

Chapter 9

Stronger signals longer time period

9.1] Faithful Amplification:

The process of raising the strength of a signal without any change in its general shape is known as "FAITHFUL AMPLIFICATION"

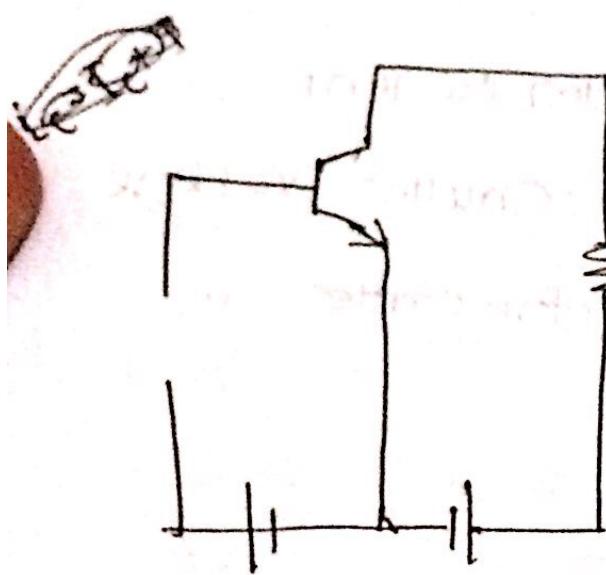
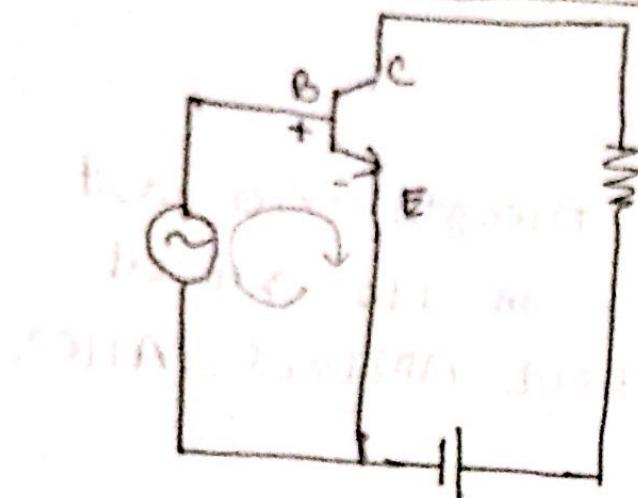
~~Condition must be satisfied:~~

- ① Proper zero signal collector current
- ② Minimum proper base-emitter voltage
- ③ collector-emitter u_c .

$$i_C = I_C + i_c$$

↓
B.C. AC B.C.

① Proper zero signal collector

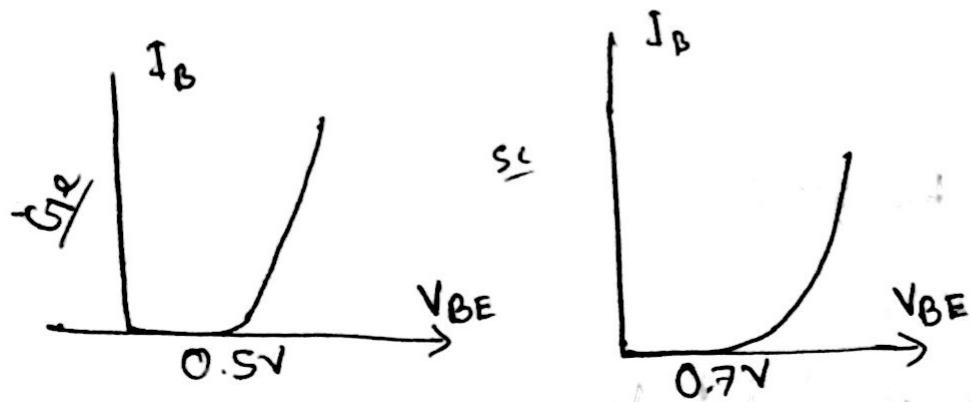


$$\boxed{i_C = I_C + i_c}$$

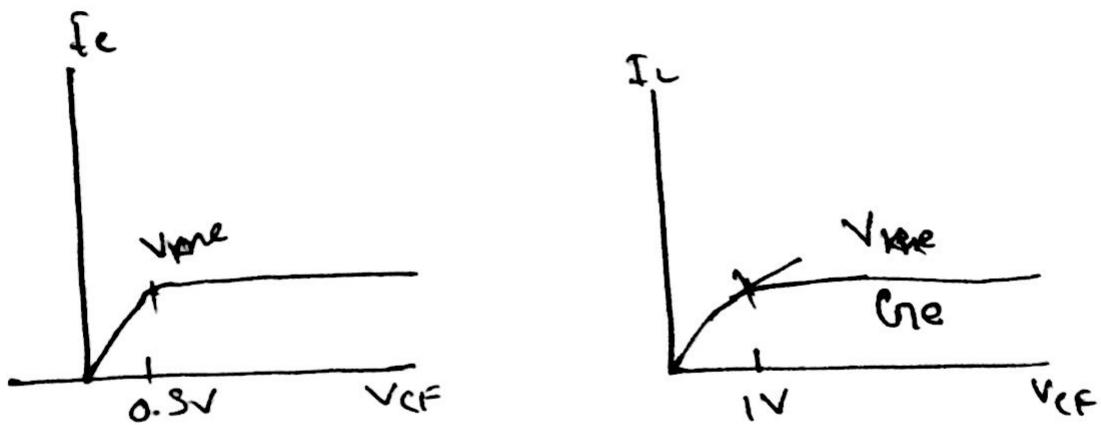
1.5

5

ii) Proper minimum V_{BE}



iii) Proper Minimum V_{CE}



9.2 | Biasing def.

9.7 | Method of Biasing

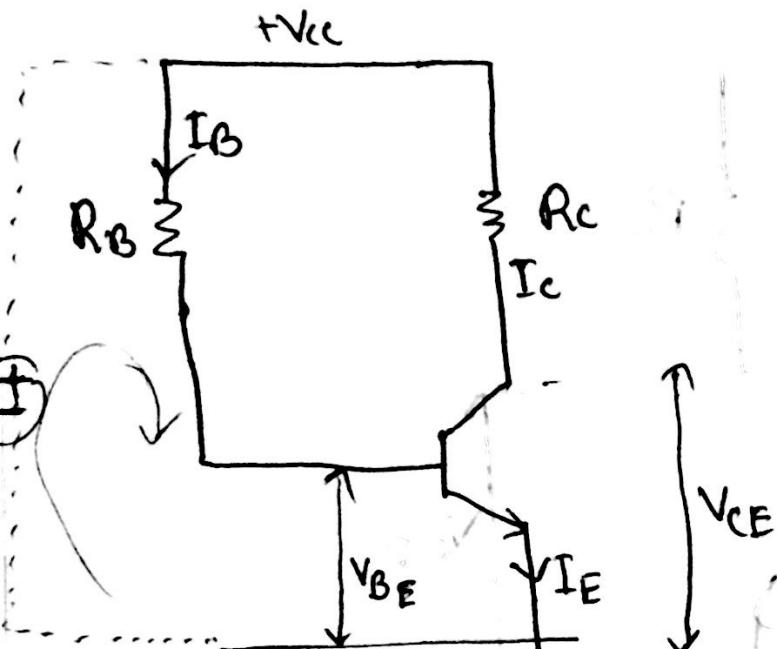
① Base Resistor

④ ~~voltage~~ 1

⑥ voltage divider bias

9.8]

Bare Resistor Method



Circuit Analysis

$$I_B = \frac{I_C}{\beta}$$

Applying KVL,

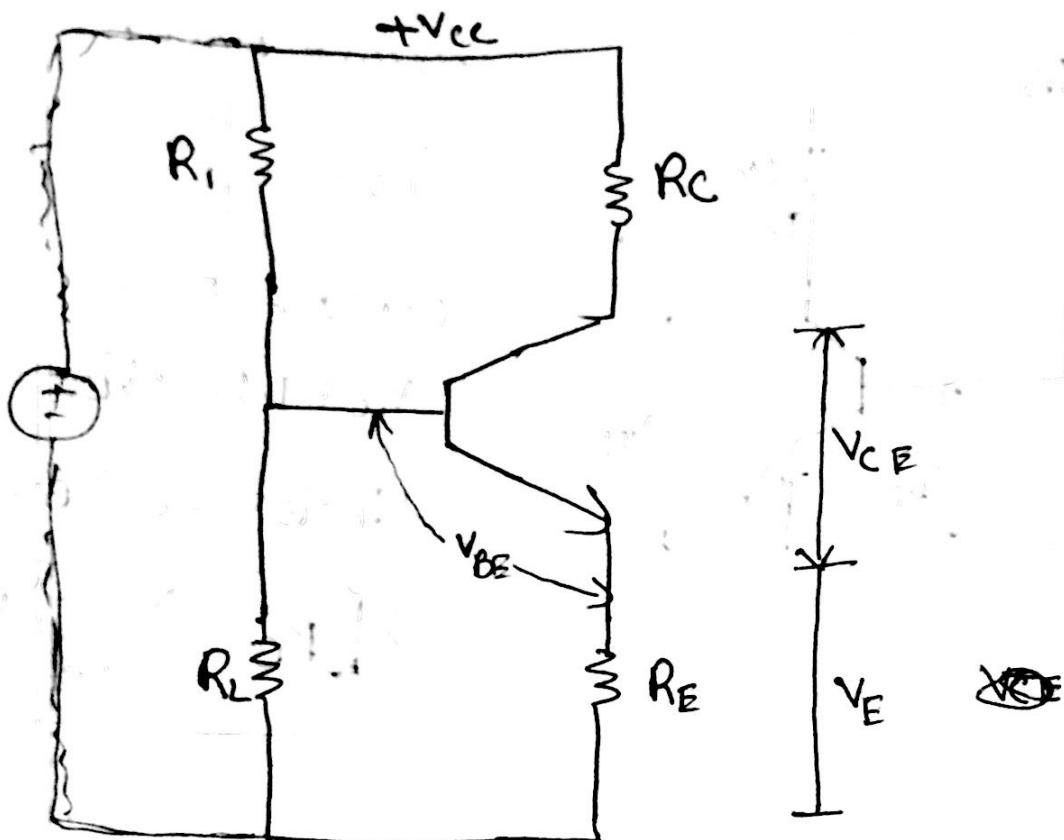
$$-V_{CC} + I_B R_B + V_{BE} = 0$$

$$\Rightarrow I_B R_B = V_{CC} - V_{BE}$$

$$\Rightarrow R_B = \frac{V_{CC} - V_{BE}}{I_B}$$

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

9.12 | (1) voltage divider bias \Rightarrow 9.12



Circuit Analysis

$$I_1 = \frac{V_{CC}}{R_1 + R_2}$$

$$V_2 = \left(\frac{V_{CC}}{R_1 + R_2} \right) \times R_2$$

Now, Applying KVL, $V_2 - V_B + V_E = 0$

$$-V_2 + V_{BE} + V_E = 0$$

$$\Rightarrow V_2 = V_{BE} + V_E \quad [V_E = I_E R_E]$$

$$\Rightarrow I_E = \frac{V_2 - V_{BE}}{R_E}$$

$$\Rightarrow I_E \approx I_C$$

$$I_C = \boxed{\frac{V_2 - V_{BE}}{R_F}}$$

V_{CE}

Apply KVL

$$-V_{CC} + I_C R_C + V_E + I_E R_E = 0$$

$$\Rightarrow V_{CC} = I_C R_C + V_{CE} + I_E R_E$$

$$= V_{CE} + I_C (R_C + R_E)$$

$$\Rightarrow V_{CC} = V_{CE} + I_C (R_C + R_E)$$

$$\Rightarrow V_{CE} = V_{CC} - I_C (R_C + R_E)$$

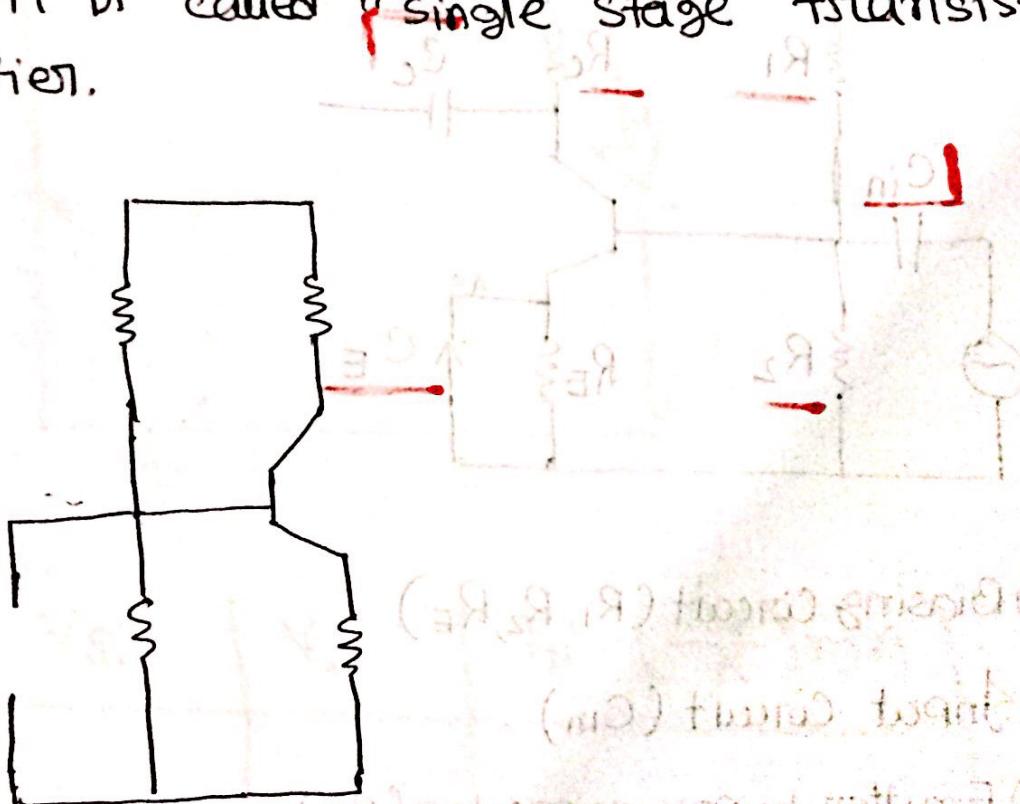
2nd class
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Chapter 10

10.1

Single Stage Transistor Amp:

When only one transistor is used with associated circuitry to amplify a weak signal, it is called ~~a single stage transistor~~ ^{single stage} ~~amplifier~~ ^{Amplifier}.



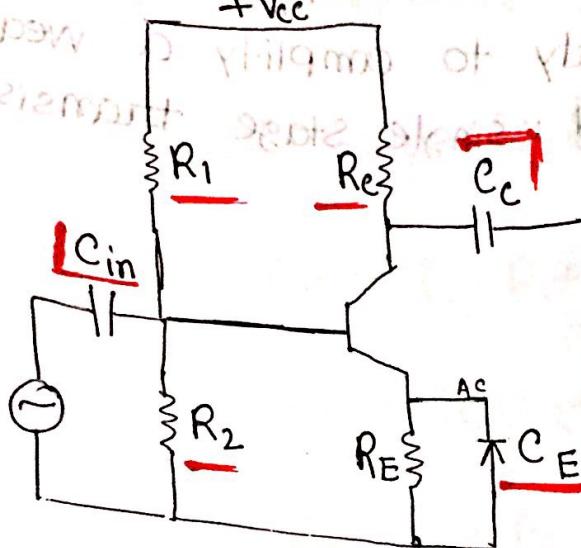
① Emitter circuit (R_E)

② Input circuit (C_{BE})

③ Emitter bypassed collector (E)

④ Output circuit (C_O)

10.4 | Partical Circuit:

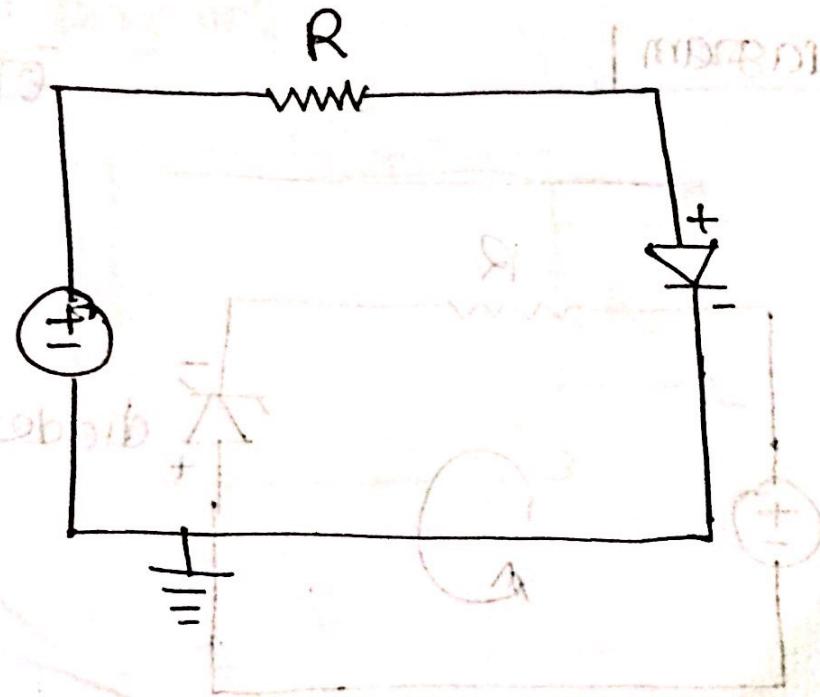


- ① Biasing Circuit (R_1, R_2, R_E)
- ② Input Circuit (C_{in})
- ③ Emitter bypass capacitor (C_E)
- ④ Coupling capacitor (C_c)

$$mA \rightarrow \text{vol}^{\prime\prime} \frac{mA}{1000}$$

Exp|2| Electronic Device

Exp|2| I-V characteristics of diode



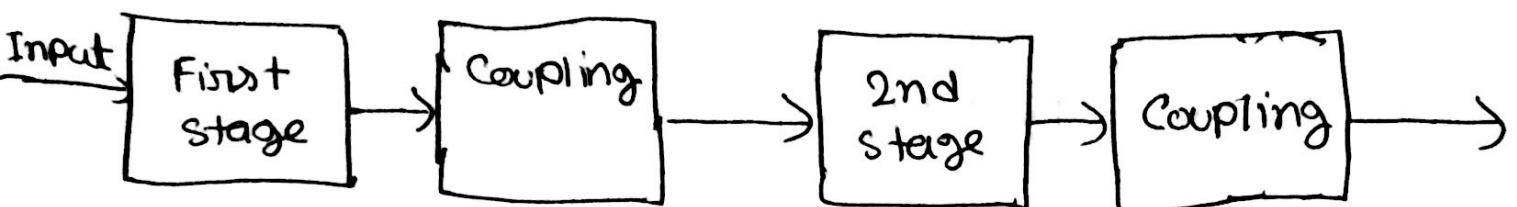
V_s	V_{R_1}	V_d	$I_d = \left(\frac{V_R}{R}\right) \text{mA}$
12V	8V	4V	4mA
12V	7V	5V	5mA
12V	6V	6V	6mA
12V	5V	7V	7mA
12V	4V	8V	8mA
12V	3V	9V	9mA
12V	2V	10V	10mA

Circuit

11.1

A transistor containing more than one stage of amplification is known "Multistage transistor Amplifier".

a) Q_1 , Q_2 , Q_3



11.2

Coupling capacitors and bypass

11.3

Gaining

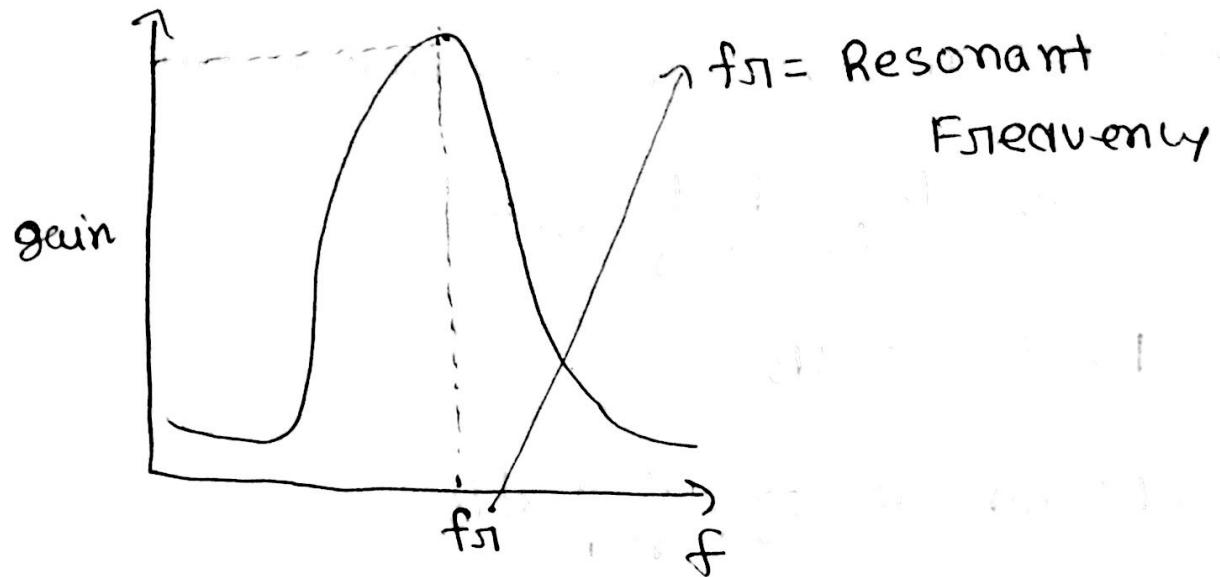
The one is ratio of output quantity to the input called Gaining.

$$G_I = G_{I_1} \times G_{I_2} \times G_{I_3} \times \dots$$

$$G_I = \frac{O/P}{I/P} = \frac{500V}{100V} = 5$$

11.3

(11) Frequency Response



MPA

$$P = VI = I^2 R = \frac{V^2}{R}$$

⑩ Decibel gain:

The common logarithm (base 10) of power gain is known as bel power gain.

Power gain

$$\text{Power gain} = \log_{10} \frac{P_{\text{out}}}{P_{\text{in}}} \text{ bel}$$

$$1 \text{ bel} = 10 \text{ dB}$$

Power gain

$$\text{Power gain} = 10 \log_{10} \frac{P_{\text{out}}}{P_{\text{in}}} \text{ dB}$$

Voltage

$$\text{Voltage} = 20 \log_{10} \frac{V_{\text{out}}}{V_{\text{in}}} \text{ dB}$$

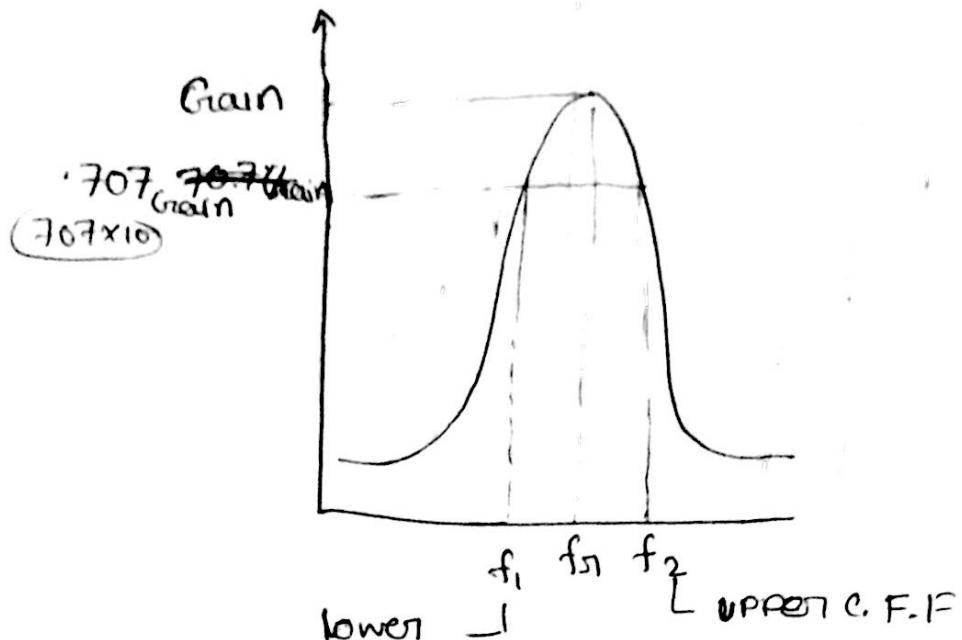
Circuit

$$\text{Circuit} = 20 \log_{10} \frac{I_{\text{out}}}{I_{\text{in}}} \text{ dB}$$

11.4]

Bandwidth

To range of frequency over which the voltage gain is equal to or greater than 70.7% of max gain is known as "Bandwidth"



Fall in voltage from max gain =

$$= 20 \log_{10} 100 - 20 \log_{10} 70.7$$

$$= 20 \log_{10} \frac{100}{70.7}$$

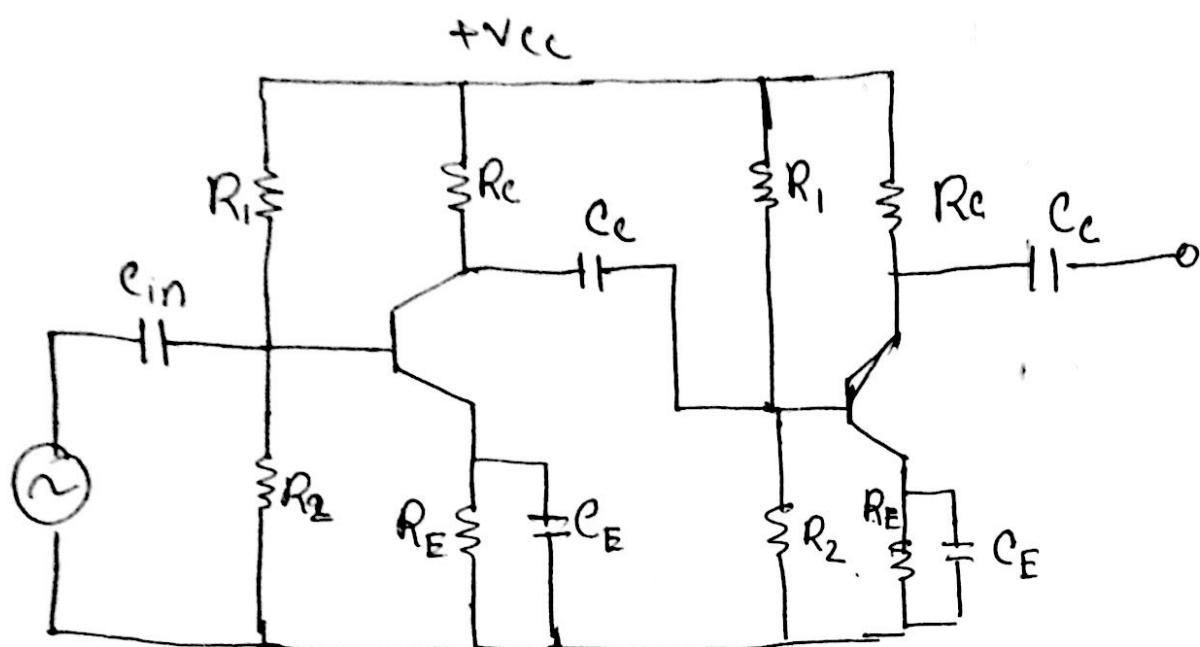
$$= 20 \log_{10} 1.4142$$

$$= 3 \text{ dB}$$

3 dB
प्राप्त शक्ति
गain घटता

4.
11.5]

RC couple transistor Amplifier:



Frequency Response

① At low freq: $< 50\text{Hz}$ gain

→ C_E is very high

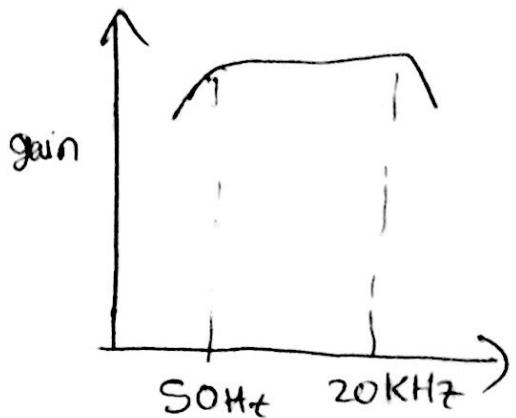
→ C_E can not shunt

② At high freq: $> 20\text{kHz}$

→ C_E is very small

→ Capacitive reactance is very low

③ At mid freq: (50Hz to 20kHz)



Advantages

- (i) Excellent frequency response
- (ii) Lower cost
- (iii) Circuit is compact

Disadvantages

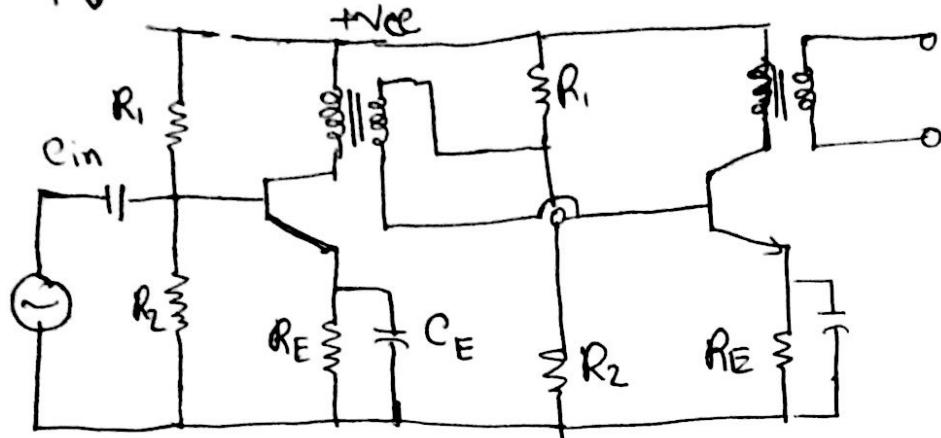
- (i) Low voltage gain
- (ii) noisy (due to stage noise)
- (iii) Impedance matching is poor.

11.6

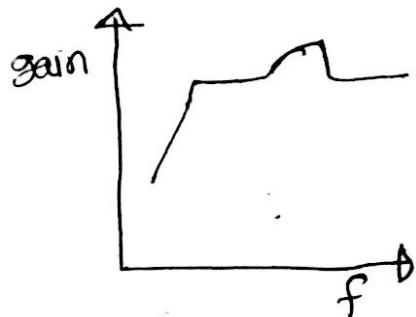
Transformer couple transistor Amplifier

$$P = V_P I_R$$

↑ V ↑



Frequency Response



Adv:

- ① No signal power is lost
- ② Excellent impedance matching
- ③ Higher gain

Disadv

- ① Poor frequency response
- ② Bulky and expensive
- ③ Distortion is higher