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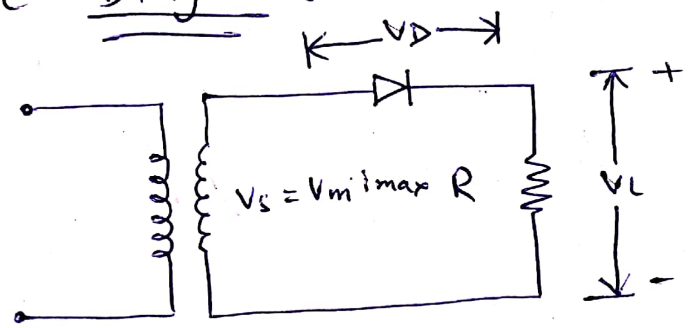
Q1:-

Ans:- Rectifier:- It is the electronic device which is used to convert AC into DC is called rectifier.

1. 1-φ ~~Fixed~~ Uncontrolled Half Wave Rectifier :-

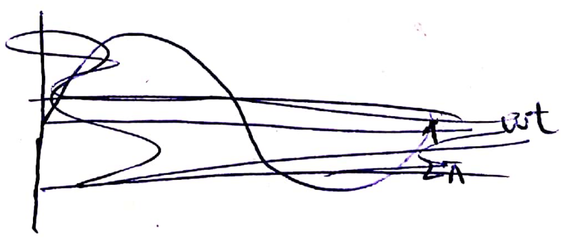
A rectifier is a circuit that convert an AC signal in to unidirictional signal diodes are used commonly in rectifiers. A single phase halfwave rectifier is the simplest type is not normally used in industrial applications however. It is useful in under-standing the principle of rectifier operation.

Circuit Diagram :-

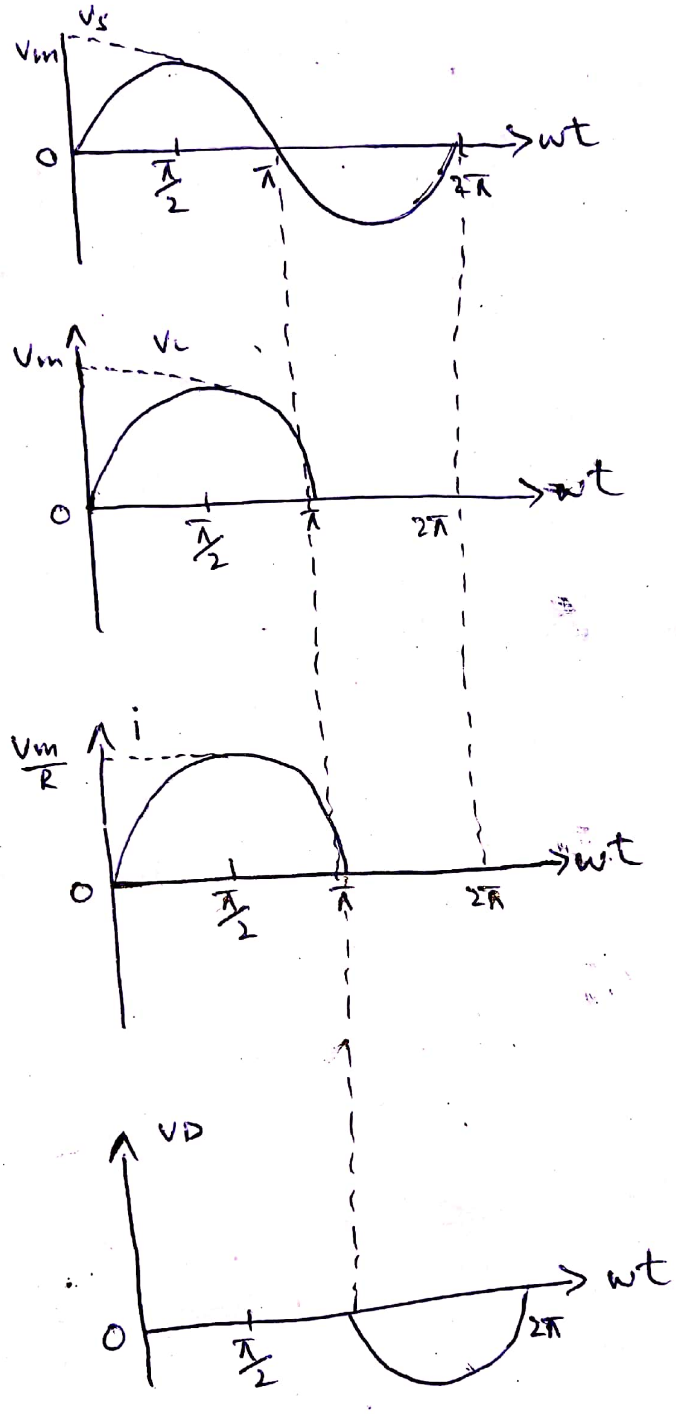


During positive half ~~wave~~ cycle. The input voltage diode D_1 is forward biase and conduct and input voltage appear across the load. During negative half cycle of the input voltage the diode in blocking condutor and input voltage is zero.

~~Wave form~~ :



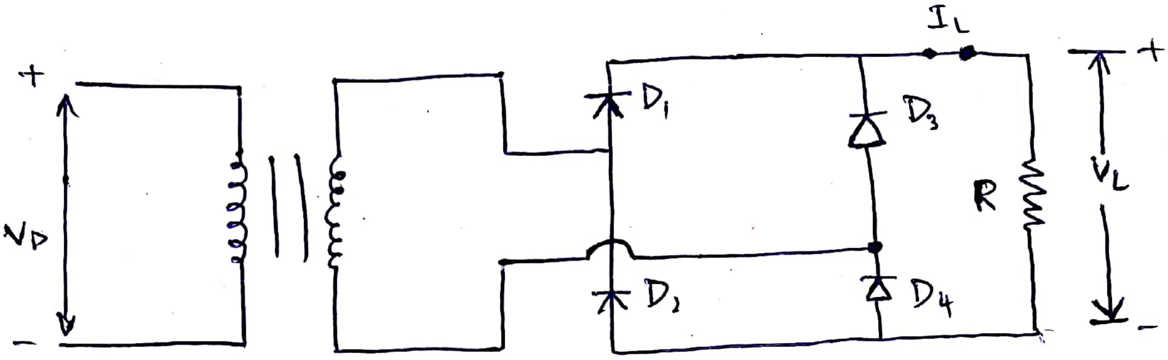
Waveform:-



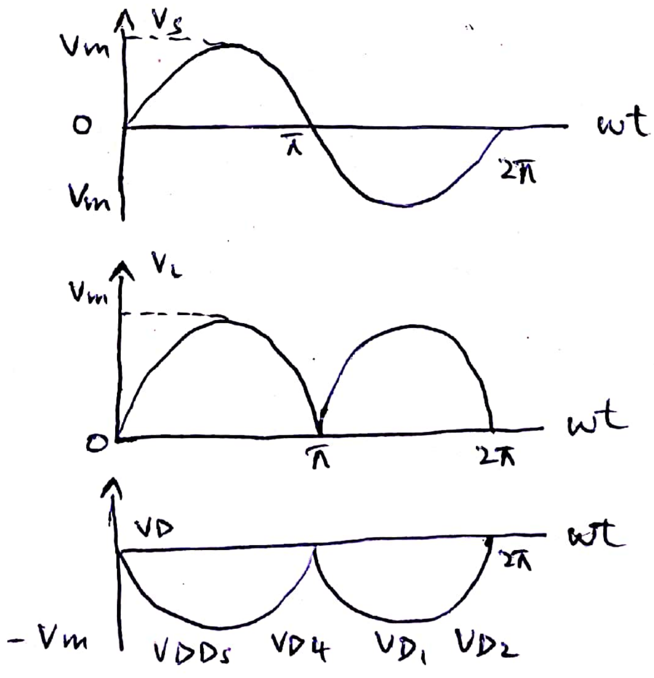
Ø Uncontrolled Full wave bridge Rectifier:-

We use four diode in bridge Rectifier circuit

Circuit Diagram:-



During positive half cycle of the input voltage the current flows through the load through diodes D_1 and D_2. During negative cycle Diodes D_3 and D_4 conducts. The peak inverse voltage of a diode is Vin



Similarities and differences :-

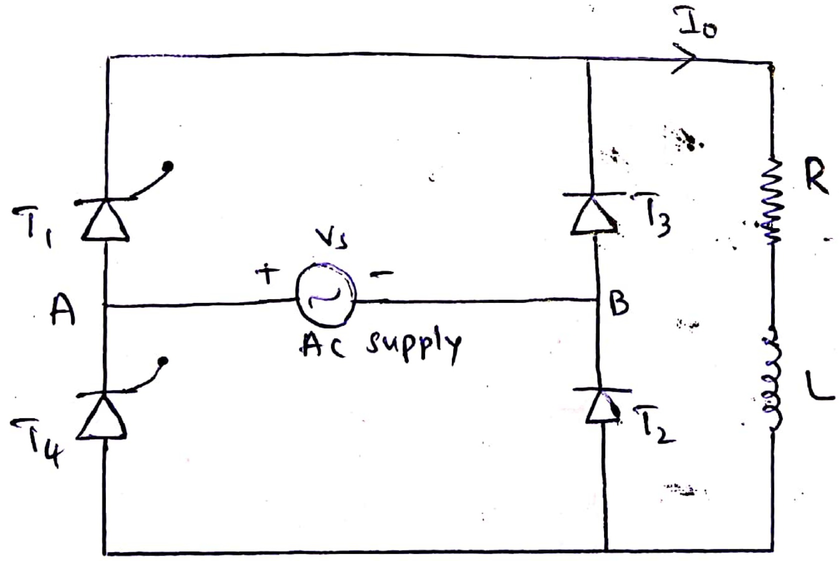
-> Both uses diode

-> During positive half cycle both conduct.

-> During negative half cycle bridge rectifier conduct but not conduct the half wave rectifier

2. 1 - ϕ Controlled bridge rectifier :-

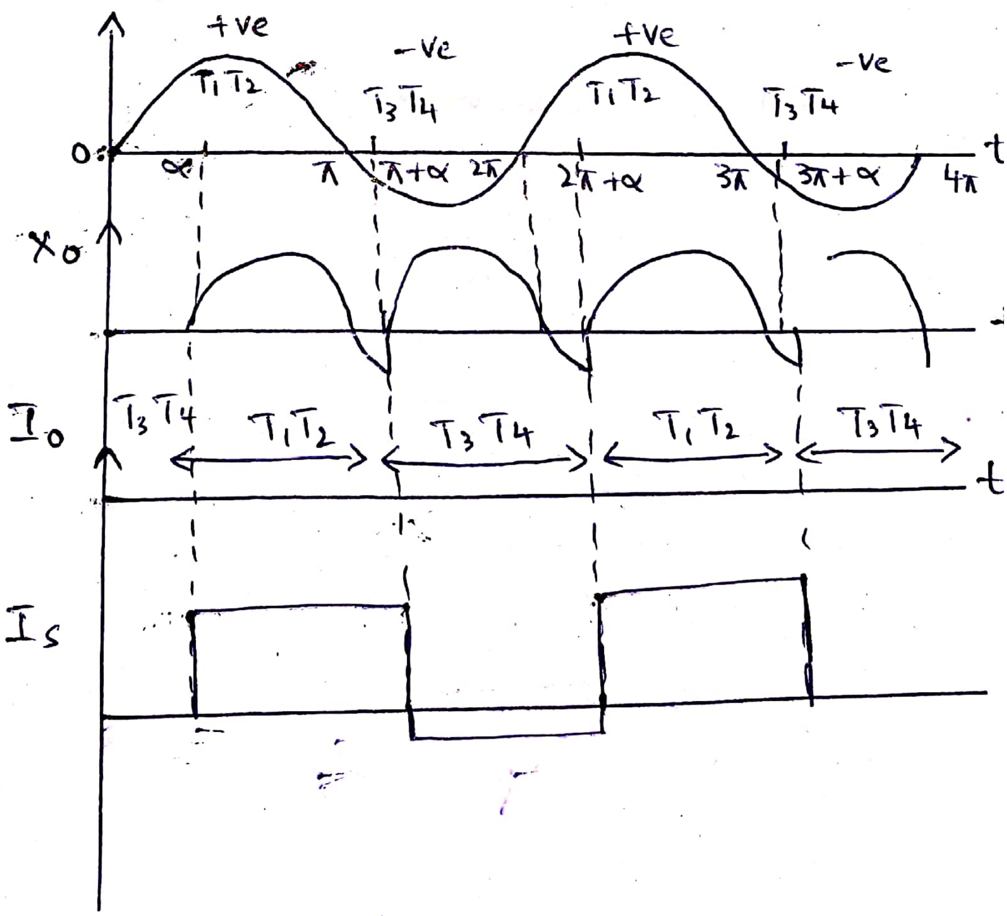
Circuit Diagram :-



Its function is basically subdivided into two parts positive half and negative half cycle. During positive half

Cycle T_1 and T_2 will become forward bias. If we give gate pulse to T_1 and T_2 current will flow in the loop. During negative half cycle. terminal A is negative with respect to terminal B. T_3 and T_4 will be in forward bias. If we give gate ~~flow in~~ pulse to T_3 and T_4 current will flow in another loop.

Graph:-



Q2:-

Sol:-

$$V_m = 46v$$

$$R = 11\Omega$$

We know that

For Halfwave

1. Vdc:-

$$\frac{V_m}{\pi} \quad \text{--- (1)}$$

$$V_m = \frac{46}{3.14} = 14.64v$$

For Full wave

$$= \frac{2V_m}{\pi}$$

$$= \frac{2(46)}{3.14}$$

$$= 29.29v$$

2. Idc:-

For Half wave

$$I_{dc} = \frac{V_m}{\pi R}$$

$$= \frac{46}{3.14(11)} = 1.33\,A$$

For Full wave

$$I_m = \frac{V_m}{R}$$

$$I_{dc} = \frac{I_m}{\pi}$$

$$= \frac{46}{11} = 4.18\,A$$

So

$$I_{dc} = \frac{4.18}{3.14} = 1.33\,A$$

3. **Vrms :-**

$$V_{rm} = \frac{V_m}{2}$$

$$= \frac{46}{2} = 23\,V$$

For Full wave

$$V_{rms} = \sqrt{2}\,V_s$$

$$\therefore V_s = \frac{V_m}{\sqrt{2}}$$

$$= \frac{46}{\sqrt{2}} = 65.05\,v$$

$$V_{rms} = \sqrt{2}\,(65.05)$$

$V_{rms} = 91.9 v$

4. **Irms :-**

For Half wave

$$I_{rms} = \frac{V_m}{2R}$$

$$= \frac{46}{2(11)} = 2.09 A$$

For Fullwave

$$\frac{I_m}{2} \quad — (1) \qquad \text{where } I_m = \frac{V_m}{R}$$

$$= \frac{46}{11} = 4.181 A \quad \text{put in (1)}$$

$$\frac{I_m}{2} = \frac{4.181}{2} = 2.0905 A.$$

5. It would like to refer the uncontrol full wave bridge rectifier because the effiecency of the full bridge rectifier is better than half wave rectifier and output frequency also greater then half wave rectifier.

Inductor = ?

$$L = \frac{T_{off}}{2} \times R \quad \text{—} ①$$

$$v_o = d v_i$$

$$d = \frac{v_o}{v_i} = \frac{0.46}{50} = 0.0092$$

$$\frac{T_{ON}}{T} = 0.46 \quad \text{—} *$$

$$T_{ON} = 0.46 \times T,$$

$$T_{ON} = \frac{0.46}{7} \qquad \because T = \frac{1}{7}$$

$$T_{ON} = \frac{0.46}{20(10^3)Hz}$$

$$T_{ON} = 2.3 \mu s$$

$$\frac{T_{ON}}{T} = 0.46$$

$$\frac{T_{ON}}{0.46} = T$$

$$\frac{2.3}{0.46} = T$$

$$T = 5 \mu s$$

Now

$$T = T_{ON} + T_{OFF}$$

$$T_{OFF} = T - T_{ON}$$

$$= 5 - 0.46 = 4.54 \mu$$

$$L = \frac{15 \mu s}{2} \times 11$$

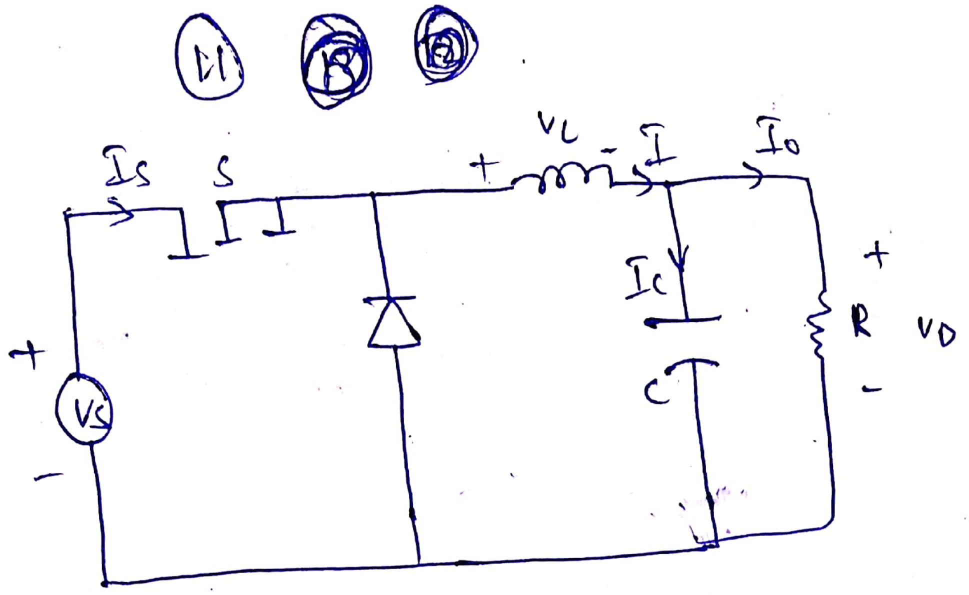
$$L = 7.5 \times 11 = 82.5$$

$$L = 82.5 \mu H$$

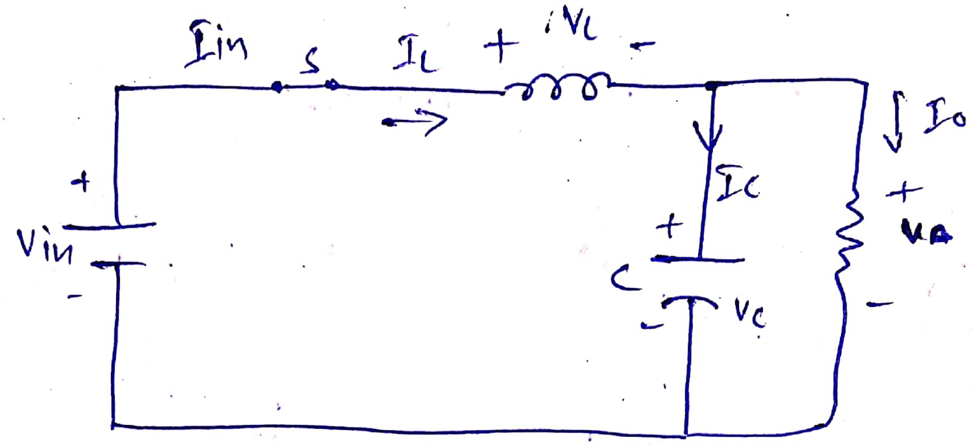
(10)

L=1.5×...

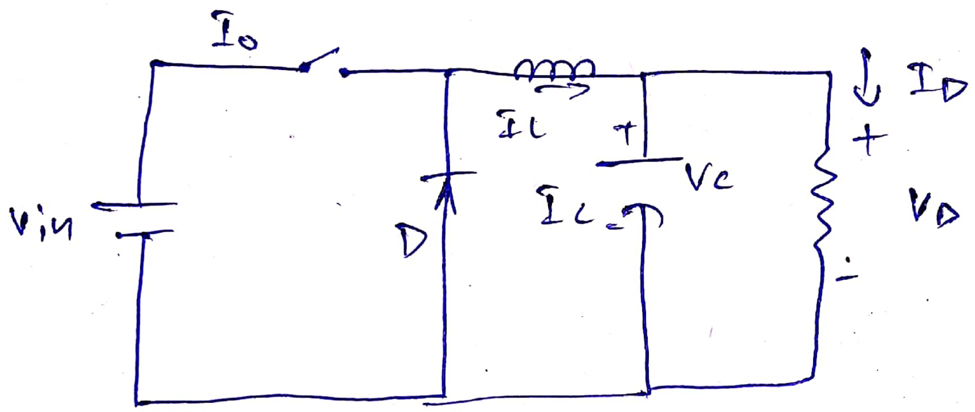
3:- Buck chopper:- DC - DC convertor are also known as convertors. Buck converter are those which reduces the input DC voltage to a sepcified DC output voltage



Working principle :- The main working principle of Buck converters is that the inductor in the input circuit resists sudden variation in input current when switch is ON the inductor stores energy from the input in the form of magnetic energy and discharged it when switch is closed. The capacitor in the output is assumed large enough that the time constant of Rc circuit in the output stage is high



Iin
S
IL
+ VL -
Io
Ic
+
Vin
-
+
C
Vc
-
+
VA
-



Io
IL
ID
+
Vc
Vin
D
IL
VD
-

In this mode the polarity of the inductor is reversed and the energy stored in the inductor is released. So the current through the inductor cannot abruptly change the diode must carry the current so it commulates and begins conducting. Energy is transfered from inductor to the capacitor resulting in a decreasing inductor current and a voltage across the resistor with the opposite polarity compared to Vin.

During steady state the ~~current~~ circuit is said to operate

1- In discontinous conduction mode if the inductor current reaches zero.

2- In continous conduction mode if the inductor current never reaches zero.

Q5:-

$V_{in} = 50v$

$V_{out} = 46\%$

$R = 11\Omega$

$f = 20KHZ$

① Duty cycle

$$\frac{V_o}{V_i} = \frac{-D}{1-D}$$

$$V_o = +V_1 d$$

$$= 1-d$$

$$0.46 = +50 \frac{d}{1-d}$$

$$(0.46)(1-d) = 50d$$

$$0.46 = 50d + 0.46d$$

$$0.46 - 0.46 = 50d$$

$$\frac{0.46}{(50)(0.46)} = 0.02$$

(2) Iout = ?

$$I_{max} + I_{min} = \frac{2dv}{R(1-d)^2}$$

$$I_{max} + I_{min} = \frac{2(0.02)(50)}{11(1-0.02)^2} = \frac{2}{10.56}$$

$$= 0.189A$$

$I_{out} = ?$

$$I_{out} = \frac{I_{max} + I_{min}}{2}$$

$$= \frac{0.189}{2} = 0.094\ A$$

$I_i = ?$

$$I_i = I_{cd}$$

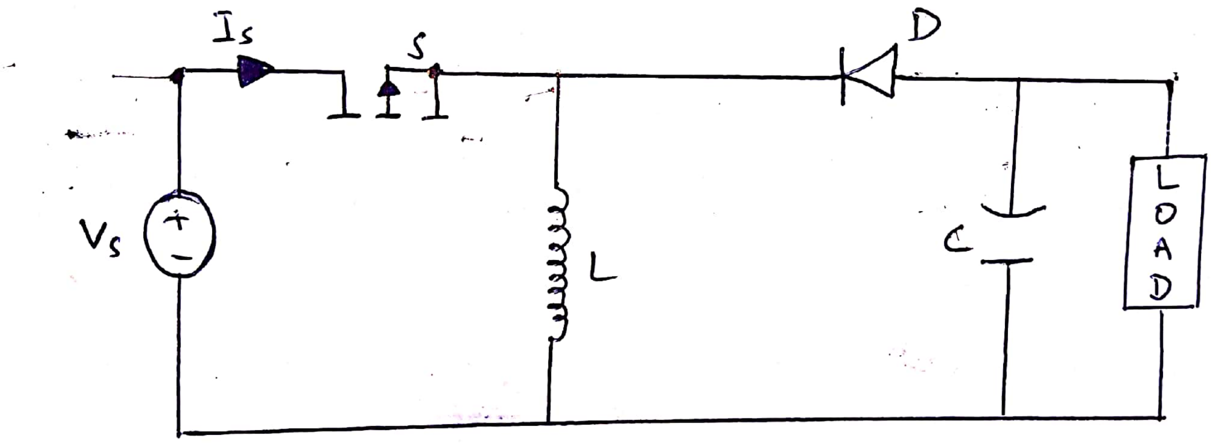
$$= 0.094 \times 0.189$$

$$= 0.0177\ A$$

Q5:-

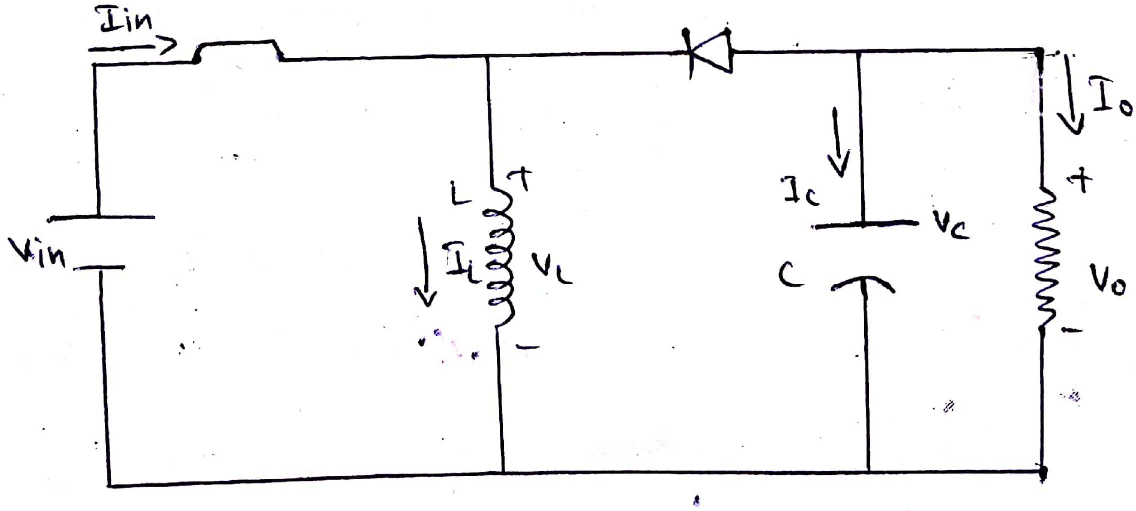
Ans:- Buck - Boost Chopper:-

A buck-boost converter which can operate as a DC-DC step down converter OR DC-DC stepup converter depending upon the duty cycle, D.



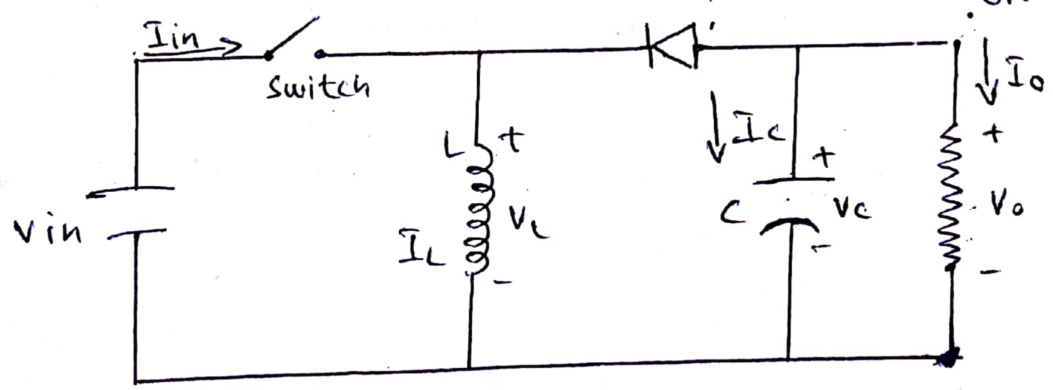
The input voltage source is connected to a solid state device. The second switch is used is a diode. The diode is connected, in reverse to the direction of power flow from source, to a capacitor and the load and the two are connected in parallel as shown in the figure above. The controlled switch is turned ON and OFF by using pulse width Modulation. PWM can be time based or frequency based. Time based is mostly used for DC-DC converters. It is simple to construct and use. Frequency remain constant in this type of PWM modulation

MODE 1 :- Switch is ON, Diode OFF

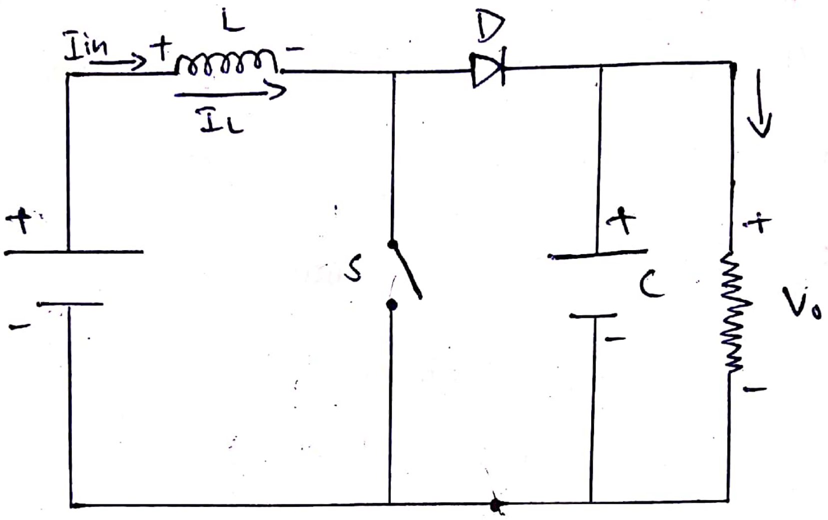


The switch is ON and therefore represents short circuit ideally offering zero resistance to the flow of current so when the switch is ON all the current will flow through the switch and the inductor and back to the DC input source. The inductor store charge during the time the switch is ON and when the solid state switch is OFF the polarity of the inductor reverses so that current flows through the load and through the diode and back to the inductor. So the direction of the current remain same.

MODE II :- Switch is OFF, Diode is ON



$$(\Delta i_L)_{closed} = \left(\frac{V_{in}}{L}\right) DT$$



In this mode the polarity of the inductor is released. The energy stored in the inductor is reversed. The energy stored in the inductor is released and is ultimatley dissipated in the load resistance, and this helps to maintaine the flow of current in the same direction through the load and also step-up the voltage as the inductor is now also acting as a source in conjunction with the input source.

Analyze the circuit using KVL

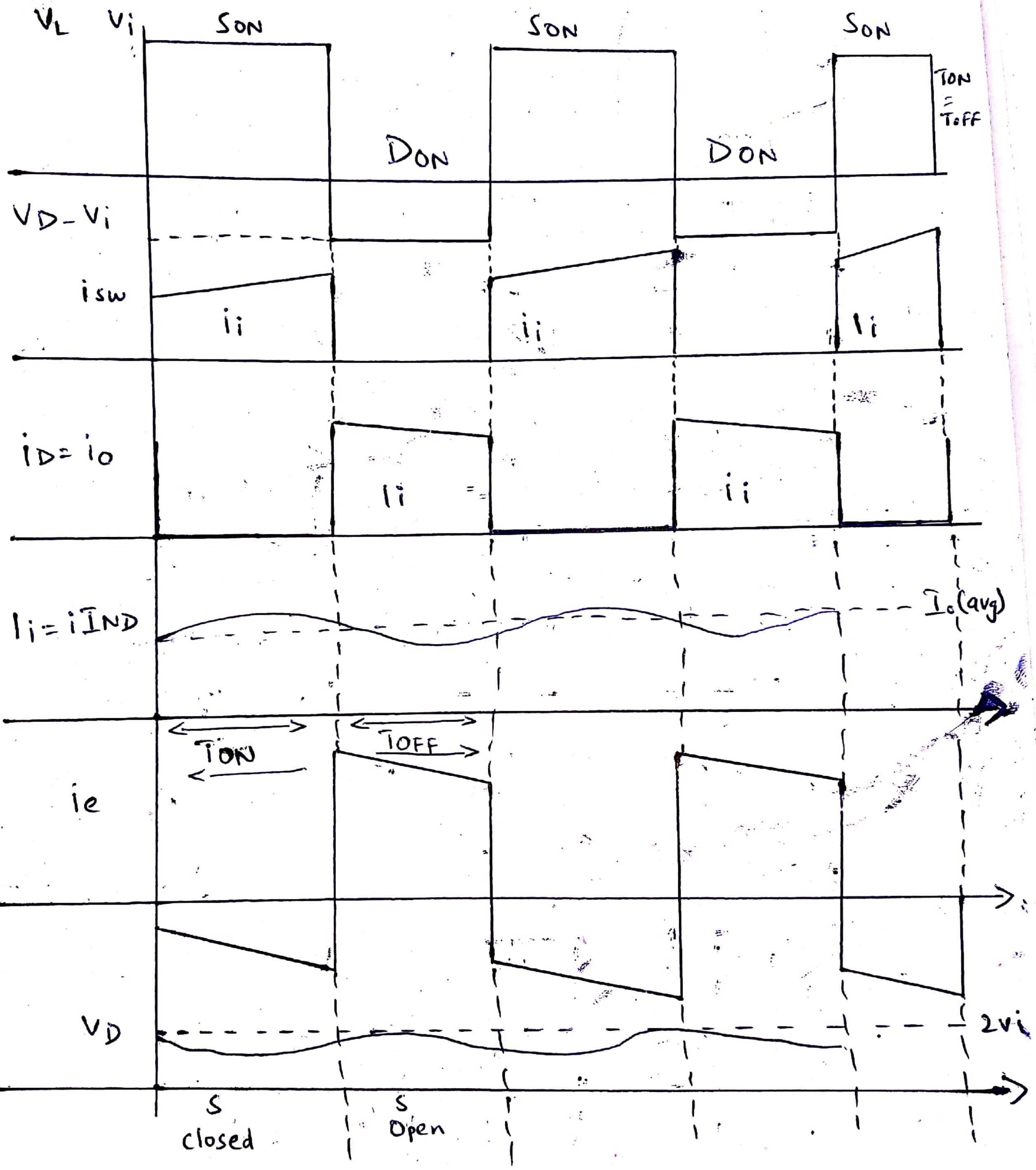
Boost converter is steady state operation for mode 2 using KVL

$$V_{in} = V_L + V_o$$

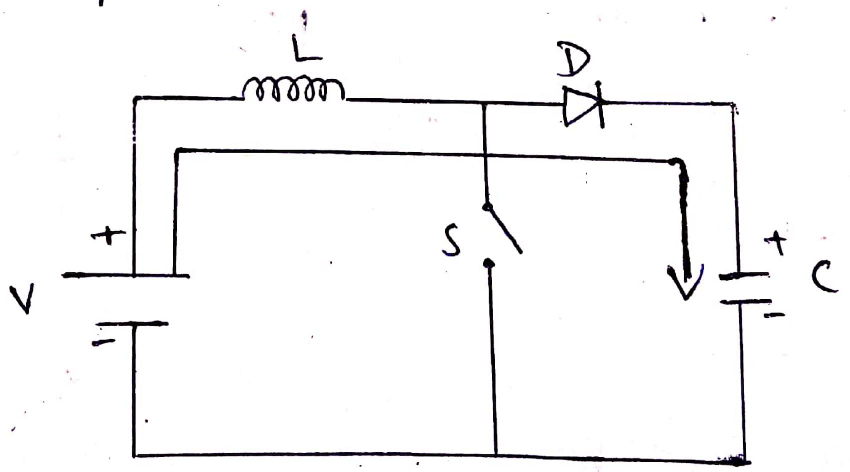
$$V_L = \frac{L\,di_L}{dt} = V_{in} - V_o$$

$$\frac{di_L}{dt} = \frac{\Delta i_L}{\Delta t} = \frac{\Delta i_L}{(1-d)T} = \frac{V_{in} - V_o}{L}$$

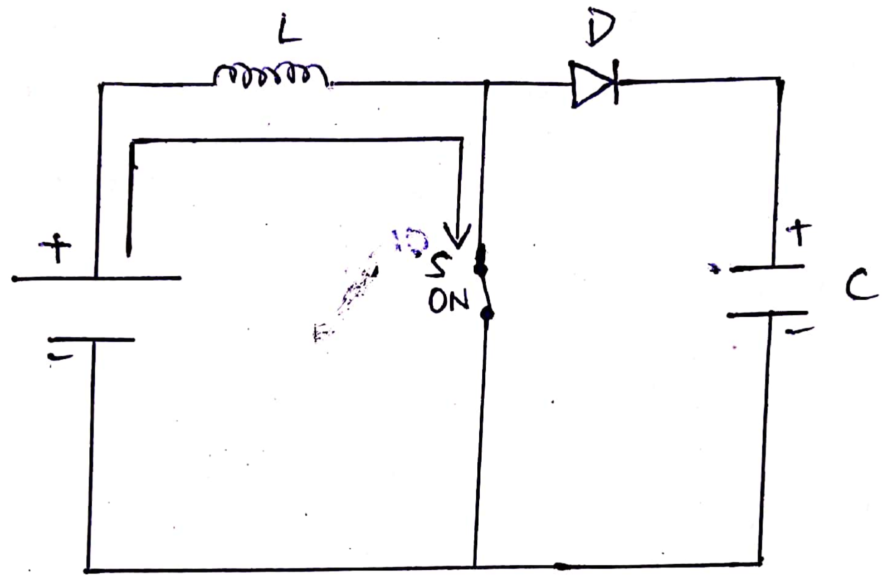
Since the switch is open for a time $T_{off} = T - T_{ON} = T - DT = (1-D)T$ we can say that $\Delta t = (1-D)T$


VL
Vi
SON
DON
SON
DON
SON
TON = TOFF
VD-Vi
isw
ii
iD= io
ii
Ii=iIND
Io(avg)
TON
TOFF
ie
VD
2vi
S closed
S Open

principle of boost converter is that the inductor in the output circuit resists sudden variations in input current. When switch is off the inductor store the energy in the form of electric energy and discharges it when switch is closed. The capacitor in the output circuit is assumed large enough that the time constant of RC circuit in the output stage is high.



The output capacitor is charged to the input voltage minus one diode drop.



When the switch is on. Our signal source goes high, turning on the MOSFET. All the current is directed through to the MOSFET through the inductor. The output capacitor stays charged since it can't discharge through the now back-biased diode.

The switch is ON and therefore represent a short circuit ideally offering zero resistance to the flow of current. Let us say the switch is ON for a time T_{ON} and is OFF for a time t_{OFF}. We define the time period T, as $T = T_{ON} + T_{OFF}$ and the switching frequency

$$f_{switch} = \frac{1}{T}$$

Booster converter in steady state operation for this mode using KVL

$$V_{in} = V_L$$

$$V_L = L\frac{di_L}{dt} = V_{in}$$

$$\frac{di_L}{dt} = \frac{\Delta i_L}{\Delta t} = \frac{\Delta i_L}{DT} = \frac{V_{in}}{L}$$

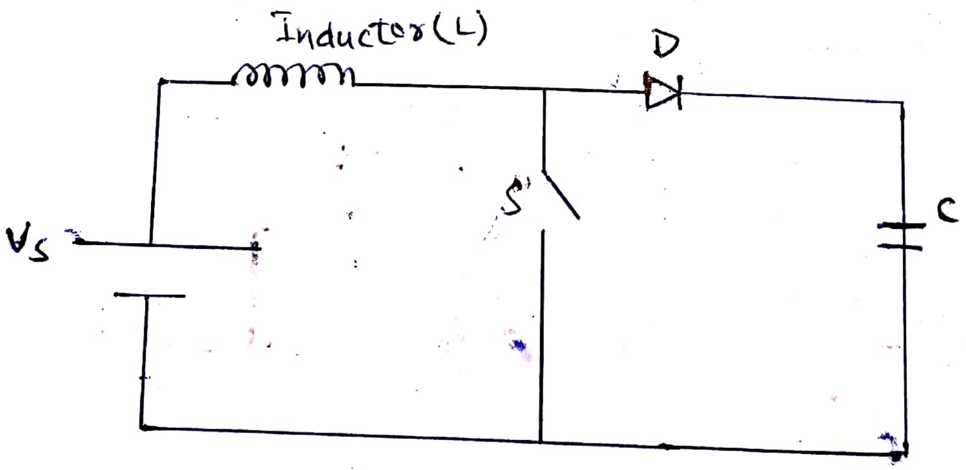
Since the switch is closed for a time $T_{ON} = DT$ we can say that

$\Delta t = DT$

15

Q4:-

Ans:- Boost chopper:- A boost converter is one of the simplest types of switch mode converter. It takes an input voltage & boost it. All consist of is an inductor, a semi conductor switch, a diode & a capacitor. It is also called as step-up converter.



Working principle:- The main working