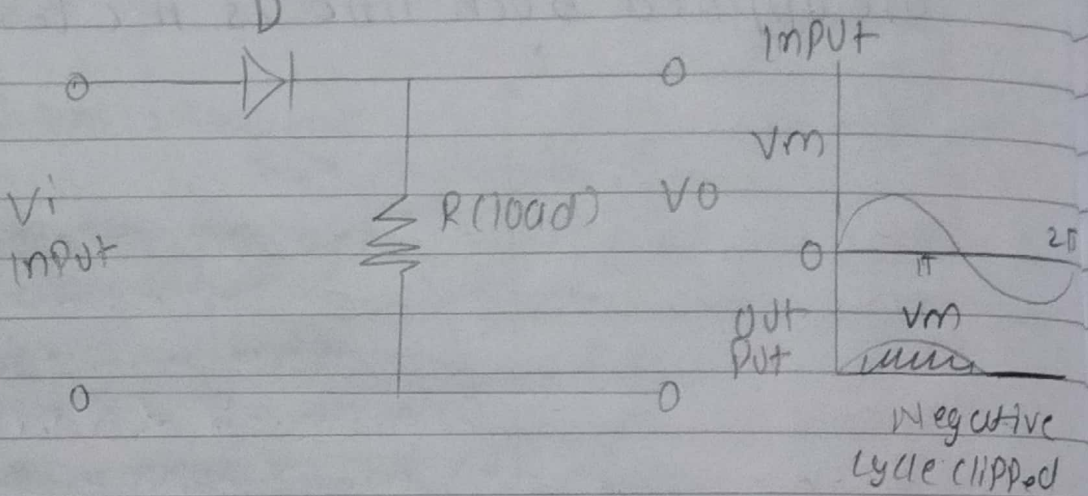
Q.B-2

1) Explain all types of series clipping circuit with necessary diagrams

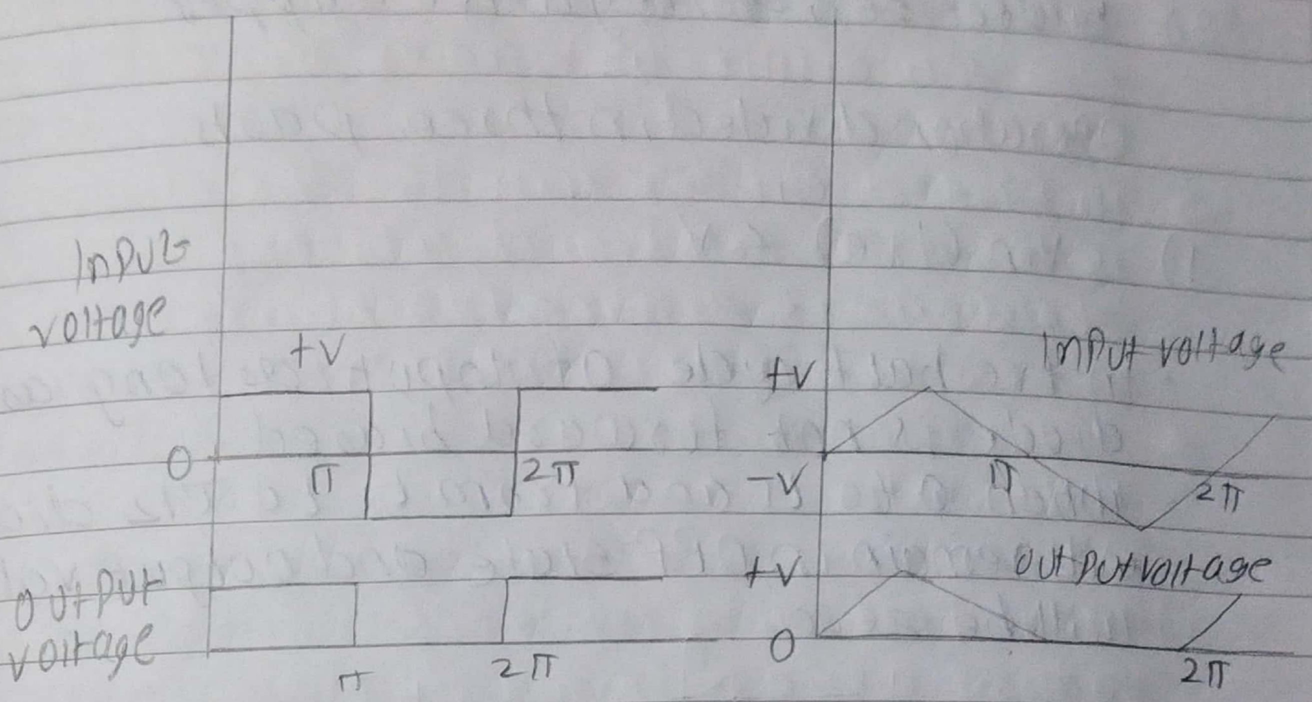
Series clipper circuit

1) Series Negative clipper
- Diode used in this configuration is assumed to be ideal one
- The clipper called as negative clipper as it clips off the negative half cycle of applied voltage



- In Positive half cycle of sinusoidal input, the o/t diode is forward biased. Being an ideal diode it act as closed switch and connects load across input. The load voltage is therefore equal to input voltage in positive half cycle

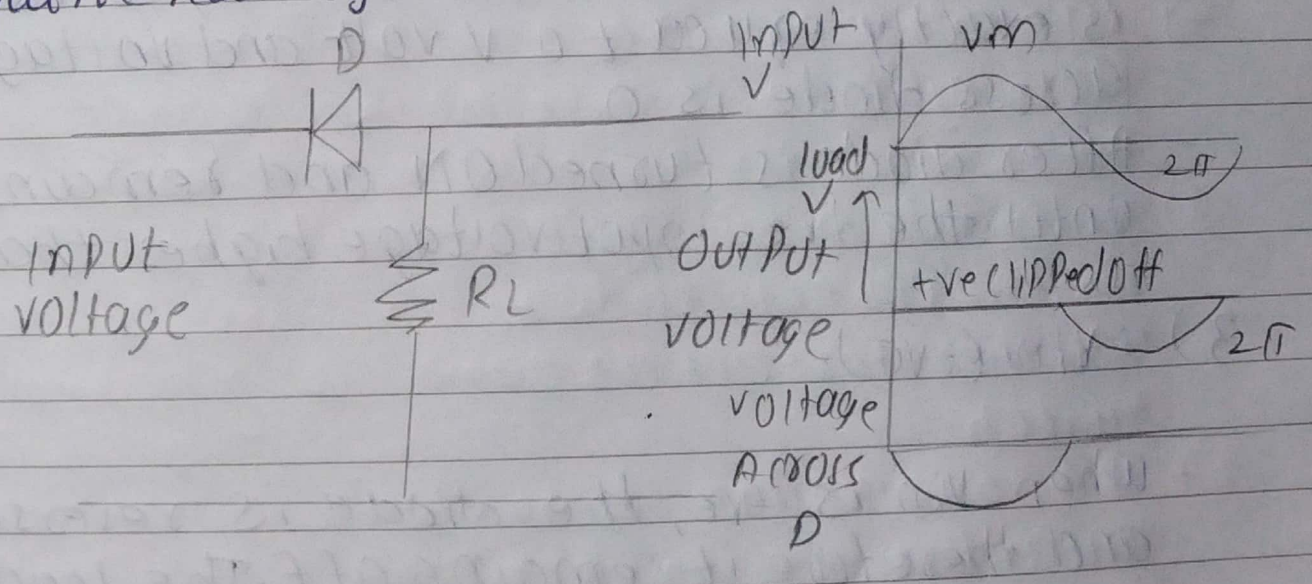
- In negative half cycle of Input, the diode is reverse biased and act as open circuit switch The load voltage is zero during negative half cycle



2) Series positive clipper

By reversing the direction of diode, it is possible to obtain the series positive clipper configuration

- The positive side of each waveform has been clipped off as now diode conducts only in negative half cycles.



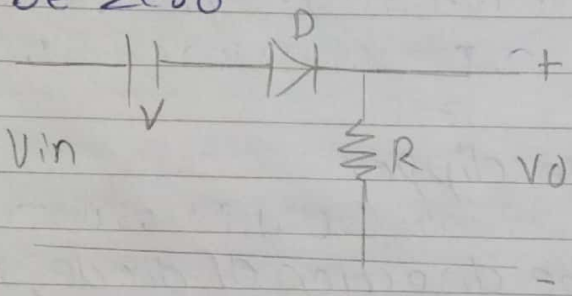
Date __/__/__

3) Biased series Negative clipper

Operation divided in three parts

1) Vin (+ve) < V

- In +ve half cycle of input as long as Vin < V diode is not forward biased
- when 0 to t1 and from t1 to T/2 diode will remain in OFF state and output voltage will be zero

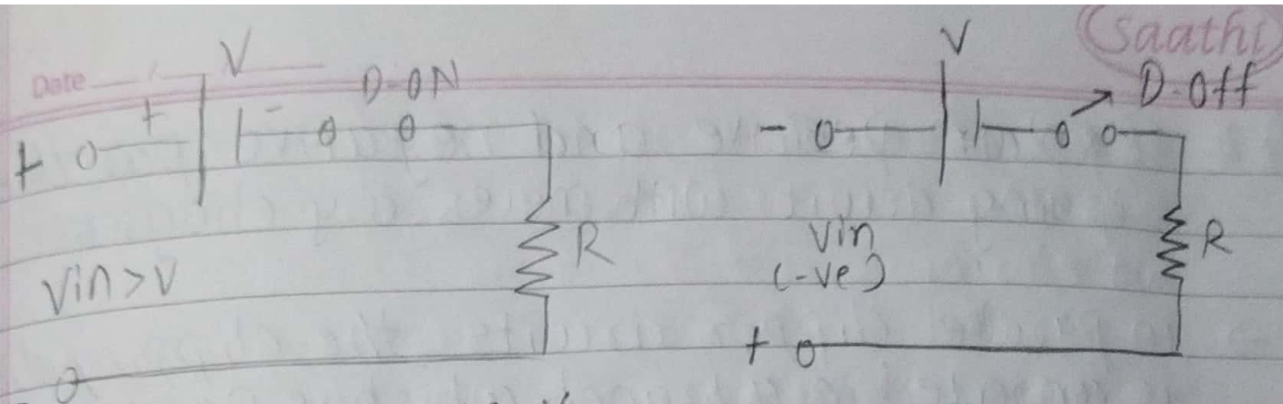


2) Vin (+ve) > V

- At the instant t1 the +ve input voltage is exactly equal to V volt and voltage across diode is 0
- After diode is turned ON and remains ON until the +ve input voltage higher than V

3) Vin (-ve)

- When Vin is -ve, the diode is reverse biased and therefore it remains OFF. The load voltage is zero during entire -ve half cycle



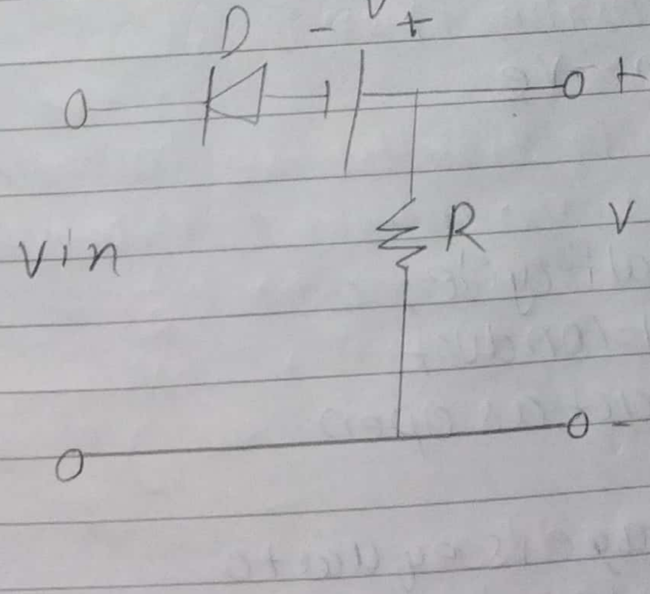
$V_o = V_{in} - V$

4) Biased Series Positive clipper

- The diode will be off and hence equivalent to an open circuited switch in whole +ve half cycle of Input and for a part of negative half cycle of Input.

for $V_{in} < V$, diode will forward Biased

for $V_{in} > V$, diode will remain off and output voltage is 0



Date ___/___/___

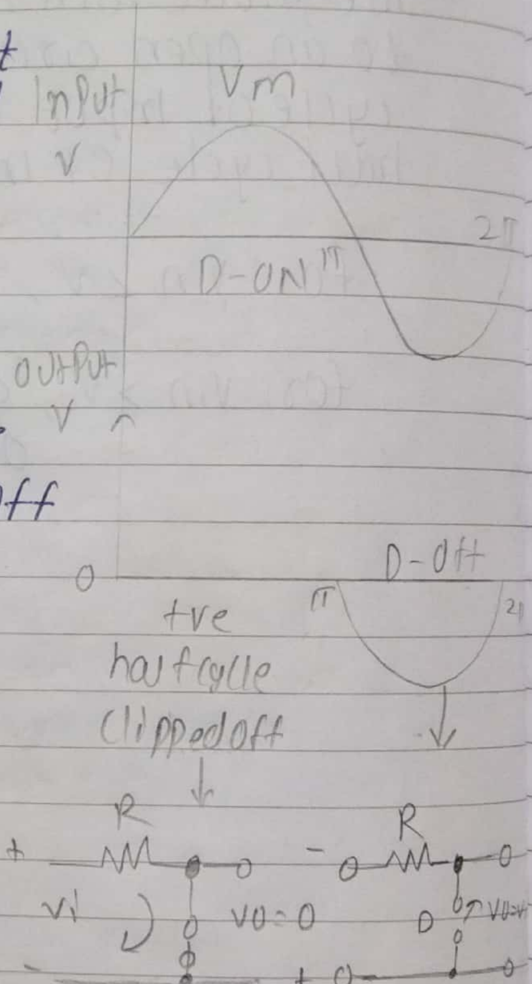
Q.2 Explain positive and negative parallel clipping circuit with necessary diagrams

→ In parallel clipper circuits, the clipping diode is connected in a branch which is parallel to load.
- The diode is assumed to be ideal one.

PARALLEL POSITIVE CLIPPER

⇒ Operation in +ve Half cycle

1) In +ve half cycle of Input voltage Diode is forward Biased and therefore conducts from 0 to π
2) The output voltage will therefore be zero in positive half cycle of Input voltage. The positive half cycle is thus clipped off



⇒ Operation in -ve Half cycle

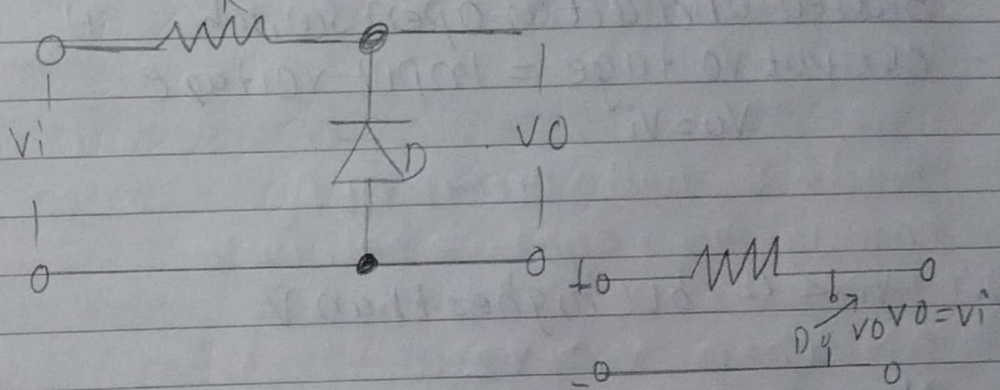
1) In negative half cycle, diode does not conduct and therefore act as open switch
2) The load voltage is equal to instantaneous input voltage. Thus negative half cycle appears across the load
3) As +ve part clipped off it is +ve clipper

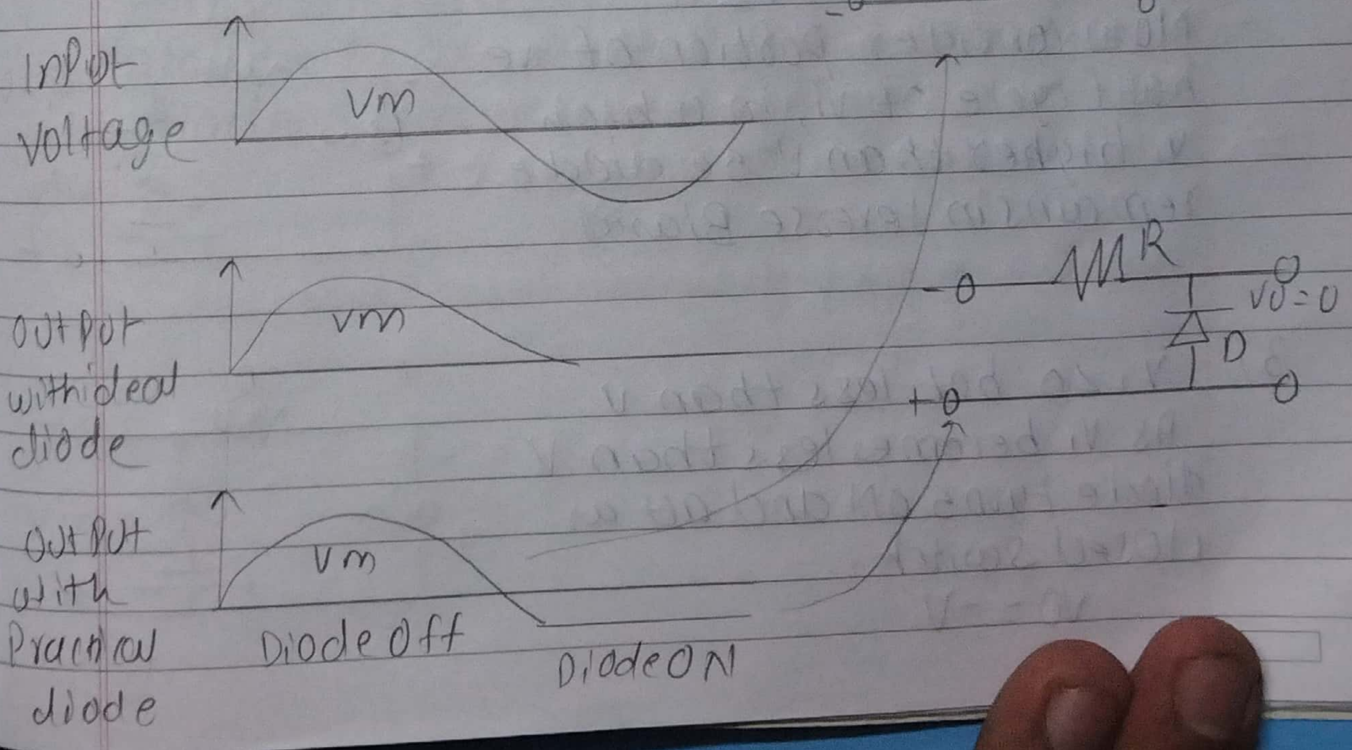
Page No.

- If diode is non Ideal then voltage across conducting diode will be 0.7V instead of 0 V

PARALLEL NEGATIVE CLIPPER

- By reversing the direction of diode in parallel positive clipper we can get negative clipper
- The diode will conduct only in negative half cycle of input to clip it off.

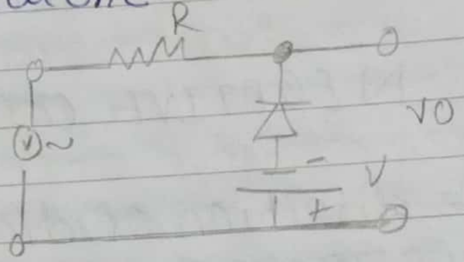




Q.3 Explain Biased positive and negative parallel clipping circuit with necessary waveforms

BIASED NEGATIVE CLIPPER

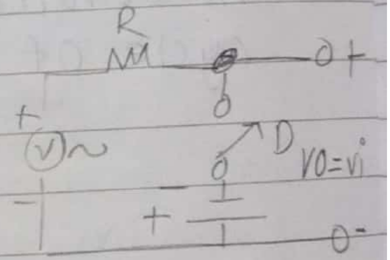
- In Biased negative clipper the dc source is called external bias and diode assumed to be ideal one



1) $V_i > 0$

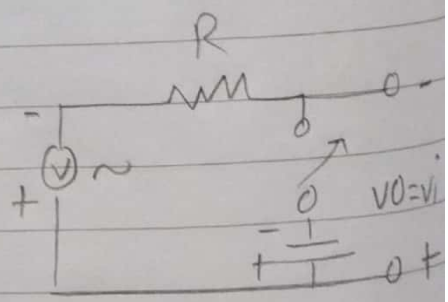
- when $v_i > 0$ Diode is reverse Biased and act as open switch
- output voltage = Input voltage

$V_O = V_i$



2) $V_i < 0$ but higher than V

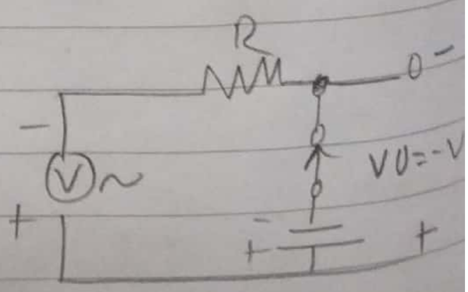
- Now consider portion of -ve half cycle of v_i, in which v_i higher than V so diode remains in reverse Biased



3) $V_i < 0$ but less than V

- As V_i becomes less than V diode turns ON and act as closed switch.

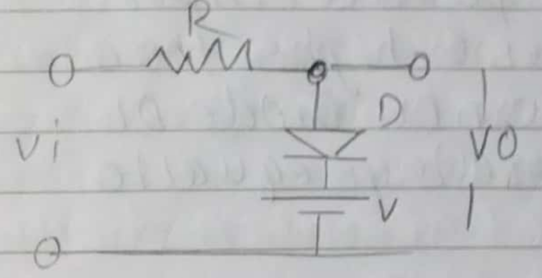
$V_O = -V$



BIASED POSITIVE CLIPPER

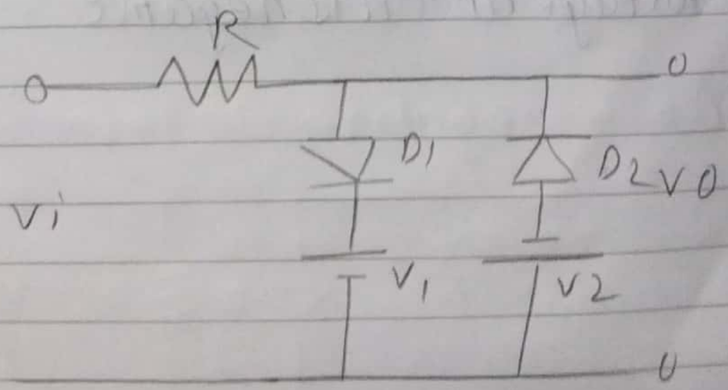
- The diode will conduct only from $t = t_1$ to $t = t_2$ when $v_i \geq V$. When diode is conducting the output voltage equal to V

- for $v_i < V$ diode is reverse biased and turned off so $V_0 = V_i$



Q.4 Explain combination parallel clipping circuit with necessary waveforms

- The two-way parallel clipper circuit to clip both half cycles of input due to presence of Diodes D1 and D2 in opposite direction. Both diode assumed to be ideal one



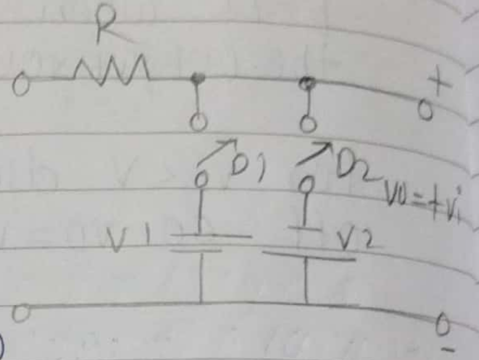
Scanned with CamScanner

Date ___/___/___

Q.5

Operation in +ve
Half cycle

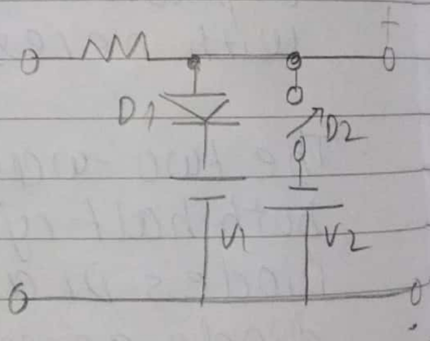
- In positive half cycle $V_i < V_1$, D_1 will reverse Biased whereas D_2 is reverse biased during complete +ve half cycle



- As soon as positive input Voltage becomes higher than V_1 it will turn on Diode D_1 and output voltage equal to V_1

Operation in -ve
Half cycle

- Diode D_1 will remain OFF throughout negative half cycle



- However D_2 will turned ON when $V_i \geq V_2$
- And when D_1 and D_2 both are OFF output voltage equal to Input voltage and it is negative

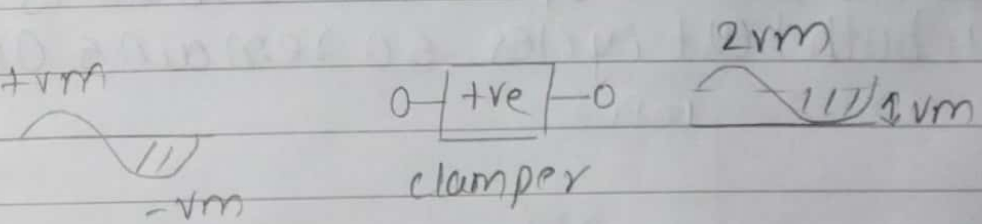
Page No.

5 Explain all types of clamper circuit with necessary waveforms

- Clamper circuits are those circuits that are used to clamp the input signal to different dc level

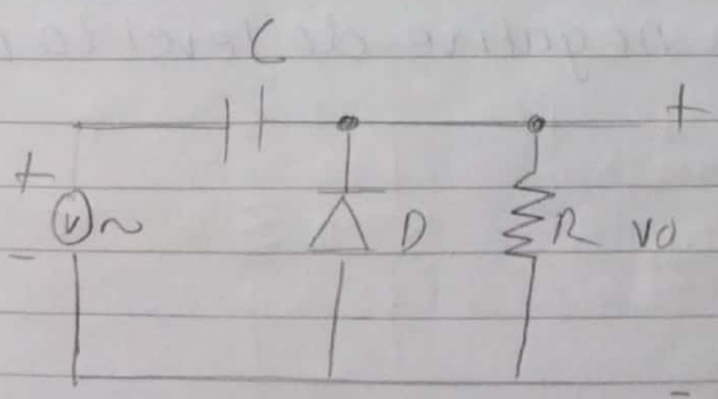
1) Positive clamper

- It adds a positive dc voltage to ac input voltage. AC input is shifted upwards



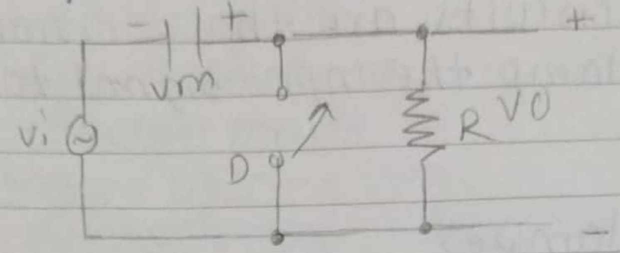
- The clamping network will always consist of three elements: capacitor, diode, Resistor

Some assumptions
- Input is perfect sine waveform
- Diode to be ideal one
- RC > 100T

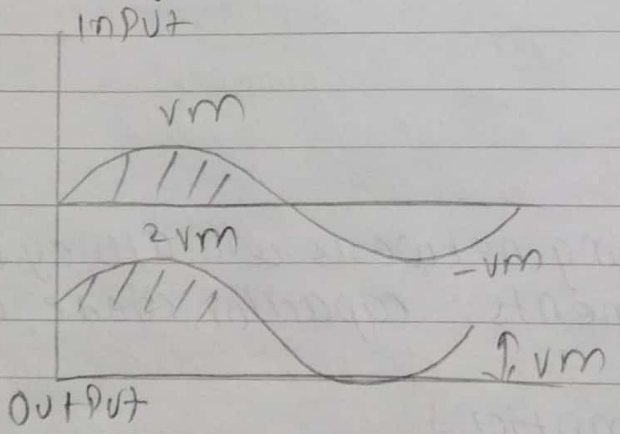


Scanned with CamScanner

- In first negative half cycle after turning on the circuit diode act as close switch and charges capacitor to peak input voltage

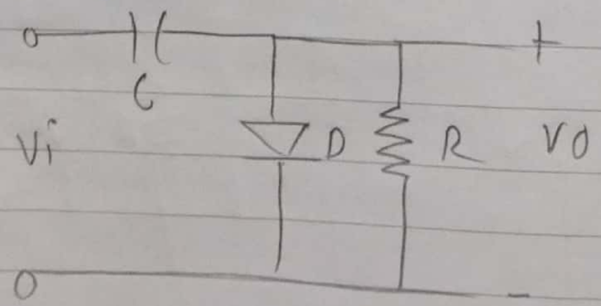


- In all Positive and negative half cycles due to large RC time constant the capacitor does not loose too much charge so vo almost remains constant
- So for rest of operation diode is reverse biased in both half cycles, so remains OFF

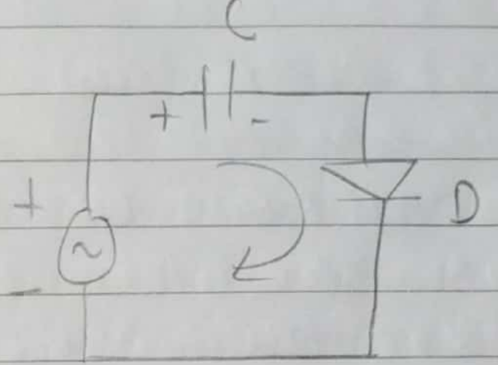


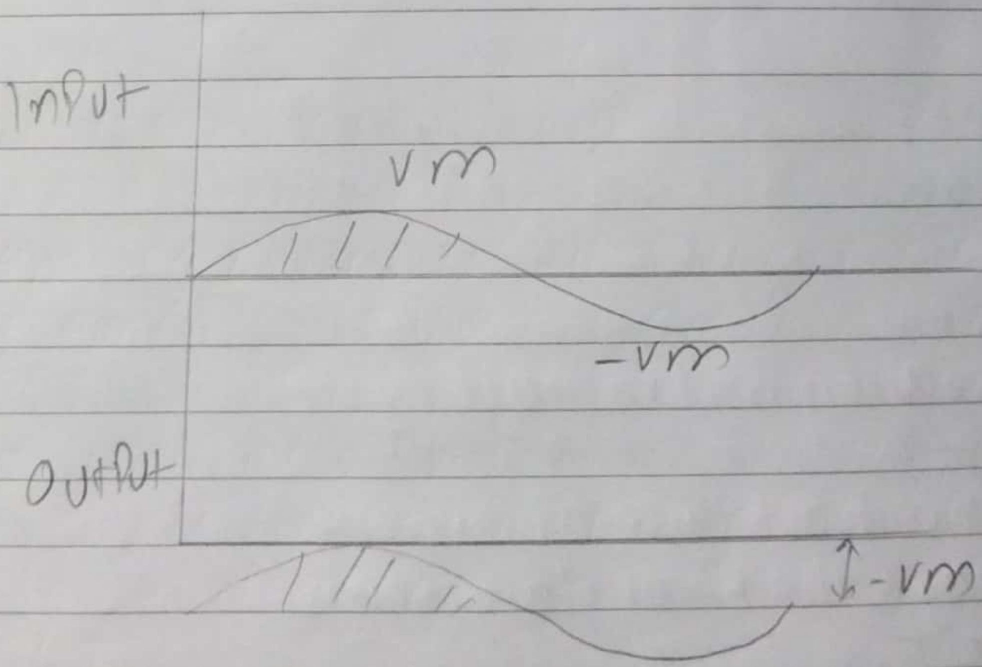
⇒ NEGATIVE CLAMPER

- It adds a negative dc level to input signal



- In first +ve half cycle the capacitor will charge through forward Biased diode to peak voltage
- This charging takes very quickly as diode resistance negligibly small.
- once capacitor charges to vm diode is reverse Bias and stops conducting.

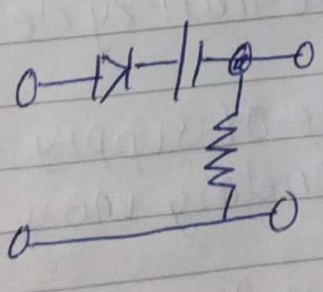
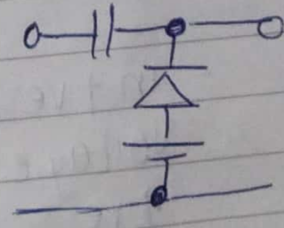




Page No:

Q.6

Q1 Difference clipper and clamper

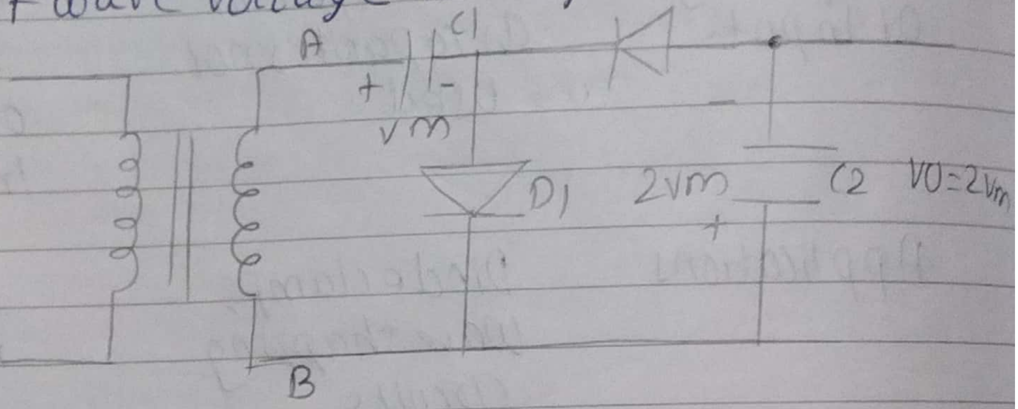
Parameter	Clipper	Clamper
Components used	Diode, Resistors	Diodes, capacitor Resistors
function	To remove a part of Input waveform	To add a dc shift to Input waveform
frequency of Input	Not Important as capacitor not used	The value of C is chosen on basis of Input frequency
Applications	Diode clamp, wave shapping circuits	voltage multipliers
Configuration		

Q.8 Write and explain voltage multipliers

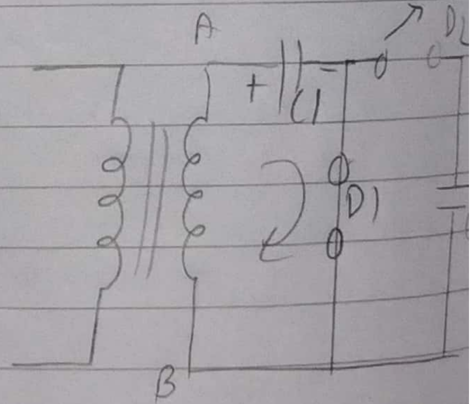
A voltage multiplier is an electrical circuit that converts AC electrical power from lower voltage to higher DC voltage using network of capacitors and diodes

1) Half wave voltage Multipliers

A Half wave circuit consist of clamper and Half wave rectifier. Therefore it is known as half wave voltage multipliers



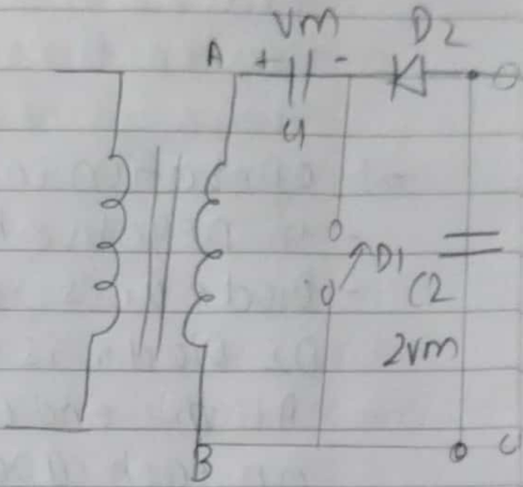
→ operation in +ve half cycle



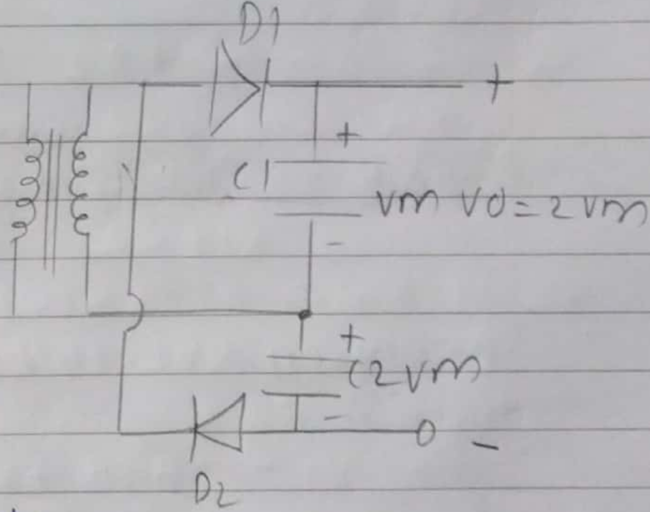
- In +ve half cycle of supply Voltage the secondary VAB is +ve
- This will turn ON Diode D1 and capacitor C1 will charge through it quickly to peak secondary voltage
- Diode D2 remains OFF and Isolates capacitor C2 from C1

⇒ operation in -ve Half cycle

- In negative half cycle the secondary voltage VAB is -ve
- This voltage will turn OFF D1 and turn ON D2 capacitor C2 will acquire voltage of 2vm
- we have assumed C1 is constant voltage during complete -ve half cycle
- In next positive half cycle Diode D2 is non conducting and capacitor C2 will discharge load If no load is connected across capacitor C2 both capacitors will remain charged.



⇒ Full wave Doubler



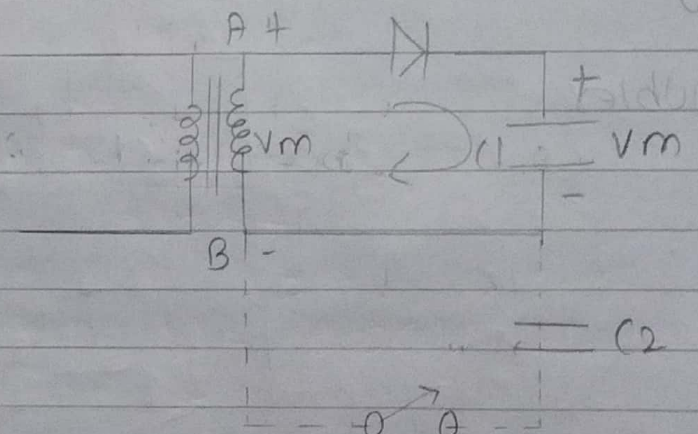
→ Operation in +ve half cycle
- In +ve half cycle VAB is +ve and induced secondary voltage
- This will turn ON D1 and turn Off D2 as it is reverse Bias. The capacitor C1 charges quickly

⇒ operation in negative half cycle

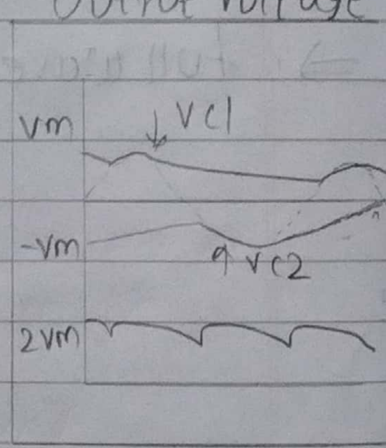
- in negative half cycle of input secondary voltage VAB is -ve
- Diode D_1 is reverse bias and cannot conduct
- D_2 Diode is forward bias and charges capacitor C_2
- At the end of -ve half cycle the voltage on each capacitor is vm.

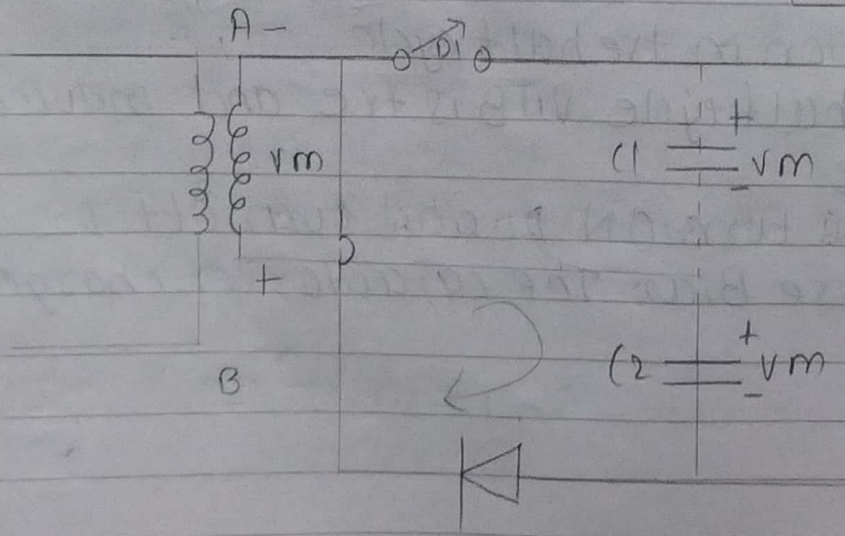
Hence output voltage $v_0 = v_{C1} + v_{C2}$

$$v_0 = 2v_m$$



Output voltage



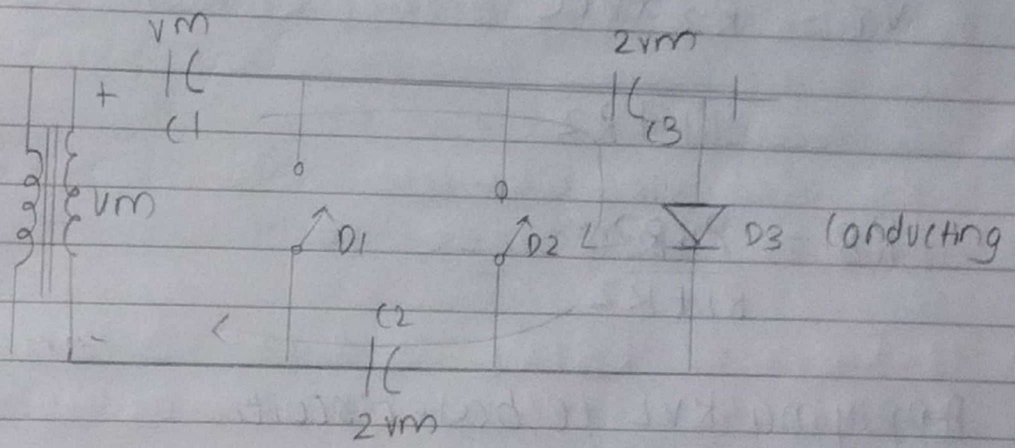


Voltage Tripler and Quadrupler

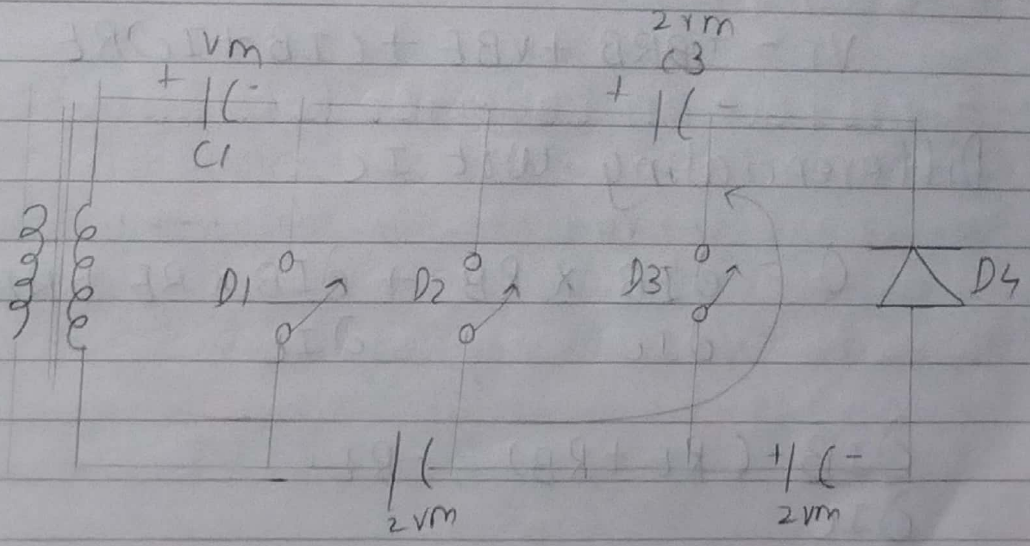
Operation

- In first +ve half cycle of input, capacitor C1 is charged to vm through Diode D1
- In next negative half cycle, the secondary voltage VAB is -ve which turns Diode D2 ON. The Capacitor C2 will charge to 2vm
- In next Positive half cycle, the Diode D3 is ON VAB is +ve. This will charge capacitor C3 to 2vm
- In next negative half cycle, Diode D4 is ON which will charge capacitor C4 to 2vm

Second +ve half cycle



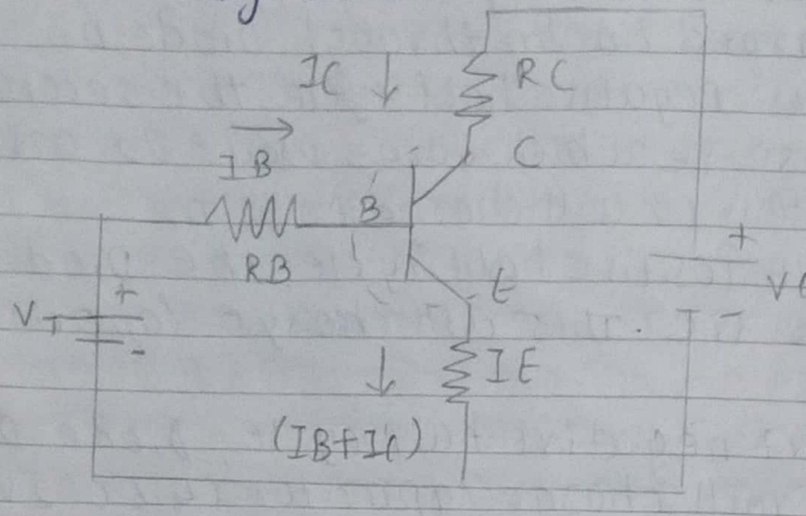
Second -ve half cycle



BJT

~~1) Mention essentials of biasing circuit~~

4. Describe stability factor for voltage divider Biasing circuit



$$V_T = \frac{R_2 \times V_{CC}}{R_1 + R_2}$$

$$R_B = \frac{R_1 R_2}{R_1 + R_2}$$

Applying KVL to base circuit

$$V_T = I_B R_B + V_{BE} + (I_B + I_C) R_E$$

Differenciating wrt I_C

$$0 = \frac{\partial I_B}{\partial I_C} \times R_B + \frac{\partial I_B}{\partial I_C} \times R_E + R_E$$

$$\frac{\partial I_B}{\partial I_C} (R_E + R_B) = -R_E$$

Date __/__/__

$$\frac{\partial I_B}{\partial I_C} = \frac{-R_E}{R_E+R_B} \rightarrow (1)$$

$$\left(S = \frac{1+\beta}{1+(-\beta)\left(\frac{\partial I_B}{\partial I_C}\right)} \right)$$

$$S = \frac{1+\beta}{1+\beta\left(\frac{R_E}{R_E+R_B}\right)}$$

$$S = \frac{(1+\beta)(R_E+R_B)}{R_B+R_E+\beta R_E}$$

$$= \frac{(1+\beta)(R_E+R_B)}{R_B+(1+\beta)R_E}$$

Dividing each term by R_E

$$S = (1+\beta) \cdot \frac{1+R_B/R_E}{(1+\beta)+R_B/R_E}$$

$$= -1+\frac{R_B}{R_E} \qquad \left(1+\beta >> \frac{R_B}{R_E}\right)$$

→ The ratio of R_B/R_E controls value of stability factor S

If $R_B/R_E << 1$

$$S = (1+\beta) \cdot \frac{1}{(1+\beta)} = 1$$

$$= 1+\frac{R_B}{R_E} \qquad \because 1+\beta >> \frac{R_B}{R_E}$$

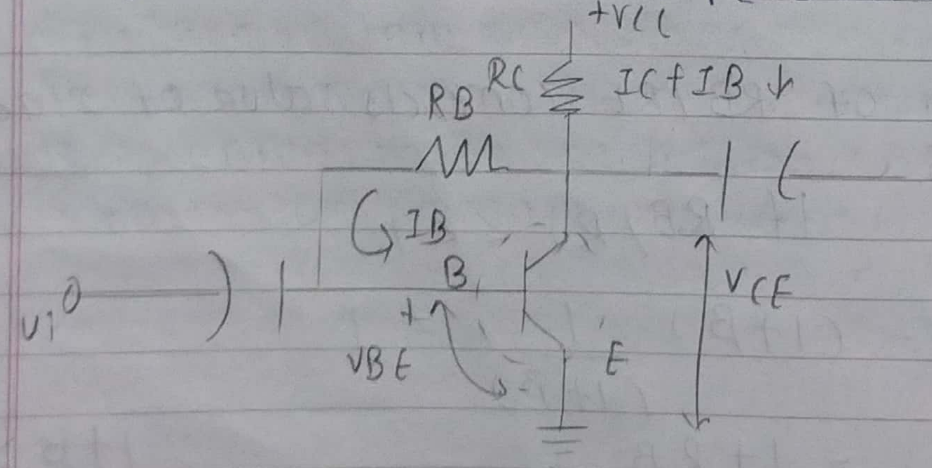
→ To keep the Ratio of RB / RE small, it is necessary to keep RB small. This means $R_1 \| R_2$ must be small. Due to small value of R1 and R2, potential divider circuit will draw more current from Vcc. By reducing RB will reduce input impedance of circuit. This reduction of input impedance in amplifier circuits is not desireable.

→ RE is another parameter we can use to decrease RB / RE. By increasing RE we can make RB / RE small. But as we increase RE drop IERE will also increase and since Vcc not constant drop across RC will reduce

→ S - small
RB - Reasonably small
RE - Not very large

→ If Ratio of RB / RE is fixed, S increases with β. Therefore stability decreases with increasing β

5. Short note on Collector feedback circuit



- It is Improvement in fixed-bias method
- In this biasing resistor is connected b/w collector and base of transistor to provide feedback path

Applying KVL

$$V_{CC} - (I_B + I_C)R_C - I_B R_B - V_{BE} = 0$$

$$V_{CC} = (R_B + R_C) I_B + I_C R_C + V_{BE}$$

$$= (R_B + R_C) I_B + \beta I_B R_C + V_{BE}$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta R_C}$$

→ Collector circuit

Apply KVL

$$V_{CC} - (I_C + I_B) R_C - V_{CE} = 0$$

$$V_{CE} = V_{CC} - (I_C + I_B) R_C$$

- If there is change in β and I_{CO} due to change in temperature then collector current I_C tends to increase. As a result, voltage drop across R_C increases. Since supply voltage V_{CC} is constant due to increase in I_C, R_C, V_{CE} decreases

- In this circuit, RB appears directly across Input and output. A part of output is fed back to input and increase in collector current decreases the base current. Thus negative feedback exist in circuit so circuit is Voltage feedback bias circuit

6. How variation in temperature changes location of Q point on DC load line

→ The junction temperature of transistor dependent on amount of current flowing through transistor

Due to increase in temperature parameters will change

1) VBE
2) βdc
3) ICBO

1) VBE

- The base to emitter voltage decreases at increase in temperature
- The base current IB will increase and it will force IC to change and hence Q point will change position

2) change in current gain β_{dc}

- The current gain β_{dc} of transistor is temperature dependent
- As $I_C = \beta_{dc} I_B$ changes in β_{dc} will change collector current I_C. This will change the position of Q point

3) Change in Reverse saturation current I_{CBO}

- The reverse saturation current of reverse biased CB junction flows due to minority carriers hence depend on temperature

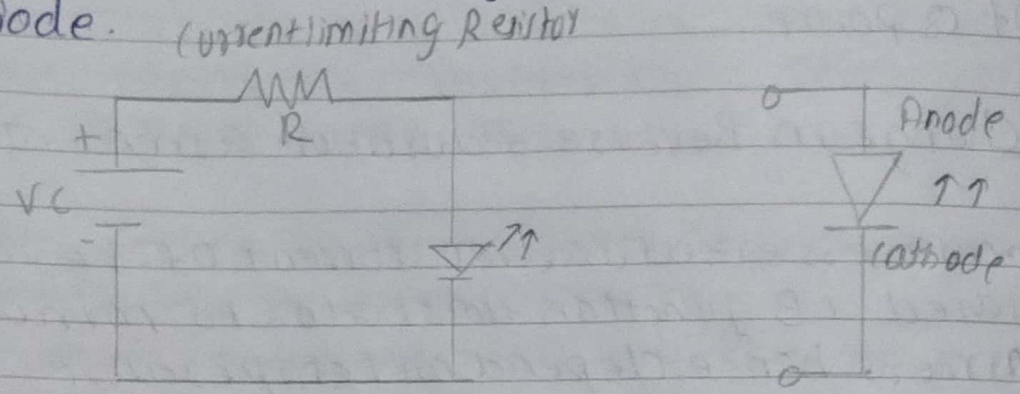
$$I_C = \beta_{dc} I_B + (1 + \beta_{dc}) I_{CBO}$$

Therefore change in I_{CBO} due to temperature will force collector current I_C and hence Q point to change.

Special Purpose Diodes

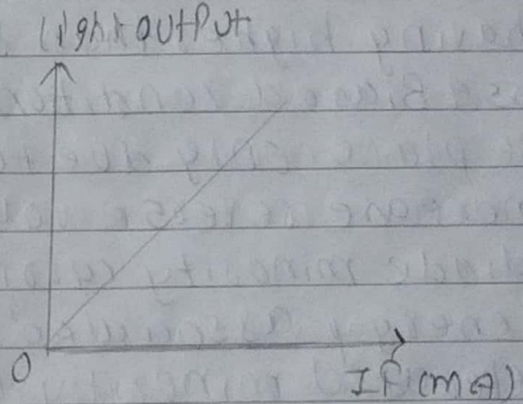
1) Explain LED Diode

- An LED emits when electrical energy is applied to it. It is a two terminal device
- A PN junction is formed b/w anode and cathode so basically called as PN junction diode.



- The active region exists b/w p and n region. The light emerges from active side in all directions when electron-hole pairs recombine
- The disadvantage of this structure is that LED emits light in all directions.
- LED are made of Gallium Arsenide, Gallium phosphide. Silicon and germanium are not used because they are essentially heat producing materials and are very poor in producing light.
- When LED is forward Bias the electrons in n region will cross junction and recombine with holes in p type.
- When the recombination takes place these electrons return back to valence band which is at lower energy level than conduction band.

- while returning back, the recombining electrons give away excess energy in form of light. This process is called electroluminescene. This is principle for operation of LED
- The colour of emitted light decided by its wavelength
- The wavelength of emitted light depends on forbidden gap and it depends on material used
- Various impurities are added during doping process to get precisely required colour of emitted light.



3) What is zener and avalanche breakdown? Compare b/w them

⇒ Zener Breakdown

- Zener Breakdown is observed in zener diodes having Vz less than 5V and 5 to 8V.
- when reverse voltage is applied to zener diode it causes a very intense electric field to appear across narrow depletion region
- This intense electric field is strong enough to pull some of valence electrons into conduction band by breaking their covalent bonds.

- A large no of free electrons will constitute a large reverse current through zener diode and breakdown called zener breakdown
- In zener-breakdown the breakdown voltage depends on temperature of p-n junction Breakdown voltage decreases with increase in junction temperature

⇒ Avalanche Breakdown

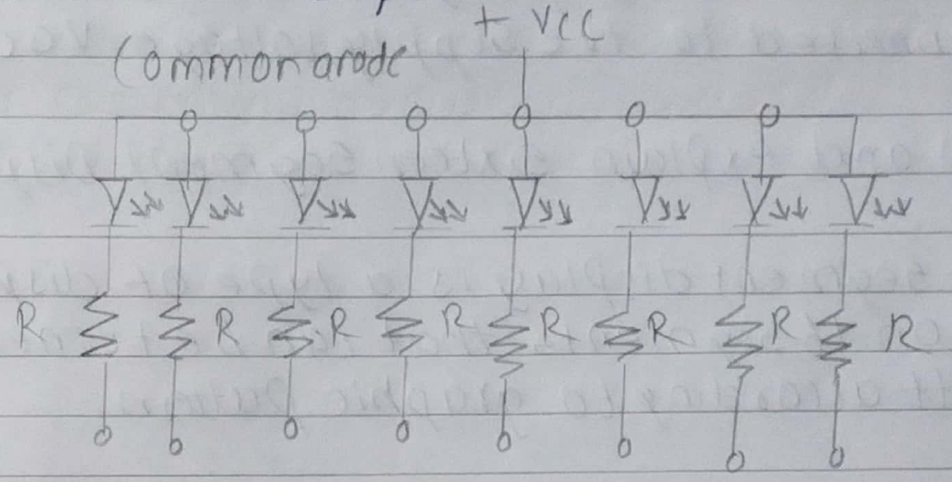
- The avalanche breakdown observed in zener diodes having higher than 8V
- In reverse Biased condition, the conduction will take place only due to minority carriers As we increase reverse voltage applied to zener diode minority carriers tends to accelerate kinetic energy associated with them increase
- The accelerated minority carriers will collide with stationary atoms and impart some of kinetic energy to valence electrons present in covalent bonds.
- Due to this additionally acquired energy, these valence electrons will break covalent bond and jump in to conduction band to become free for conduction
- The newly generated free electrons will get accelerated. This will knock out some more valence electrons by means of collision This phenomenon called as carrier multiplication
- This self sustained multiplication is called Avalanche effect. A large reverse current starts flowing through zener diode and avalanche breakdown occured

Date ___/___/___

4. Draw and explain seven segment display for common cathode and common anode.

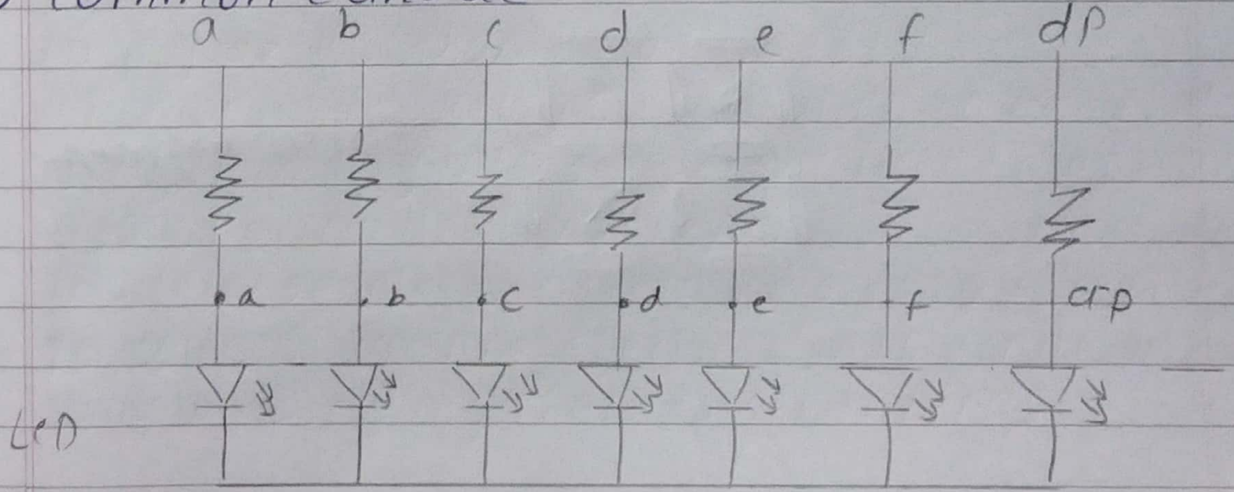
→ Common Anode

- The name suggest the anode terminals of all
- LED segments are connected together to form common anode point



- The common anode point connected to Vcc.
- A current limiting resistor is externally connected in series with cathode terminal of each segment
- The cathodes of segments to be turned ON are connected to ground

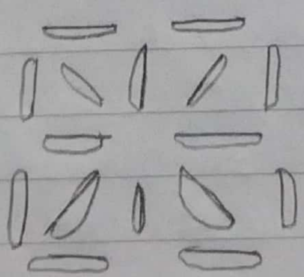
→ Common cathode



- As name suggest, the cathode terminal is made common to form common cathode point and all anode terminals are brought out separately
- A current limiting resistor is externally connected in series with anode terminal of each segment. The common cathode point is connected to ground and anodes of only segment to be illuminated are connected to the supply voltage VCC

5. Draw and explain sixteen segment Display

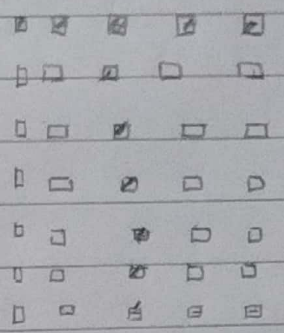
- A 16-segment display is a type of display based on 16 segments that can be turned on and off according to graphic pattern
- It is an extension of more common 7 segment display by adding four diagonal and two vertical segments and by splitting the three horizontal segments into half
- Each of the sixteen segments is an LED in shape of segment



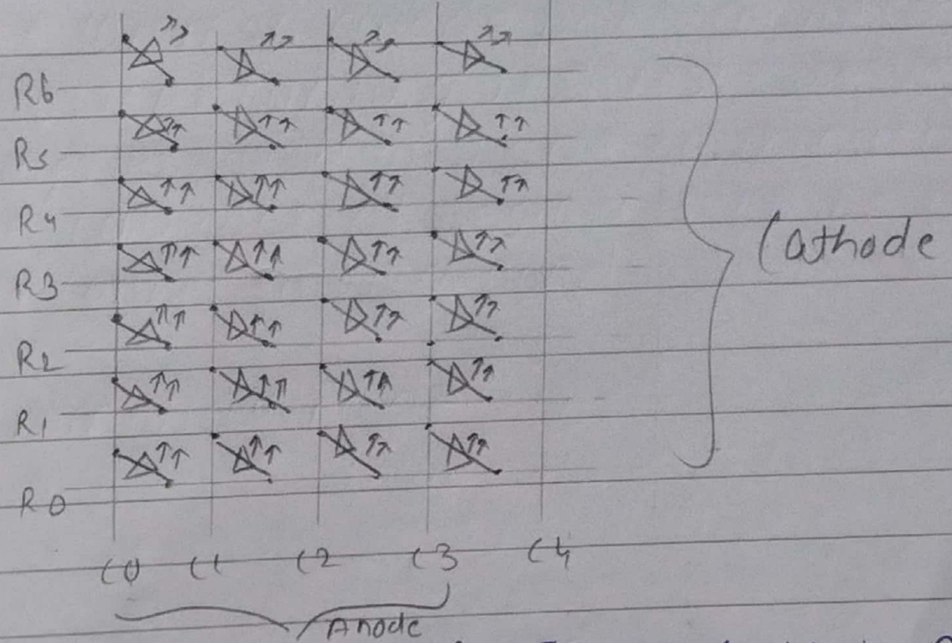
Sixteen Segment

6. Draw and explain Dot Matrix LED display

- The dot matrix displays are used to display numeric and alphanumeric characteristics
- An LED is connected to each dot and according to number or character to be displayed particular dots are illuminated.
- A 3x5 dot matrix is used for displaying the numeric characters and 5x7 dot matrix used for displaying anumeric characters



- Here 5 columns and 7 rows of LED are arranged



- Due to large no of LED used, it is not practical to use a separate driver for each LED
- Techniques like dynamic displays system can used to improve brightness of display.

Date ___/___/___

- In dynamic display systems all required LED are not turned on simultaneously. But they turn on in sequential order fastly
- Due to sequentially illuminating of LEDs current drawn from DC supply reduces and brightness can be improved.

Scanned with CamScanner