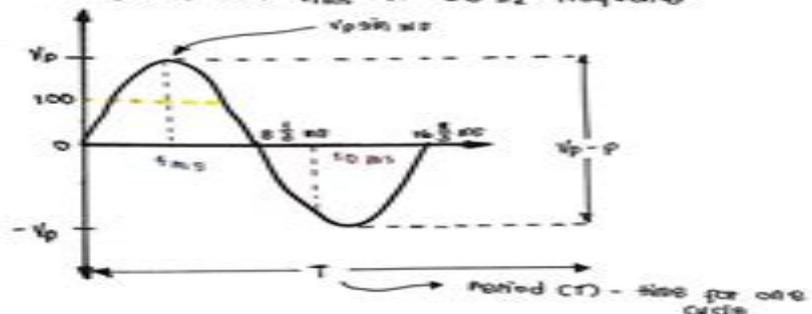


# 06 ALTERNATING CURRENT FUNDAMENTALS

AC source is 220 V<sub>rms</sub> at 60 Hz frequency



$V_{peak} = \sqrt{2} V_{rms}$  (root mean square)  
 $V_{peak} = \sqrt{2} (220)$   
 $V_{peak} = 311.13 V_p$   
 $V_{p-p} = 2V_p$   
 $V_{p-p} = 2 (311.13)$   
 $V_{p-p} = 622.26 V_{p-p}$

$T = \frac{1}{F}$   
 $T = \frac{1}{60 \times 2}$   
 $T = 16 \frac{2}{3} ms$

Find V at 4 ms  
 $V_{4ms} = V_p \sin \omega t$   
 $= 311.13 \sin 2\pi(60)t$  ;  $\omega = 2\pi f$  → angular velocity  
 $= 311.13 \sin 120\pi t$  (using Radians)  
 $= 311.13 \sin 120\pi(4ms)$   
 $V_{4ms} = 310.52 V$

Find V at 10ms  
 $V_{10ms} = V_p \sin \omega t$   
 $= 311.13 \sin [180(180)(4 \times 10^{-3})]$  (using degrees)  
 $= 311.13 \sin (86.40^\circ)$   
 $V_{10ms} = 310.52 V$

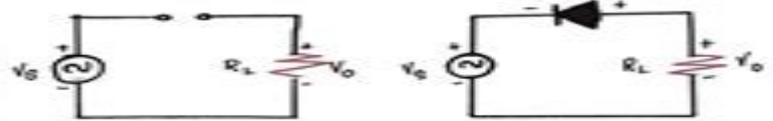
Find V at 10ms  
 $V_{10ms} = V_p \sin \omega t$   
 $= 311.13 \sin 150^\circ (10ms)$   
 $V_{10ms} = -182.88 V$

Find  $t_1$  and  $t_2$  when  $V = 100V$   
 $100 = 311.13 \sin 120\pi t$   
 $\left[ \frac{100}{311.13} = \sin 120\pi t \right] \sin^{-1}$   
 $\sin^{-1} \frac{100}{311.13} = 120\pi t$   
 $t_1 = \frac{\sin^{-1} \frac{100}{311.13}}{120\pi}$   
 $t_1 = 0.87 ms$   
 $t_2 = \frac{1}{2} - t_1$   
 $= \frac{1}{2} - 0.87$   
 $t_2 = 7.46 ms$

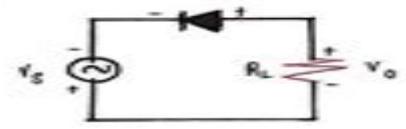
Checking:  
 $V = 311.13 \sin 120\pi(0.87 ms)$   
 $V = 100.225 V$   
 $t_2 = \frac{1}{2} - t_1$   
 $V = 311.13 \sin 120\pi(7.46 ms)$   
 $V = 100.6 V$

## DIODES USED IN AC APPLICATIONS

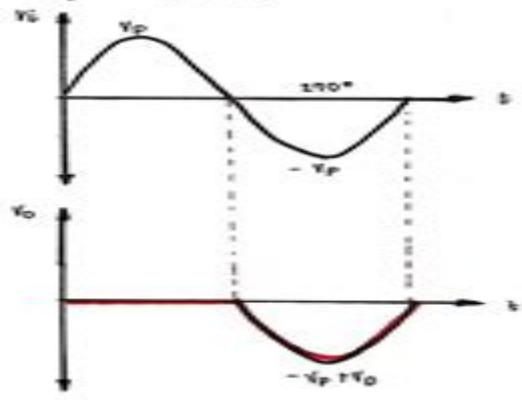
- 1. Clipper circuits
  - are electronic circuits that removes certain portion of the input signal; "clip off"
  - Series Clipper Circuits - the diode is in series between the input and the output
  - Series Positive Clipper - positive portion is removed



⊕ cycle (D is off)  
 $V_o = 0V$

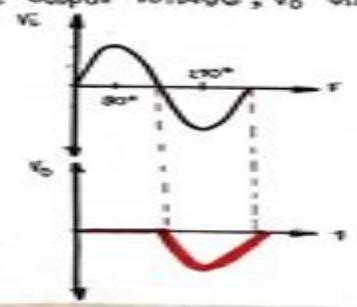


⊖ cycle (D is on)  
 $-V_s + V_p - V_o = 0$   
 $V_o = -V_s + V_p$



If  $V_s$  is 5 V<sub>rms</sub>, plot the output voltage,  $V_o$  using silicon diodes

$V_p = \sqrt{2} V_{rms}$   
 $= \sqrt{2} (5)$   
 $V_p = 7.07 V_p$   
 ⊕ cycle  
 $V_o = 0V$   
 ⊖ cycle:  $V_o = -V_s + V_D$   
 at  $180^\circ$   
 $V_o = -V_p + V_D$   
 $= -(7.07 V) + 0.7 V$   
 $V_o = -6.37 V_p$



# Alternating Current Fundamentals

**JL Elias**

A decorative graphic element consisting of a light blue horizontal bar with a rounded right end, and a red circular glow behind it.

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