**SEM. IV, paper- CC10**

# Two terminal devices and their applications

## (Specially: **Ripple factor calculation**)

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**Lecture-IV**

## Ripple factor of a full wave rectifier :—

The output of a rectifier contains both "dc" as well as "ac" components. This undesirable "ac" components are called ripples, Ripple factor is defined as the ratio of r.m.s value of ac components in the output.

$$\text{Ripple factor} = \frac{\text{r.m.s value of ac component}}{\text{value of dc component}}$$

$$\Rightarrow \gamma = \frac{I_{ac}}{I_{dc}} \quad \text{---} (1)$$

Now, $I_{r.m.s} = \sqrt{I_{ac}^2 + I_{dc}^2}$

$$\Rightarrow I_{r.m.s}^2 = I_{ac}^2 + I_{dc}^2$$

$$\Rightarrow I_{ac}^2 = I_{r.m.s}^2 - I_{dc}^2$$

$$\Rightarrow I_{ac} = \sqrt{I_{r.m.s}^2 - I_{dc}^2} \quad \text{---} (11)$$

Using (11) in (1), we get,

$$\gamma = \frac{\sqrt{I_{r.m.s}^2 - I_{dc}^2}}{I_{dc}}$$

$$\Rightarrow \gamma = \sqrt{\frac{I_{r.m.s}^2 - I_{dc}^2}{I_{dc}^2}}$$

$$\Rightarrow \gamma = \sqrt{\frac{I_{rms}^2}{I_{dc}^2} - \frac{I_{dc}^2}{I_{dc}^2}}$$

$$\Rightarrow \gamma = \sqrt{\left(\frac{I_{rms}}{I_{dc}}\right)^2 - 1} \quad \text{---(III)}$$

For full wave rectifier:—

$$I_{rms} = \frac{I_0}{\sqrt{2}} \text{---(IV)} \qquad I_{dc} = \frac{2I_0}{\pi} \text{---(V)}$$

Where $I_0$ is peak value of ac input.

Using (IV) & (V) in (III), we get,

$$\gamma = \sqrt{\left(\frac{\frac{I_0}{\sqrt{2}}}{\frac{2I_0}{\pi}}\right)^2 - 1} = \sqrt{\left(\frac{\pi}{2\sqrt{2}}\right)^2 - 1} = \sqrt{\frac{\pi^2}{8} - 1}$$

$$\therefore \boxed{\gamma = 0.48}$$

Thus in full wave rectifier, the value of dc component is more than ac components.

## Ripple factor for half wave Rectifier

$$\gamma = \sqrt{\left(\frac{I_{rms}}{I_{dc}}\right)^2 - 1} \quad \text{---(iii)}$$

for half wave rectifier,

$$I_{rms} = \frac{I_0}{2} \text{ ---(vi)} \quad \& \quad I_{dc} = \frac{I_0}{\pi} \text{ ---(vii)}$$

where $I_0$ is Peak value of ac input.

using (vi) & (vii) in (iii), we get,

$$\gamma = \sqrt{\left(\frac{I_0/2}{I_0/\pi}\right)^2 - 1} = \sqrt{\frac{\pi^2}{4} - 1}$$

$$\therefore \boxed{\gamma = 1.21}$$

Thus ac components exceeds the dc components in half wave rectifier, due to this reason, half wave rectifier is seldom used.