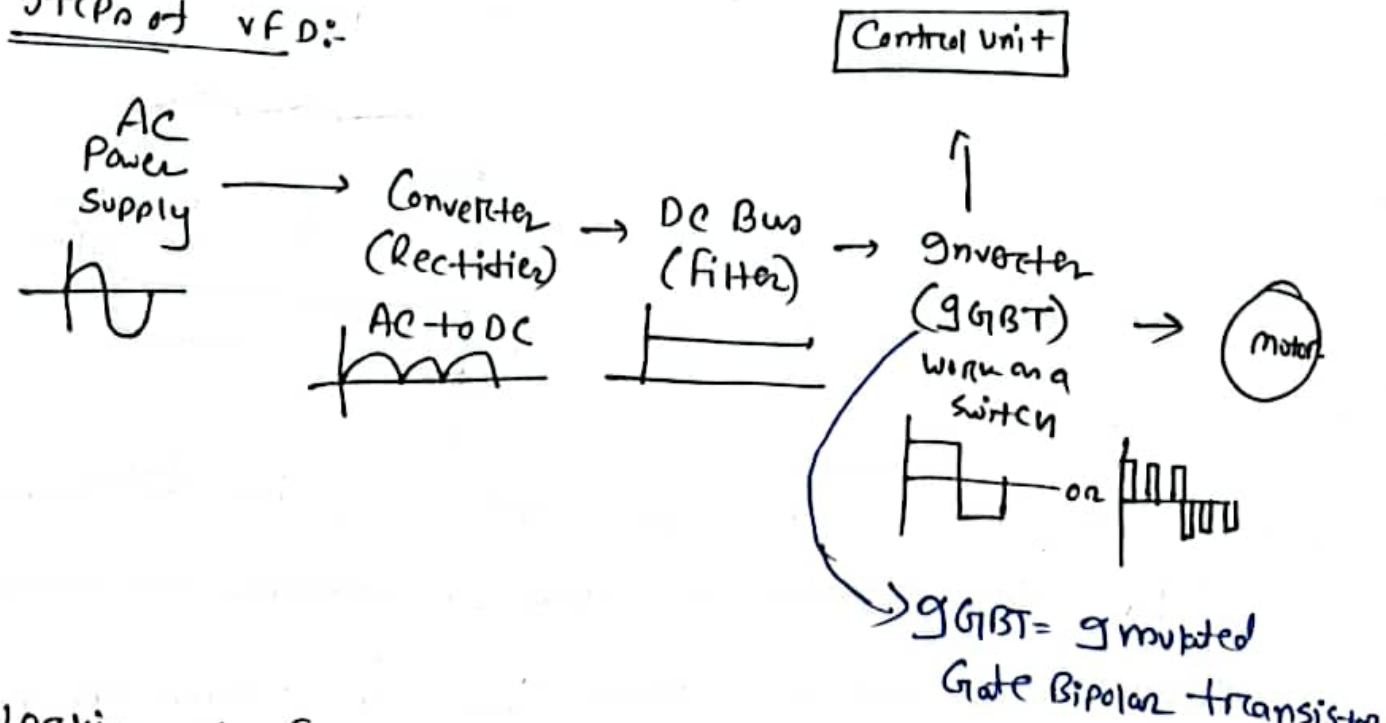
Variable frequency Drive (VFD)

VFD is basically used for Controlled the Speed of Induction motor, synchronous motor.

VFD varies the supplies frequency to an AC motor in order to Control its speed, allowing a smooth Startup, and adjusting motor speed as the application required.

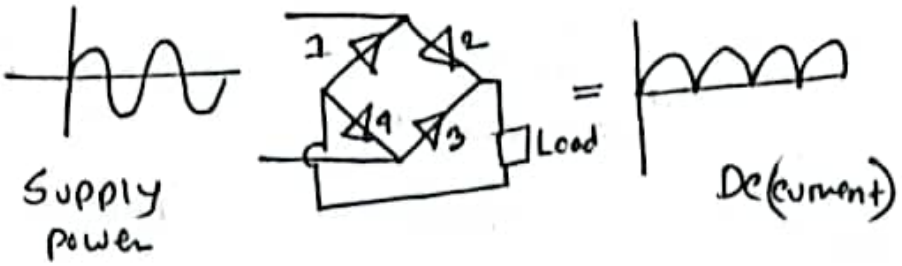
Steps of VFD:-



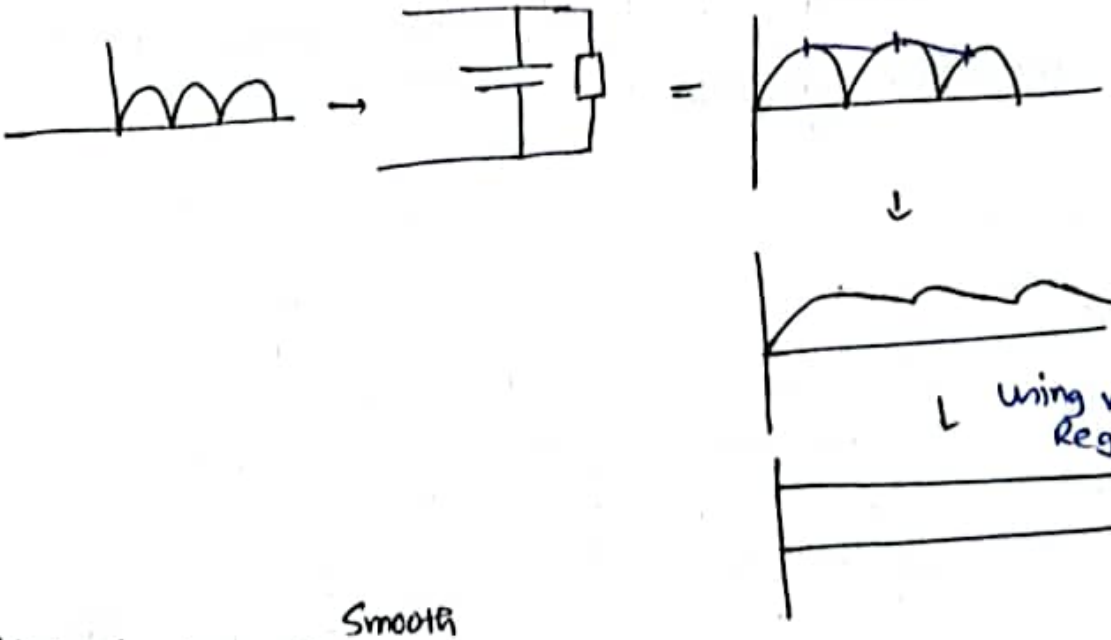
Working of VFD:-

Converter → Here Rectifier is used to Convert AC power supply to DC.

1, 2, 3, 4 → Diode.

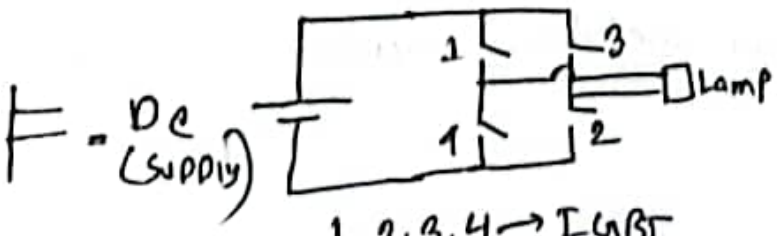


There is ripple in DC(current), so we need to smooth out those ripples to clean up the DC electricity. For this we use a DC bus which is actually a filter.



Smooth

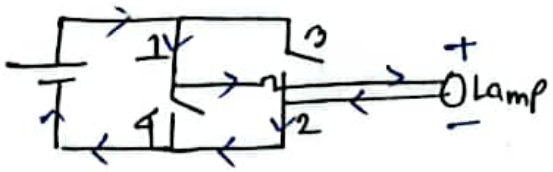
Now, convert this DC to AC and vary the frequency. For this we need an inverter. Inverter are basically IGBT which act as switches that can turn on and off super-fast.

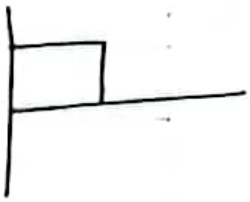


1, 2, 3, 4 → IGBT act as a switch.

Cond → 1

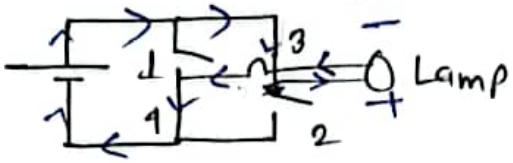
when 1, 2 closed then,

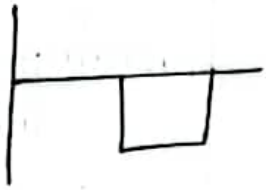




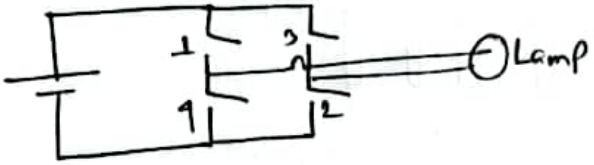
Cond → 2

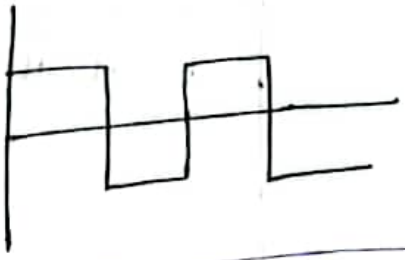
When 3, 4 Closed then,





Finally;





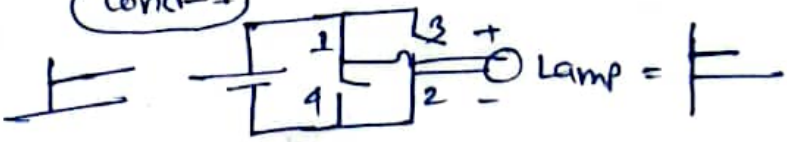
Here, we open and closed the switch at different speed and duration (t) to change the waveform.

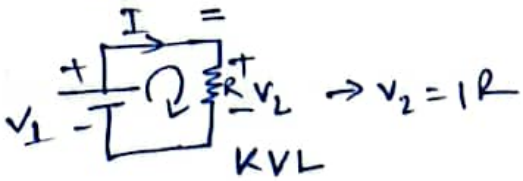
If we used a Controller (IGBT act as switch) to rapidly open and closed the switches multiple times per cycle in a pulsating pattern, each pulse varying in width. This is known as PWM (Pulse width Modulation)

বুঝাতেছি → Exam এ লিখা লাগবে না,

এখানে Square wave দেখাচ্ছে,

Cond-1





$\rightarrow V_2 = IR$

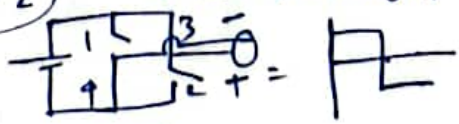
KVL

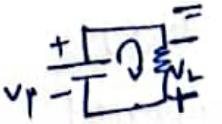
$V_1 - V_2 = 0$

$V_1 = V_2$

এখানে V_1 (supply voltage) সমান straight line হবে এবং output এ সমান straight line দেখাবে,

Cond-2



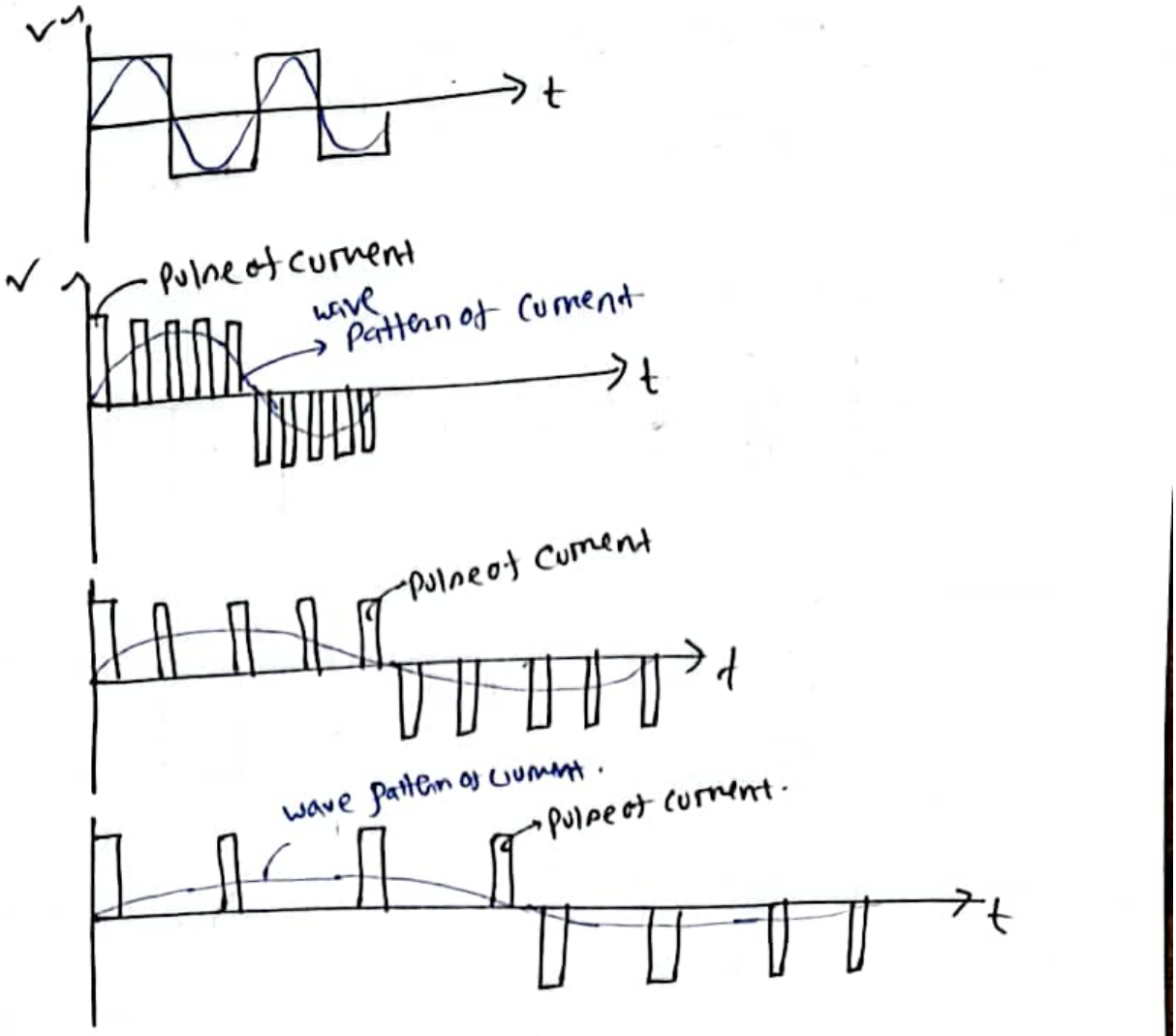


KVL = $V_1 + V_2 = 0$

$\therefore V_1 = -V_2$

এখানে output এ square wave দেখাবে,

So, the output is.



Here we can control the frequency by controlling the timing of the switches.

If t is increased, frequency is decreased.

$$f = \frac{1}{t}$$

If t is decreased, frequency is increased.

If frequency is increased or decreased then Speed is also increased or decreased.

$$N_s = \frac{120f}{P}$$

$$N_s \propto f$$

So, Controlling frequency we can control the Speed of motor.