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19EET103 / ELECTRIC CIRCUITS AND ELECTRON DEVICES

UNIT 5- RECTIFIERS AND POWER SUPPLIES

Full Wave Rectifier

- Electric circuits that convert AC to DC are known as rectifiers.
- Rectifiers are classified into two types as Half Wave Rectifiers and Full Wave Rectifiers.
- Significant power is lost while using a half-wave rectifier and is not feasible for applications that need a smooth and steady supply.

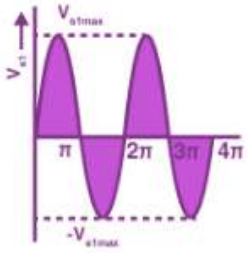
Defining Full Wave Rectifiers

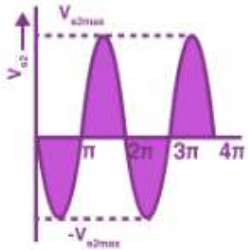
- A full wave rectifier is defined as a rectifier that converts the complete cycle of alternating current into pulsating DC.

Full Wave Rectifier Circuit

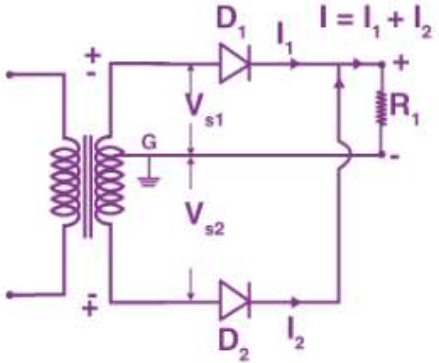
- The circuit of the full wave rectifier can be constructed in two ways.
- The first method uses a center tapped transformer and two diodes.
- The second method uses a standard transformer with four diodes arranged as a bridge.

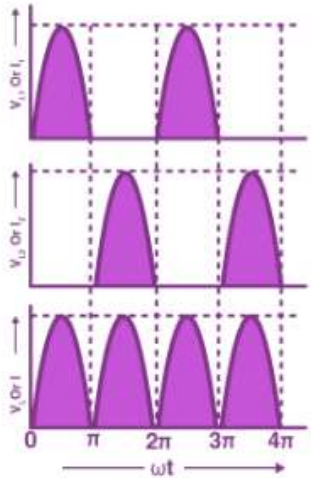
CENTRE-TAP FULL WAVE RECTIFIER





Input voltage waveform





Output voltage waveform

Full Wave Rectifier Formula

Peak Inverse Voltage

Peak inverse voltage is the maximum voltage a diode can withstand in the reverse-biased direction before breakdown. The peak inverse voltage of the full-wave rectifier is double that of a half-wave rectifier. The PIV across D_1 and D_2 is $2V_{max}$.

DC Output Voltage

The following formula gives the average value of the DC output voltage:

$$V_{dc} = I_{av}R_L = \frac{2}{\pi} I_{max}R_L$$

RMS Value of Current

The RMS value of the current can be calculated using the following formula:

$$I_{rms} = \frac{I_{max}}{\sqrt{2}}$$

Form Factor

The form factor of the full wave rectifier is calculated using the formula:

$$K_f = \frac{RMS\ value\ of\ current}{Average\ value\ of\ current} = \frac{I_{rms}}{I_{dc}} = \frac{I_{max}/\sqrt{2}}{2I_{max}/\pi} = \frac{\pi}{2\sqrt{2}} = 1.11$$

Peak Factor

The following formula gives the peak factor of the full wave rectifier:

$$K_p = \frac{Peak\ value\ of\ current}{RMS\ value\ of\ current} = \frac{I_{max}}{I_{max}/\sqrt{2}} = \sqrt{2}$$

Rectification Efficiency

The rectification efficiency of the full-wave rectifier can be obtained using the following formula:

$$\eta = \frac{DC\ Output\ Power}{AC\ Output\ Power}$$

The efficiency of the full wave rectifiers is 81.2%.

Advantages of Full Wave Rectifier

•The rectification efficiency of full wave rectifiers is double that of half wave rectifiers. The efficiency of half wave rectifiers is 40.6% while the rectification efficiency of full wave rectifiers is 81.2%.
•The ripple factor in full wave rectifiers is low hence a simple filter is required. The value of ripple factor in full wave rectifier is 0.482 while in half wave rectifier it is about 1.21.
•The output voltage and the output power obtained in full wave rectifiers are higher than that obtained using half wave rectifiers.

Disadvantage

Full wave rectifier is that they need more circuit elements than the half wave rectifier which makes, making it costlier.