Lecture Study Guideline

You need to follow three steps to study

Step 1: Watch the topic related video uploaded on LMS.

Step 2: Read the lecture notes attached.

Step 3: Read the topic from course book.

Topic: collector characteristic curve of transistor

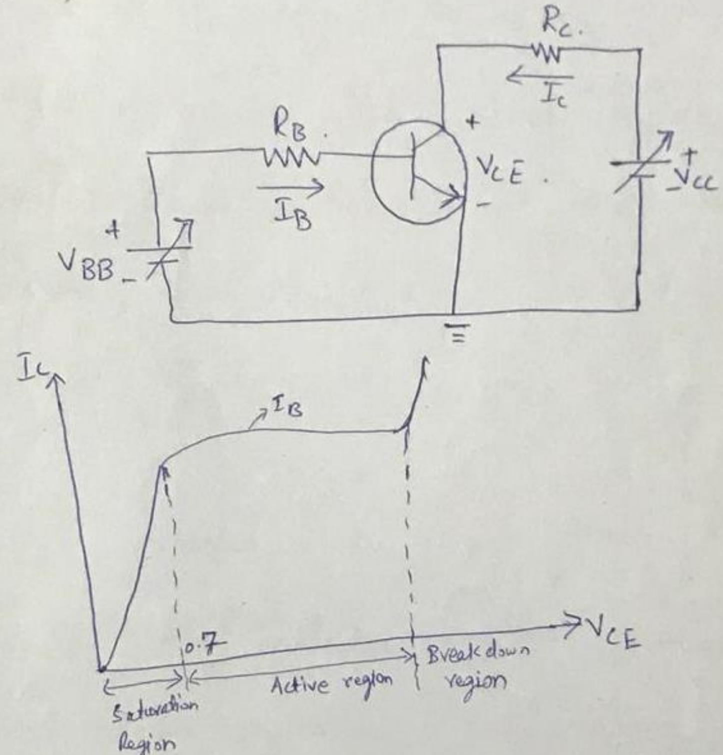
Step 1

Watch the topic related video uploaded on LMS.

Step 2

Collector characteristic Curves :-

These curves show how the collector current I_c varies with collector to emitter voltage (V_{CE}) for specified values of base current (I_B).



i) V_{BB} = certain value I_B = small I_B produces V_{CC} = zero

Base emitter junction (F.B) , Base collector junction (F.B)

Transistor is in saturation region.

V_{CE} is very low . I_C = zero initially and increases rapidly in saturation region

(ii) V_{cc} = increased. V_{CE} increases gradualy.

Base emitter junction (FB), Base collector junction become (R.B) after 0.7V of V_{cc}.

This region is called active or linear region. As Base collector junction become (R.B) then I_c become nearly constant.

$$I_C = \beta_{DC} I_B.$$

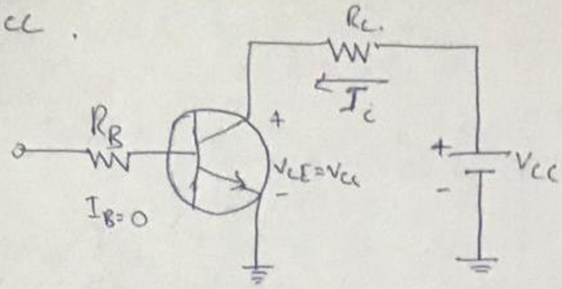
(iii) V_{CE} increased. so high that Reverse biased base collector junction goes into break down region.

Transistor should not be operated into break down region. I_C become so high.

Cuttoff region :-

When $I_B = 0$ transistor is in cuttoff region.

$V_{CE} = V_{CC}$.

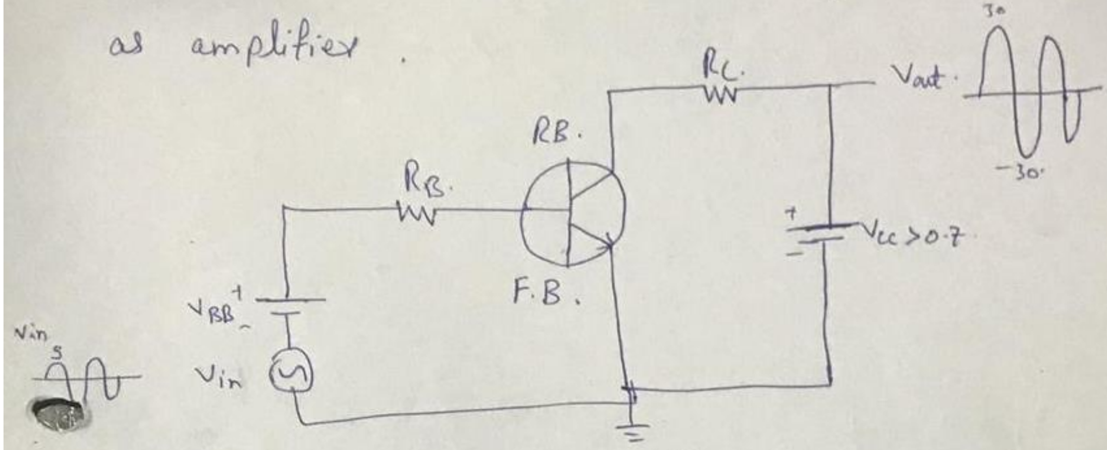


I_c is very small

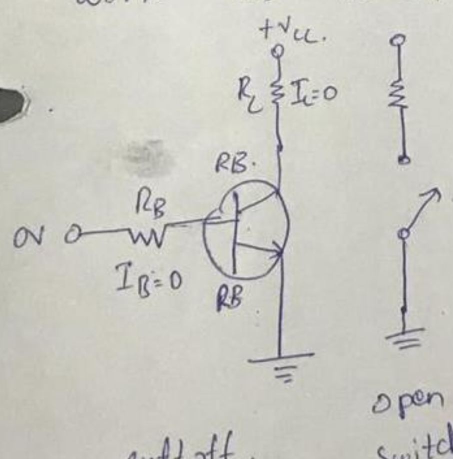
Both base-emitter and base collector junctions are reverse biased.

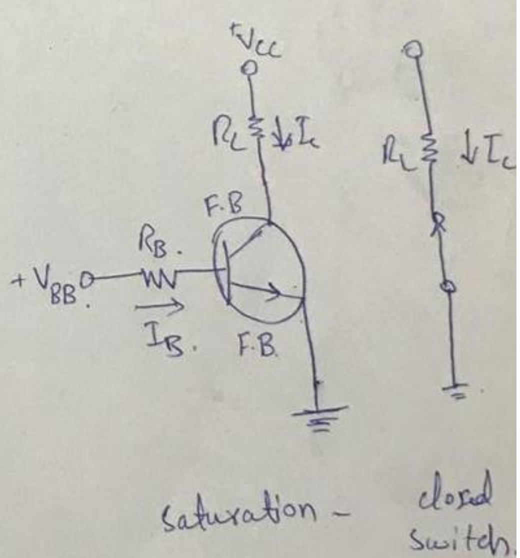
	Base emitter Junction	Base collector Junction
Saturation Region	Forward biased V_{BB} has some value.	Forward biased. $V_{CC} < 0.7$.
Active Region	Forward biased V_{BB} has some value.	Reverse biased $V_{CC} > 0.7V$.
Cuttoff	Reverse biased $V_{BB} = 0$.	Reverse biased V_{CC}.

Transistor is biased into active region to work as amplifier.



Transistor is biased into cutt off or saturation region to work as switch.





Step3: Read topic 4.3 from text book (Thomas L Floyd 7th edition)

Topic: Q-point of transistor

Step 1

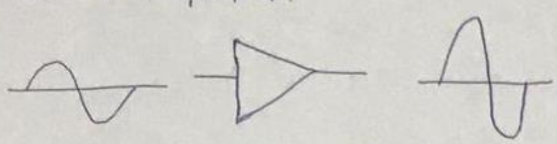
Watch the topic related video uploaded on LMS.

Step 2

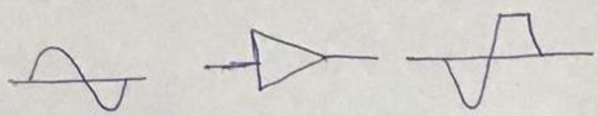
Transistor bias circuits. (CH #5)

Amplifier symbol 

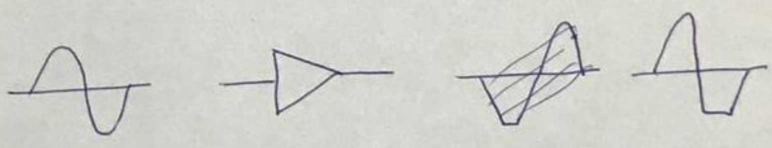
Transistor as amplifier:



(a) Linear operation.



(b) cutoff region (output voltage clipped)

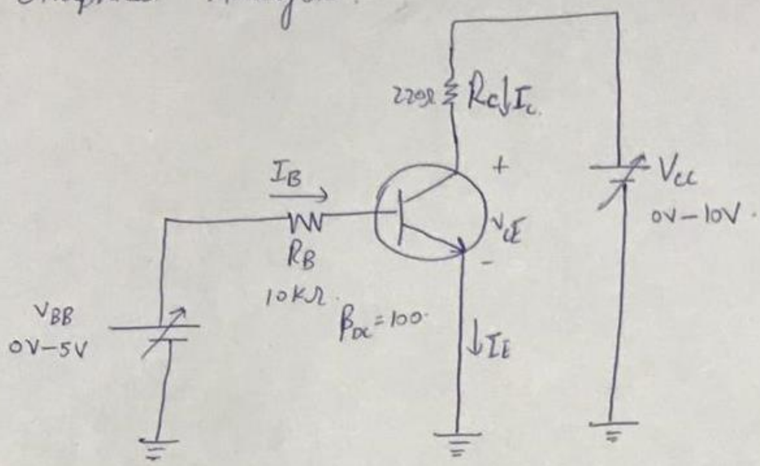


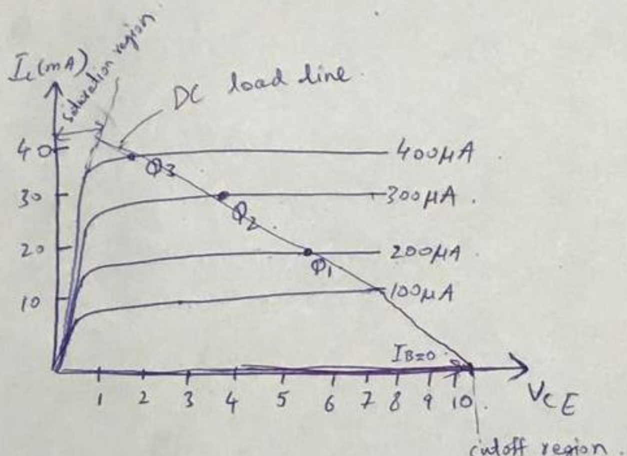
(c) Saturation region (output voltage clipped)

Case (b) and (c) is because of improper biasing.

To overcome this problem we chose Q point.

Graphical Analysis :-





$$I_B = \frac{V_{BB} - V_{BE}}{R_B}$$

$I_B = 200\mu A$. $\quad I_C = \beta_{DC} I_B = 100 \times 200\mu A = 20mA$.

$$V_{CE} = V_{CC} - I_C R_C = 10 - (20mA)(220) = 10 - 4.4$$

Q_1 $\quad \boxed{V_{CE} = 5.6V}$ $\quad \boxed{I_C = 20mA}$

$I_B = 300\mu A \quad I_C = 30mA \quad V_{CE} = 3.4V, \; Q_2$

$I_B = 400\mu A \quad I_C = 40mA. \quad V_{CE} = 1.2V. \; Q_3.$

As I_B increase, I_C increase, V_{CE} derease

I_B decrease, I_C decrease, V_{CE} increase.

By changing V_{BB} we will change I_B and our Q point will move on dc load line.

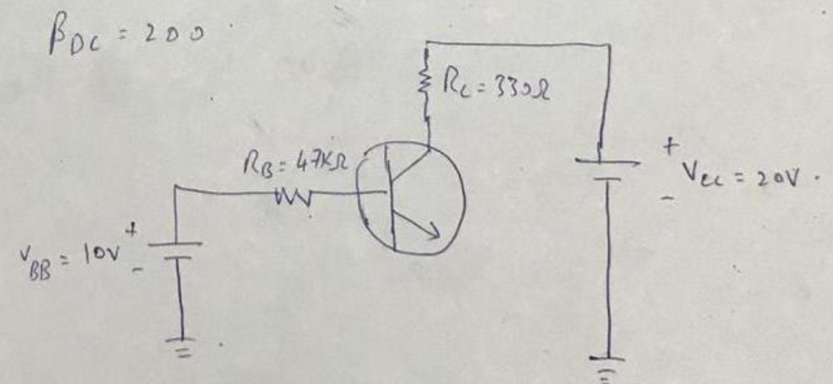
Linear operation :-

we will chose Q point between saturation region and cutoff region on the DC load line.

Example:

Determine the Q point of the circuit?

$\beta_{DC} = 200$



Linear region: 1(c)

$$I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{10V - 0.7V}{47k\Omega} = 198\mu A$$

$$I_C = \beta_{DC} I_B = (200)(198\mu A) = 39.6mA$$

$$V_{CE} = V_{CC} - I_C R_C = 20V - 13.07V = 6.93V$$

Q - point $I_C = 39.6\,mA$ at $V_{CE} = 6.93V$

cutt off :

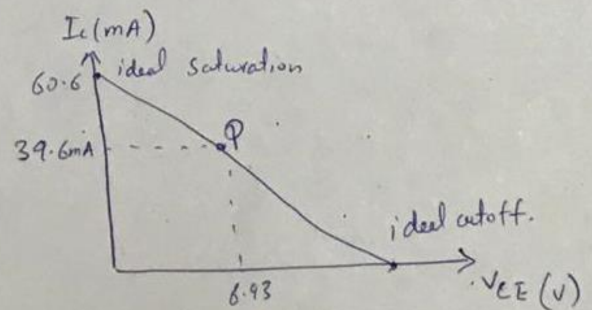
$I_B = 0$, $I_{C(cutoff)} = 0$. $I_C = \beta_{DC} I_B$

$V_{CE} = V_{CC}$ (ideal)

Saturation region :

$V_{CE} = V_{CC} - I_{C(sat)} R_C$. $V_{CE} = 0$ (ideal)

$$I_C = \frac{V_{CC}}{R_C} = \frac{20V}{330} = 60.6mA$$



Step3: Read topic 5.1 from text book (Thomas L Floyd 7th edition)