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Department - IT
Term/Sation - WINTE TERM - 2020 / C.
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Subject Name/Code - Introduction to Discrete Devices (UECL105)
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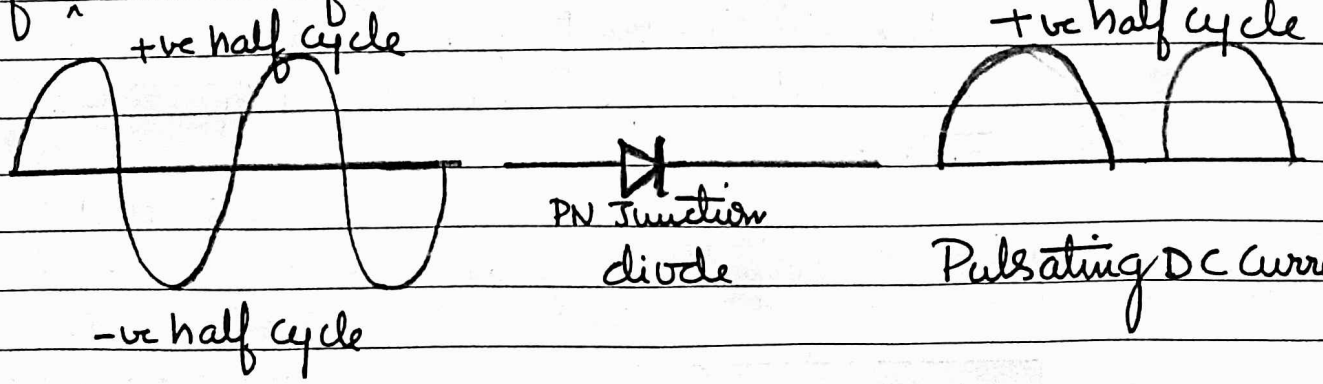
CO1 a) Define rectifier and explain the Half wave rectifier with waveform.

Answer: A rectifier is can electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC).

Half-wave rectifier is the simplest form of rectifier available. The below diagram illustrates the basic principle of a half wave rectifier.



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When a standard AC waveform is passed through a half-wave rectifier, only half the AC waveform remains.

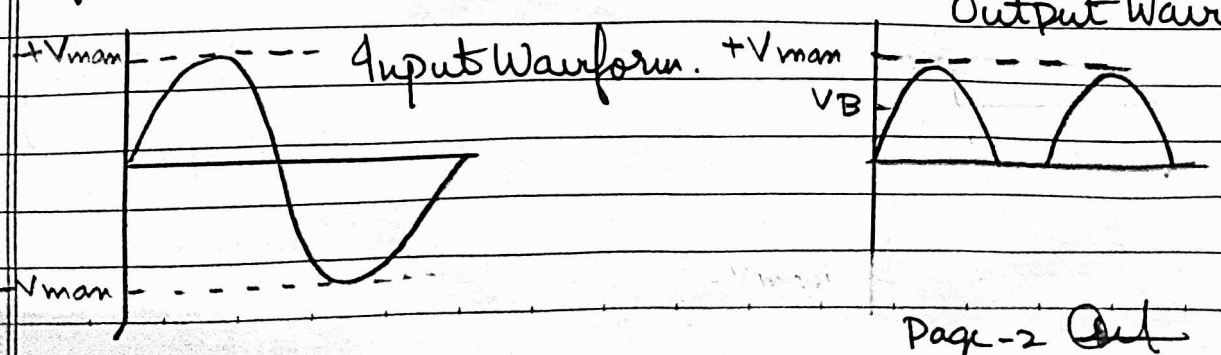
Half-wave rectifiers only allow one half-cycle on the positive or negative half cycle of the AC voltage through and will block the other half-cycle on the DC side.

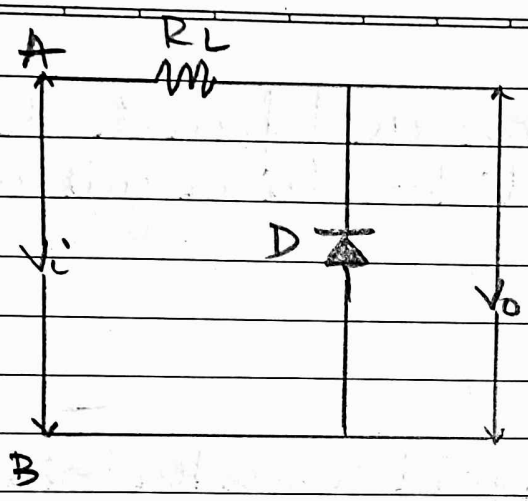
(b) Define clipper and explain parallel negative clipper in detail.

Answer: Clipper circuit are the circuit that clip off or removes a portion of an input signal, without causing any distortion to the remaining part of the waveform.

Parallel negative clipper is also known as Shunt negative clipper.

An shunt negative clipper, during the +ve half cycle the diode is reverse biased and hence the entire positive half cycle appears at the output. On the other hand, during the negative half cycle the diode is forward is forward biased and hence no output signal is generated.





Shunt negative clipper.

CO2-(b) Given

$V_{RMS} = 32.53\,V$, $R_d = 15\,\Omega$, Secondary winding = 100
$R_L = 4k\,\Omega$.

$$\text{Average} = \frac{2V_P}{\pi}$$

$$V_{rms} = \frac{V_P}{\sqrt{2}}$$

$$\text{Efficiency} = \eta = \left(\frac{\text{Work output}}{\text{Work Input}}\right) \times 100$$

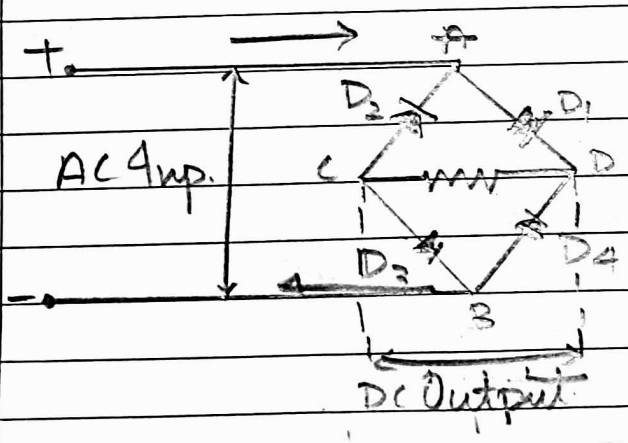
The ripple factor $= \gamma = 1.21$.

c) A bridge rectifier makes use of four diode in a bridge arrangement to achieve full-wave rectification.

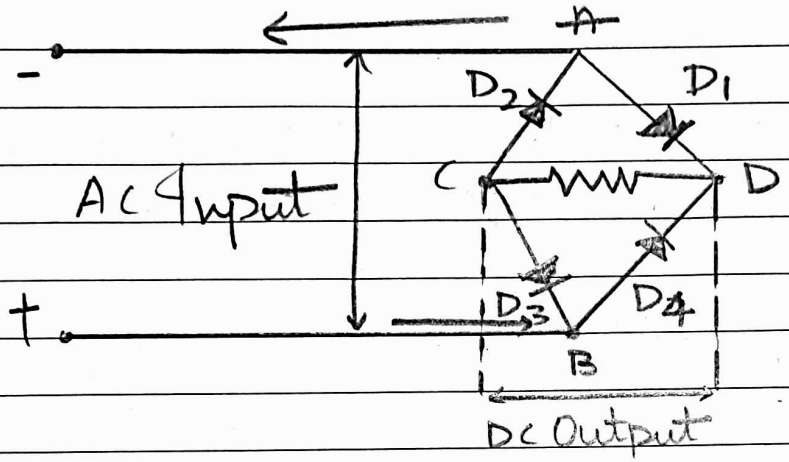
Working:

When an AC signal is applied across the bridge rectifier during the positive half cycle, terminal A becomes positive while terminal B becomes negative.

This results in diodes D_1 and D_3 to become forward biased while D_2 and D_4 become reverse biased.

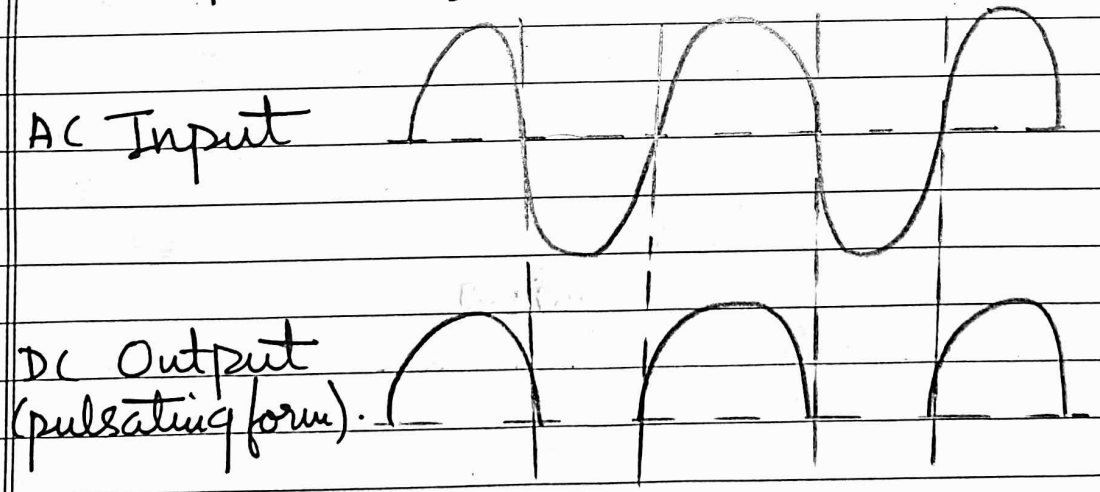


During negative half-cycle, terminal B becomes positive while the terminal A becomes negative. This causes diodes D_2 and D_4 to become biased and Diode D_1 and D_3 to reverse biased.



Thus, a bridge rectifier allows electric current during both positive and negative half cycle of the input AC signal.

The output waveform of the bridge rectifier



Ripple factor: The smoothness of the output DC signal is measured by a factor known as ripple factor.

$$r = \sqrt{\frac{(V_{rm})^2}{V_{DC}} - 1}$$

The ripple factor of bridge rectifier is 0.48.

Efficiency:

The ratio of the DC output power to the AC input power.
The max efficiency of a bridge rectifier is 81.2%.

$$\eta = \frac{\text{DC output Power}}{\text{AC input Power}}$$