

## 5.2 Filters

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• The output of rectifier is pulsating in nature, i.e. it contains 'ac' as well as 'dc' components.

$$V_{out} = \frac{2V_m}{\pi} - \frac{4V_m}{3\pi} \cos 2\omega t - \frac{4V_m}{15\pi} \cos 4\omega t \dots$$

$$V_{out} = \underbrace{\frac{2V_m}{\pi}}_{\text{dc component}} - \underbrace{\frac{4V_m}{3\pi} \cos 2\omega t}_{\text{ac component}} \quad \text{--- Neglecting higher terms}$$

• However, most of the electronic circuits require a DC voltage which is constant in value. Hence to remove 'ac' component and to get plain 'dc' at the output, we make use of a circuit known as 'Filter'.

• Thus, filter is a circuit, which <sup>removes (or minimizes)</sup> the 'ac' ripple from the pulsating dc of the rectifier output and provides a 'smooth' DC of constant value to reach the output load.

## Filter Circuits and types of Filters



fig: 1.1 Action of a Filter

- Generally inductors and capacitors are used as filter components.
- 1. The reactance of the inductor is given as

$$X_L = 2\pi fL$$

$$\text{thus, } f=0 \rightarrow X_L=0$$

$$f=\infty \rightarrow X_L=\infty$$

It means inductor acts as short circuit for dc components (ie it passes DC) but has a large impedance for ac components (ie it blocks AC)

Another important property of inductor is that it opposes any sudden changes in the current.

- Therefore, wherever we apply AC current to the inductor, then inductor opposes the variation in the AC current, and makes it smooth.

• Hence, inductor is always connected in series with the load  $\rightarrow$  to allow the DC output current to pass through it. 03

2. The reactance of the capacitance is given as

$$X_c = \frac{1}{2\pi fC}$$

$$\text{thus, } f=0 \rightarrow X_c = \infty$$

$$f = \infty \rightarrow X_c = 0$$

It means capacitor acts as open circuit for dc components (ie it blocks DC) but has a low impedance for ac components (ie it passes AC)

• The capacitor is always connected in parallel with the load, so whatever the AC component present at the output of rectifier are passed to the ground (through the capacitor), and the DC voltage reaches the load.

## Filter Circuits and types of Filters

The following are the different filter circuits used in conjunction with rectifiers. 04

1. Inductor filter or 'L' filter
2. Capacitor filter or 'C' filter
3. Inductor-capacitor filter or LC filter
4. C-L-C or  $\pi$  filter

