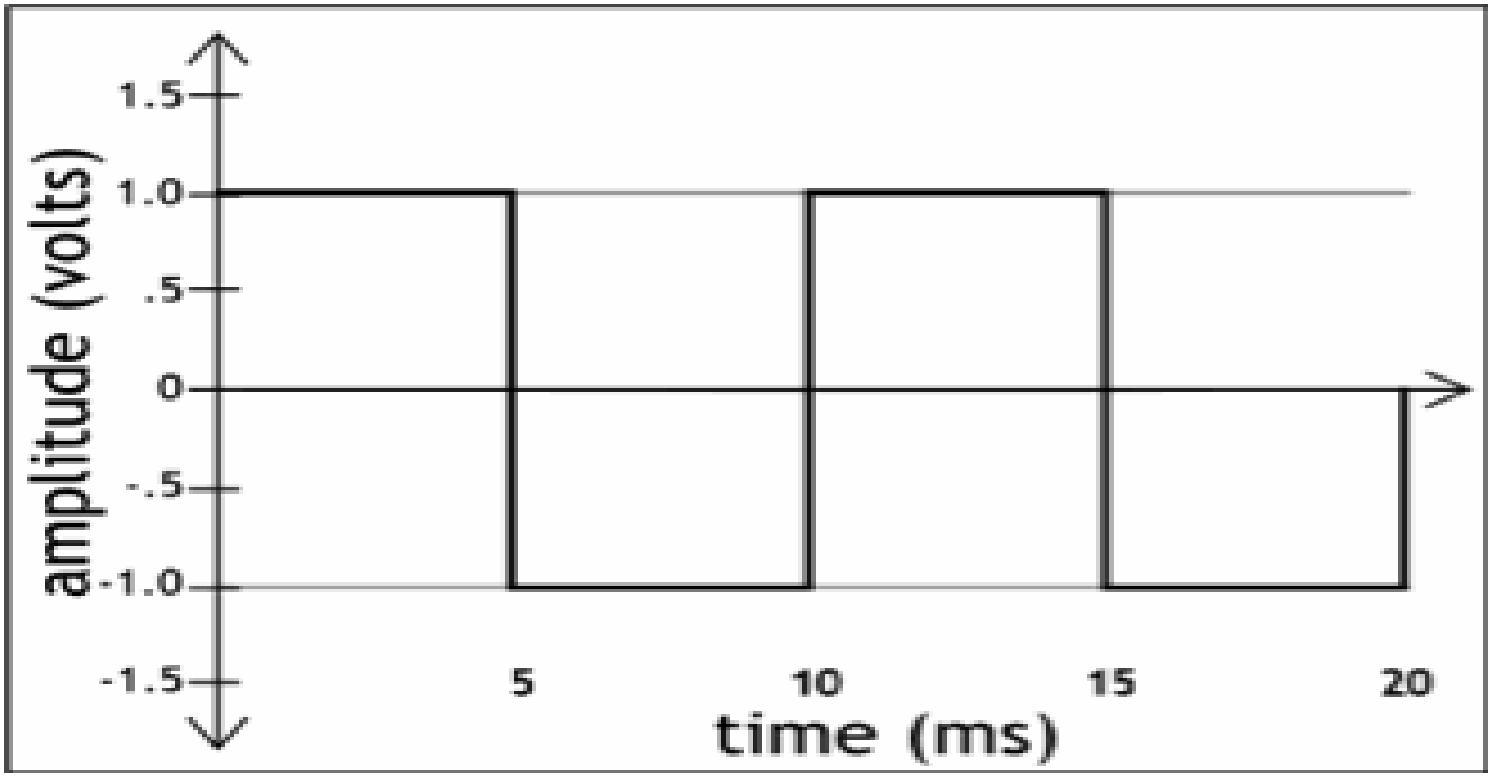
- First the inverting terminal (2) is at zero potential and the input at the non-inverting terminal (3) has some potential V1. This occurs due to the power supply of the operational amplifier. The potential difference between the two input terminals is Vi= V1-0 = V1.

- This '+ ve' voltage drives the output of operational amplifier into '+ ve' saturation voltage (+Vsat).

- When the + Vsat is fed back to the inverting terminal (2) through the resistor R, the capacitor C gets charged and the potential of the right side plate of the capacitor gradually rises (or) the V2 value rises.

- When V2 becomes slightly more than V1, the input becomes '-ve' and immediately this '-ve' voltage drives the output of the operational amplifier in to '-ve' saturation voltage (- Vsat).

- Now the capacitor discharges gradually. When V2 becomes less than V1 and (V1 – V2) becomes ‘+ve’ and the output drives to +Vsat. The same process is repeated and the output of the operational amplifier swings between two saturation voltages i.e. between + Vsat and - Vsat. The output Eo of the operational amplifier is square wave.



SINE WAVE GENERATOR

- Sine wave can be generated from triangular wave using Resistor-diode shaping Network.

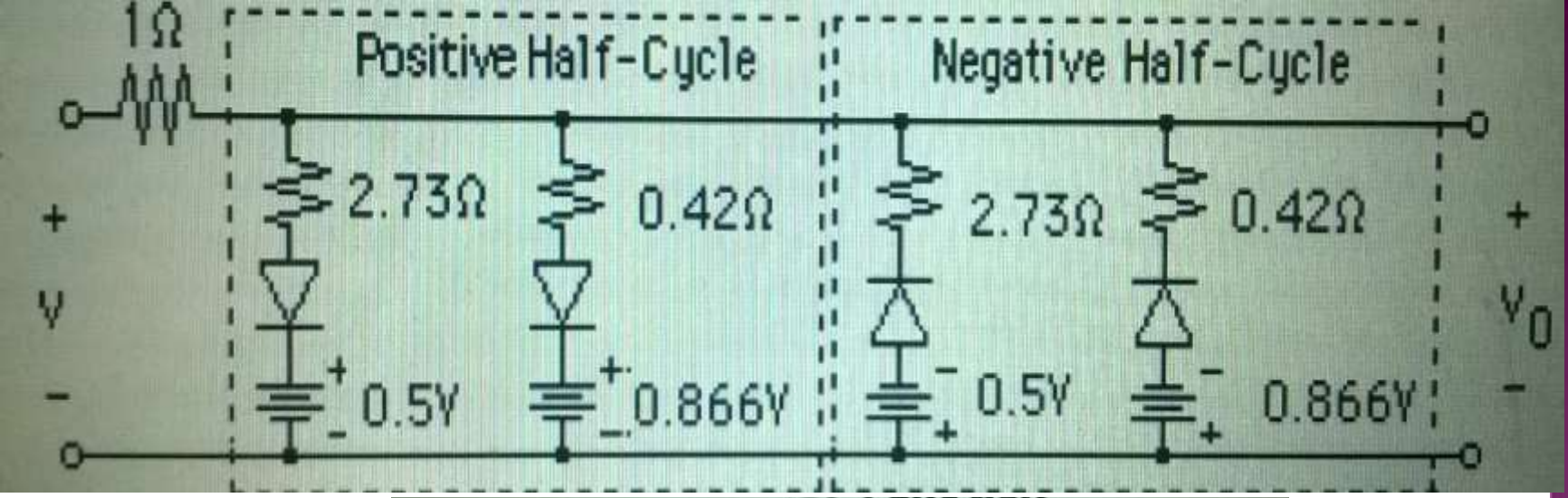
Procedure:

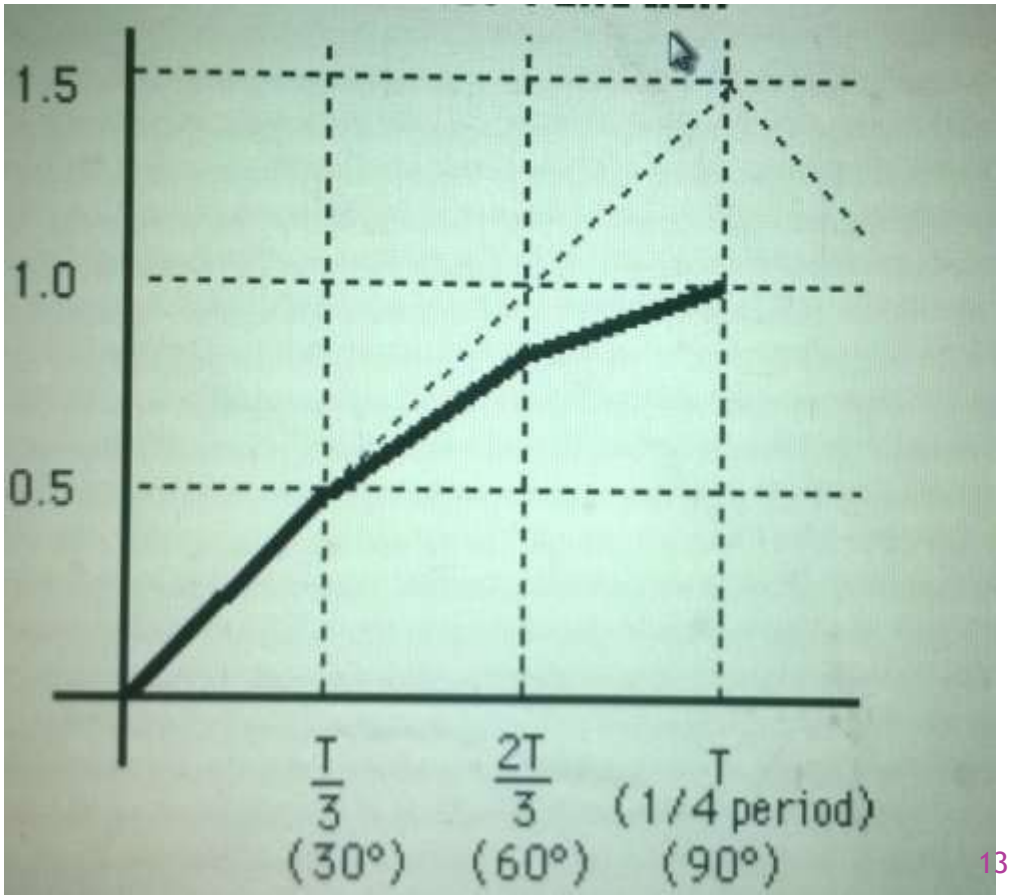
• While the diodes are reverse-biased neither shunt branch conducts, and Vo = V, i.e., the output voltage follows the ramp.

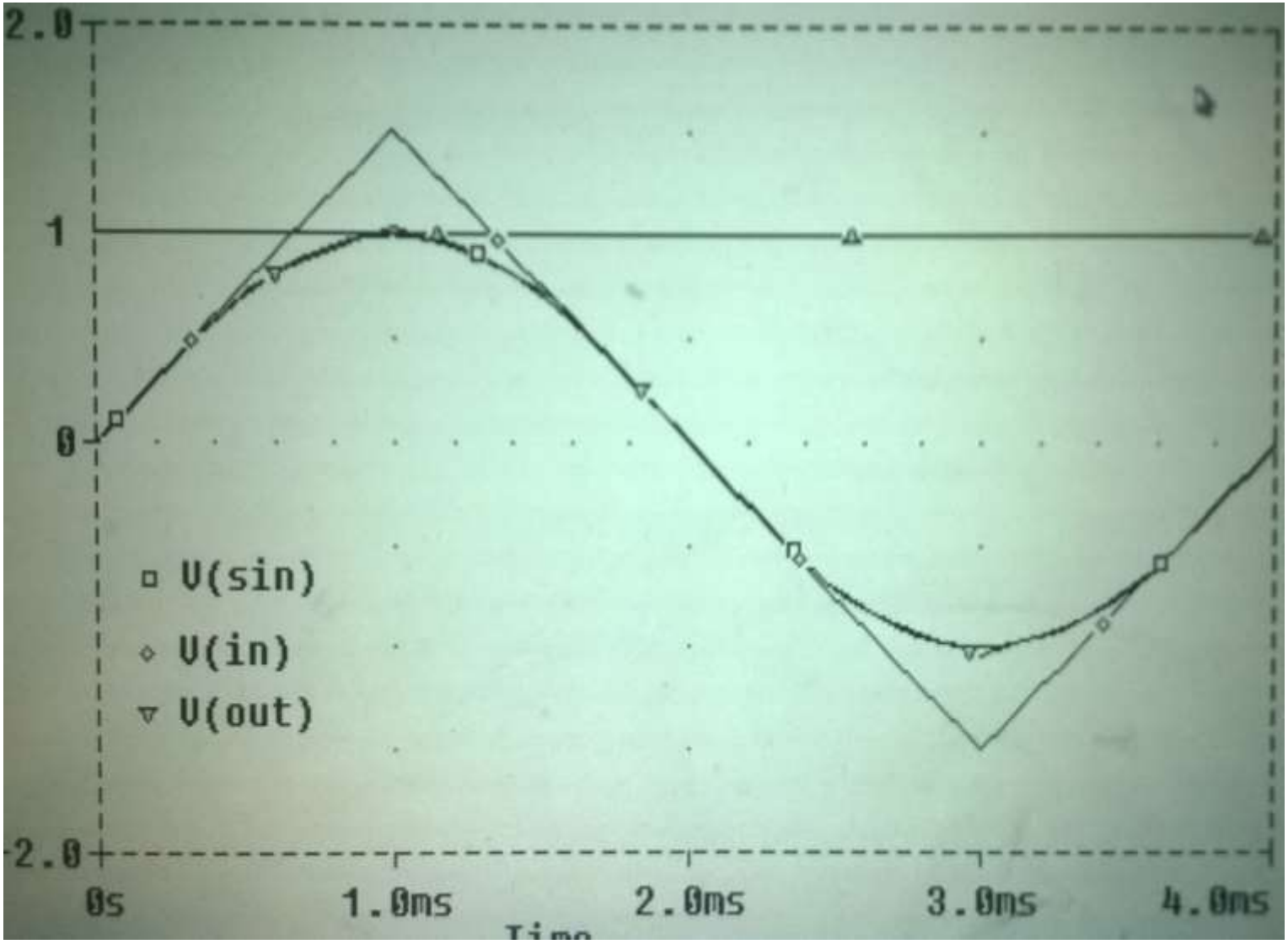
•Suppose V1 < V2 is 0.5 volt. Then when the input voltage reaches 0.5 volt D1 begins to conduct. The output voltage is given by

$$Vo = 0.5 + (V-0.5)(R1/(1+R1))$$

and setting Vo = 0.866 when V=1 requires R1 = 2.73W. Similarly set Vo = 1 volt when V = 1.5V (with V2 = 0.866 volt) calculate. Note that D1 is conducting in this interval. Calculate R2= 0.42W


1Ω
Positive Half-Cycle
Negative Half-Cycle
2.73Ω
0.42Ω
2.73Ω
0.42Ω
+
V
−
+
0.5V
0.866V
0.5V
0.866V
+
V_0
−


1.5
1.0
0.5
T/3 (30°)
2T/3 (60°)
T (1/4 period) (90°)


2.0
1
0
-2.0
V(sin)
V(in)
V(out)
0s
1.0ms
2.0ms
3.0ms
4.0ms