

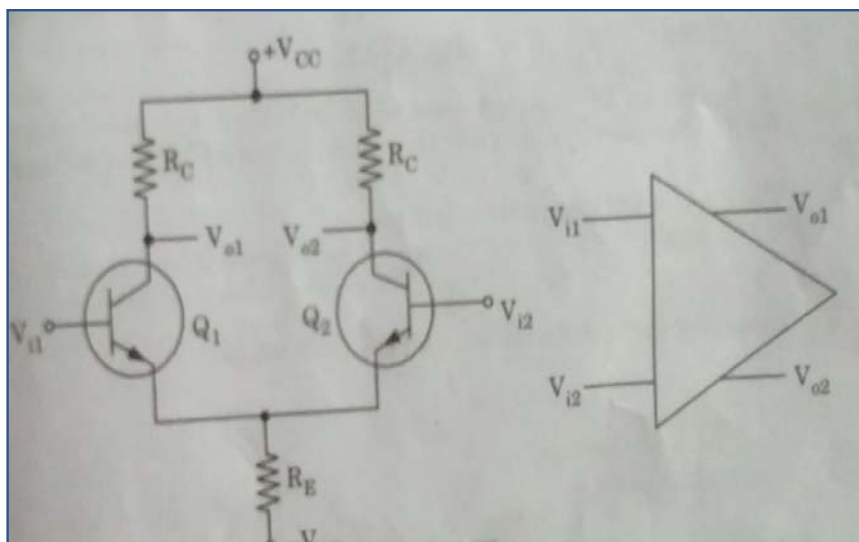
# UNIT-4 >>CURRENT MIRROR AND OP-AMP DESIGN

## SUBJECT-ANALOG CIRCUIT

### LECTURE-2>>DIFFERENTIAL AMPLIFIER

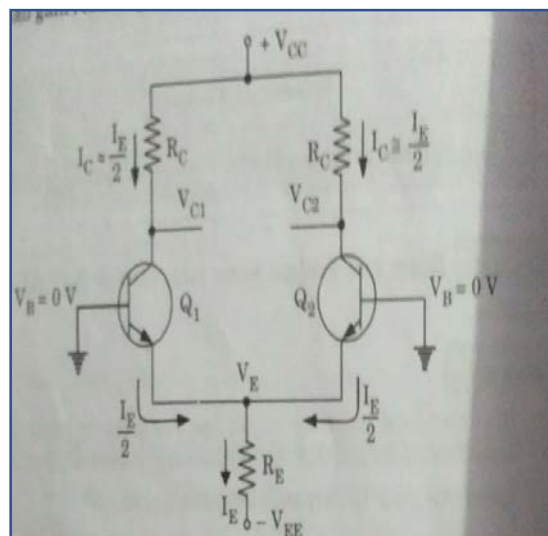
#### STRUCTURE OF BJT DIFFERENTIAL AMPLIFIER: -

- 1- The differential amplifier circuit has two separate inputs and two separate outputs and that the emitters are connected together.
- 2- It also consists of two separate voltage supplies.



- 3- In differential amplifier circuit, the input signal operates both transistors in single-ended operation due to the common emitter connection, resulting in output from both collectors.
- 4- In double-ended operation, the difference of the inputs resulting in outputs from both collectors due to the difference of the signals applied to both inputs.
- 5- In common-mode operation, the common input signal results in opposite signals at each collector, these signals cancel each other so that the resulting output signal is zero.

6- The main feature of the differential amplifier is the very large gain when opposite signals is applied to the inputs as compared to the very small gain resulting from common inputs.



7- Let's consider DC bias operation of  
With each base voltage at 0 V,  
the common emitter DC bias  
voltage is

$$V_E = 0 V - V_{BE} = 0.7 V$$

8- The emitter DC bias current is then,

$$I_{C1} = (V_E - (-V_{EE})/R_E = V_{EE} - 0.7 V / R_E$$

9- Assuming the transistors are well matched, we get

$$I_{C1} = I_{C2} = I_E/2$$

∴ Collector voltage,

$$V_{C1} = V_{C2} = V_{CC} - I_C R_C = V_C - I_E/2 R_C$$