Digitron PreLab 6

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$V_p = 10v$ (peak Voltage)

$V_{on} = 0.6v$ (Diod on Voltage)

$R = 20\ K\Omega$

$f = 100\ Hz \Rightarrow T = \frac{1}{f} = 0.01\ sec$

$C = 1\mu F$

* Half wave rectifier ripple voltage V_r is given

- $V_r = (V_p - V_{on}) \cdot (1 - e^{-T/RC})$

$V_r = (10 - 0.6) \cdot (1 - e^{-(\frac{0.01}{20\times10^3 \times 1\times10^{-6}})})$

$V_r = (9.4) \cdot (1 - e^{-(\frac{0.01}{20\times10^{-3}})})$

$\boxed{V_r = 3.698V}$

Full wave rectifier, Ripple Voltage is given by:

- $V_r = (V_p - 2V_{on}) \cdot (1 - e^{-T/2RC})$

$V_r = (10 - 2(0.6)) \cdot (1 - e^{-(\frac{0.01}{2\times20\times10^3 \times 1\times10^{-6}})})$

$V_r = (8.8) \cdot (1 - e^{-(\frac{0.01}{40\times10^{-3}})})$

$V_r = (8.8) \cdot (1 - e^{-1/4})$

$\boxed{V_r = 1.946V}$

- Conduction Time Interval is the Same for Both half-wave and full-wave Rectifier

  - $\Delta T = \frac{T}{2\pi} \times \cos^{-1}\left(\frac{V_p - V_r}{V_p}\right)$

- For Full wave Rectifier $V_r = 1.946V$

  - $\Delta T = \frac{0.01}{2\pi} \times \cos^{-1}\left(\frac{10 - 1.946}{10}\right)$

$$\boxed{\Delta T = 0.571 \text{ sec}}$$

- For Half Wave Rectifier $V_r = 3.698\,V$

  - $\Delta T = \frac{T}{2\pi} \times \cos^{-1}\left(\frac{V_p - V_r}{V_p}\right)$

$$\Delta T = \frac{0.01}{2\pi} \times \cos^{-1}\left(\frac{10 - 3.698}{10}\right)$$

$$\boxed{\Delta T = 0.80008 \text{ sec}}$$

- Peak Inverse Voltage

  For Half wave rectifier

  - $PIV = 2V_p - V_{on} \Rightarrow 2(10) - 0.6 = \boxed{19.4}$

- For Full Wave Rectifier

  - $PIV = V_p - V_{on}$

$$= 10 - 0.6$$

$$\boxed{PIV = 9.4}$$