Here, $f_1'' > f_1$ and hence

$$fL = f_1' = 190.98Hz$$

TWO MARK QUESTIONS AND ANSWERS

1. What is roll off?

The frequency response is nearly ideal over a wide range of mid frequency. Only at low and high frequency ends, gain deviates from ideal characteristics. The decrease in voltage gain with frequency is called as roll off.

2. What is bandwidth of an amplifier?

Bandwidth of the amplifier is defined as the difference between upper cut-off and lower cut-off frequencies.

Bandwidth = f_2 - f_1

The frequency f_2 lies in high frequency region while the frequency f_1 lies in low frequency region.

3. What is the significance of octaves and decades in frequency response?

The octaves and decades are the measures of change in frequency. A ten times change in frequency is called a decade. On the other hand, octave corresponds to doubling or halving of the frequency. For example, increase in frequency from 100Hz to 200Hz is an ctave. Likewise, a decrease i frequency from 100 kHz to 50kHz is also an octave.

4. State Miller theorem using resistor and capacitor.

For the analysis purpose ,in transistor amplifiers, it is necessary to split the capacitance between input(base or gate) and the output(collector or drain).The capacitance may be C_{bc} (in case of BJT) or C_{gd} (in case of FET). This can be achieved using Miller's theorem.

Miller's theorem: i) For resistor- $\frac{Z}{1-K}$, $\frac{ZK}{K-1}$

ii) For capacitor- $C(A_v + 1), C\left(\frac{A_v+1}{A_v}\right)$

5.Derive the expression for midband gain.

In the midband, the voltage gain of the amplifier is approximately maximum. It is designated as midband gain or A_{mid}.

$$A = \frac{A_{mid}}{\sqrt{1 + (f_1/f)^2}\sqrt{1 + (f/f_2)^2}}$$

i) Midband : $A = A_{mid}$

ii) Below Midband:

$$A = \frac{A_{mid}}{\sqrt{1+\left(\frac{f_1}{f}\right)^2}}$$

iii) Above Midband:

$$A = \frac{A_{mid}}{\sqrt{1+\left(\frac{f}{f_2}\right)^2}}$$

6. Define f_α cut-off frequency.

It is the frequency at which the transistor's short circuit CB current gain drops by 3 dB or $1/\sqrt{2}$ times from its value at low frequency.

$$f_\alpha = \frac{1}{2\pi\, r_\pi (1+h_{fb}) c_\pi}$$

$$f_\alpha = \frac{1+h_{fe}}{2\pi\, r_\pi\, c_\pi} \approx \frac{h_{fe}}{2\pi\, r_\pi\, c_\pi}$$

$$|A_i| = \frac{h_{fb}}{\sqrt{\left(1+\left(\frac{f}{f_\alpha}\right)^2\right.}}$$

$A_t f = f_\alpha$

$$|Ai| = \frac{h_{fb}}{\sqrt{2}}$$

7. Define f_β cut off frequency.

It is the frequency at which the transistor's short circuit CE current gain drops by 3dB or $1/\sqrt{2}$ times from its value at low frequency.

$$f_\beta = \frac{1}{2\pi\, r_\pi (c_\pi + c_\mu)}$$

$$f_\beta = \frac{g_{b'e}}{2\pi (c_\pi + c_\mu)}$$

$$f_\beta = \frac{g_m}{2\pi\, h_{fe}\, (c\pi + c\mu)} \quad \because g_{b'e} = \frac{1}{r_\pi} = \frac{g_m}{h_{fe}}$$

8. Define f_T frequency.

It is the frequency at which short circuit CE current gain becomes unity.

A_t $f = f_T$,$| A_i | = 1$

$$1 = \frac{h_{fe}}{\sqrt{1 + \left(\frac{f_T}{f_\beta}\right)^2}}$$

$$h_{fe} = \sqrt{1 + \left(\frac{f_T}{f_\beta}\right)^2}$$

$$h_{fe} = \frac{f_T}{f_\beta} \qquad \because \frac{f_T}{f_\beta} \gg 1$$

$$f_T = f_\beta h_{fe}$$

Sub f_β in f_T,

$$f_T = \frac{h_{fe} \times g_m}{h_{fe} \times 2\pi (C_\pi + C_\mu)}$$

$$f_T = \frac{g_m}{2\pi (C_\pi + C_\mu)}$$

Since $C_\pi \gg C_\mu$,

$$f_T = \frac{g_m}{2\pi C_\pi}$$

9. Define gate and junction capacitance.

Gate capacitance:

It is a parallel plate capacitance formed by gate electrode with channel, with the oxide layer act as a capacitor dielectric. It is denoted as C_{ox}.

Junction capacitance:

These capacitances are due to reverse biased pn junctions formed by the n^+ source region and p-type substrate, and the n^+ drain region and p-type substrate. These are denoted as source diffusion and drain diffusion capacitance respectively.

10. What are the internal capacitance of MOSFET?

There are two types of internal capacitances in MOSFET. They are:

i) Gate Capacitance

There are three gate capacitances: C_{gs}, C_{gd} & C_{gb}.

ii) Junction Capacitances

a) source diffusion
b)drain diffusion capacitance

11. If the rise time of BJT is 40 nanoseconds, what is the bandwidth that can be obtained using BJT?

$$B.W = \frac{0.35}{t_r}$$

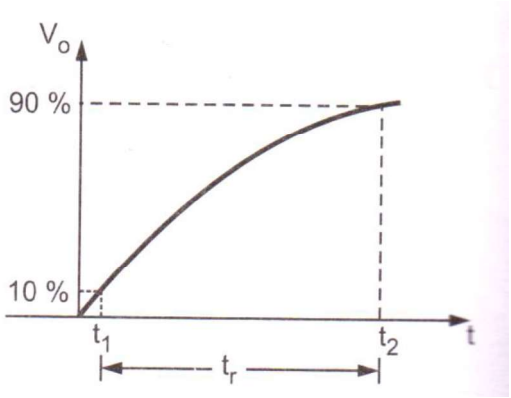
$$= \frac{0.35}{40 \times 10^{-9}}$$

$$= 8.75\ MHz.$$

12. Define rise time.

The time for waveform to rise from 0.1 to 0.9 of its steady state value is called as rise time.

$$t_r = t_2 - t_1$$



13. Draw general frequency response curve of an amplifier