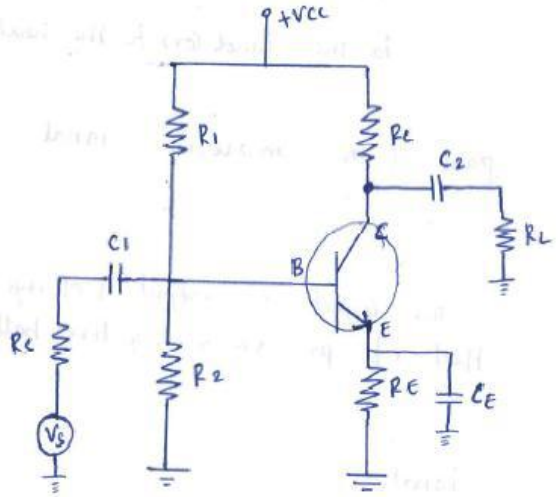
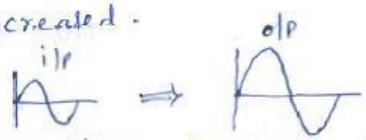
Topic 2.4 : Single stage amplifiers-Common Emitter amplifier

Common Emitter Amplifier



* Amplifier is used to increase the signal level ie the amplifier is used to get a large signal output from a small signal input.

* For Ex: We give sin wave as input We get the same sin wave output. The frequency is not change but Amplitude increased.



* To make the transistor as an amplifier, it's to be biased to operate in active region ie the Base-Emitter junction is forward bias and Base-collector junction is Reverse biased.

1. Biasing circuit

* Resistance R_1, R_2 & R_E forms the voltage divider bias circuit for the CE amplifier.
* It sets the proper operating point for the CE amplifier.

2. Input capacitor C_1

* This capacitor couples the signal to the base of the transistor.
* It blocks any dc component present in the signal & passes only ac signals for amplification.
* Because of this biasing conditions are maintained constant.

3. Emitter Bypass Capacitor C_E

* C_E is connected in parallel with the R_E to provide a low resistance path to the amplified ac signal.
* If's not inserted, the amplified ac signal passing through R_E will cause a voltage drop across it.
* This will reduce the output voltage, reducing the gain of the amplifier.

4. Output Coupling Capacitor C_2

* C_2 couples the output of the amplifier to the load (or) to the next stage of the amplifier.
* It blocks dc & passes only ac part of the amplifier signal.

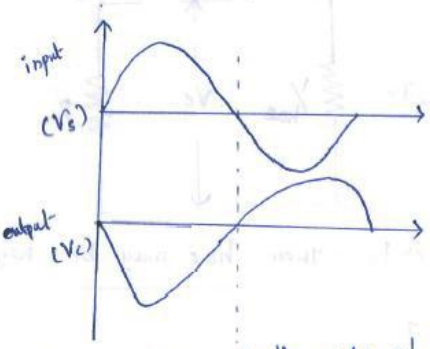
5. Phase Reversal

* The phase relationship between the input & output voltages can be determined by considering the effect of positive & negative half cycle separately.

Consider positive half cycle of input signal :

* In which terminal 'A' is positive w.r.to 'B'.
* Due to this 2 voltages, ac (V_c) & dc (V_{cc}) will be adding each other, increased forward bias on the Base-Emitter junction.
* This will increase the base current I_B.
* The I_c is β times the I_B ie $I_c = \beta I_B$ hence the I_c will also increases.
* This will increase the voltage drop across R_c.
* Since $V_c = V_{cc} - I_c R_c$, the increase in I_c results in a drop in V_c, as V_{cc} is constant.

* Thus, as V_i increases in a positive direction. V_o goes in a negative direction & we get negative half cycle of output voltage for positive half cycle of the input.



Consider negative half cycle of input signal:

* In which terminal 'A' is negative w.r.to 'B'
* Due to this 2 voltages V_c & dc will be opposing to each other, decreased forward bias on the Base-Emitter junction.
* This will decrease the base current I_B.
* The I_c decreases & the voltage drop across R_c decreases, increase the output voltage.
* Thus as we get positive halfs cycle at the output for the negative half cycle of the input.
* ∴ We can say that there is a phase shift of 180° between input & output voltages for a CE amplifier.