1.

PART A - (10 × 2 = 20 Marks)

Q.1 *An amplifier has $A_v = 1000 \pm 100$, determine the feedback needed to keep the gain within ± 0.1 %. find A_{vf}.*

Ans. : Given : $A_v = 1000, \quad \Delta A_v = 100$

$$\frac{\Delta A_v}{A_v} = \frac{1000}{100} = 0.1$$

$$\therefore \quad \% \frac{\Delta A_v}{A_v} = 0.1 \times 100 = 10\ \%$$

It is required to have gain variation of 0.1 %.

$$\therefore \quad \% \frac{A_{vf}}{A_f} = 0.1\ \%$$

$$\therefore \quad \frac{\Delta A_{vf}}{A_f} = 0.001\ \%$$

$$\text{Sensitivity} = S = \frac{\Delta A_{vf}/A_{vf}}{\Delta A_v/A_v} = \frac{0.001}{0.1} = 0.01$$

$$D = \frac{1}{S} = \frac{1}{0.01} = 100 = 1 + A_v\beta$$

$$\therefore \quad \beta = \frac{100-1}{A_v} = \frac{99}{1000} = 0.099$$

$$A_{vf} = \frac{A_v}{1+A_v\beta} = \frac{1000}{1+(1000\times 0.099)} = 10$$

2.Why frequency compensation is required in amplifiers?

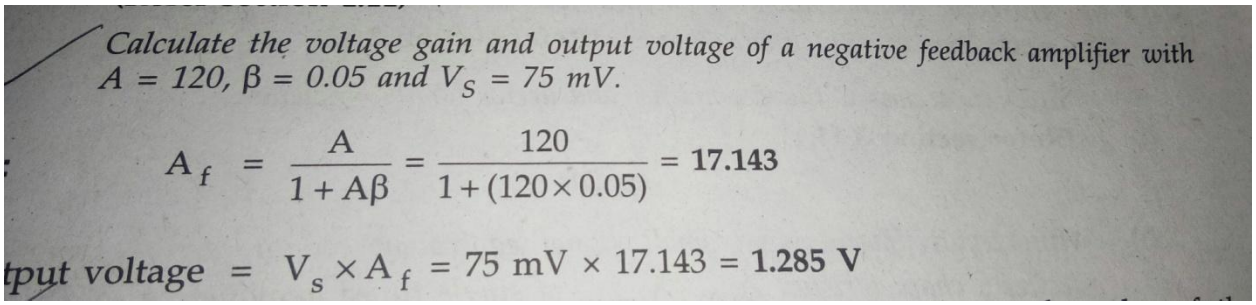
- If a feedback amplifier has more than two poles it can be unstable.
- hence, frequency compensation is used to make unstable feedback amplifiers stable.

3. What is Gain Margin?

The stability of a feedback loop can be assessed by examining its Bode plot and by evaluating one of the two related parameters.

One parameter called the gain margin is defined as the difference between unity and magnitude of A(jw)β at w=180.

4.



Calculate the voltage gain and output voltage of a negative feedback amplifier with $A = 120$, $\beta = 0.05$ *and* $V_S = 75$ *mV.*

$$A_f = \frac{A}{1 + A\beta} = \frac{120}{1 + (120 \times 0.05)} = \mathbf{17.143}$$

tput voltage $= V_s \times A_f = 75 \text{ mV} \times 17.143 = \mathbf{1.285 \text{ V}}$

5.Mention the Bandwidth of double tuned amplifier:

BW = $\sqrt{2}$(f2-f1)

At 3db bandwidth,

BW = 3.1fr/Q

6. What is the need of amplitude control in an oscillator?

An additional amplitude control loop stabilizes amplitude by detecting it by some means, comparing the detected amplitude to a reference voltage, and inputting the difference as an error to the forward path of the amplifier.

7.

Q.32 **Draw the feedback circuit of a Colpitt's oscillator. Obtain the value of the equivalent series capacitance required if it uses a L of 100 mH and is to oscillate at 40 kHz.**

AU : May-13, 16

Ans. : *The feedback circuit of Colpitt's oscillator is shown in the Fig.2.16.2*

$$f = \frac{1}{2\pi\sqrt{LC_{eq}}}$$

$$\therefore \quad 40\times10^{3} = \frac{1}{2\pi\sqrt{100\times10^{-3}\times C_{eq}}}$$

$$\therefore \quad C_{eq} = 158.314\ pF$$

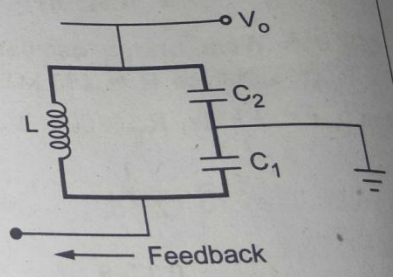


Fig. 2.16.2

8. Advantage of RC phase shift oscillator:

- The circuit is simple to design.
- Produces sinusoidal output waveform.

Disadvantages:

- By changing the values of R and C, the frequency of the oscillator can be changed.
- The frequency stability is poor.

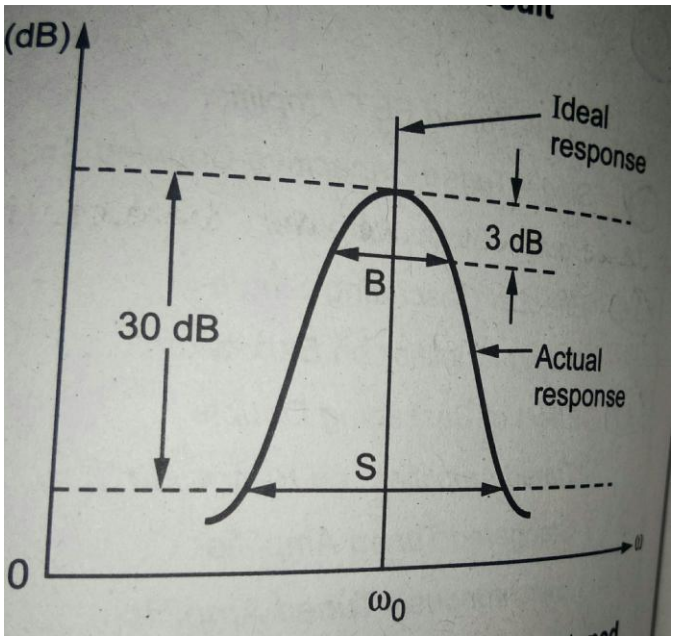
9. Principle of tuned amplifier:

A tuned circuit is capable of amplifying a signal over a narrow band of frequencies that are centered at resonant frequency.

When the reactance of the inductor balances the reactance of the capacitor, in the tuned circuit at some frequency, it is called resonant frequency.

10. Draw the ideal and actual response of tuned amplifiers:

This is a tuned parallel LC circuit which resonates at a particular frequency.



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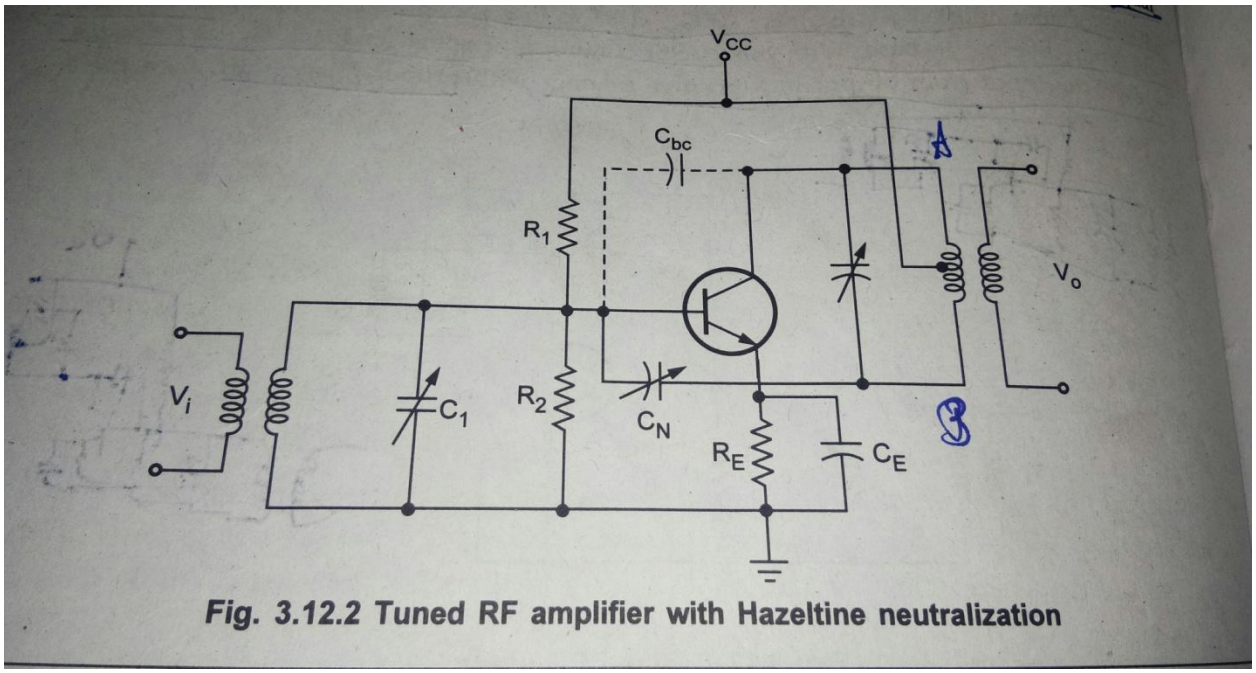
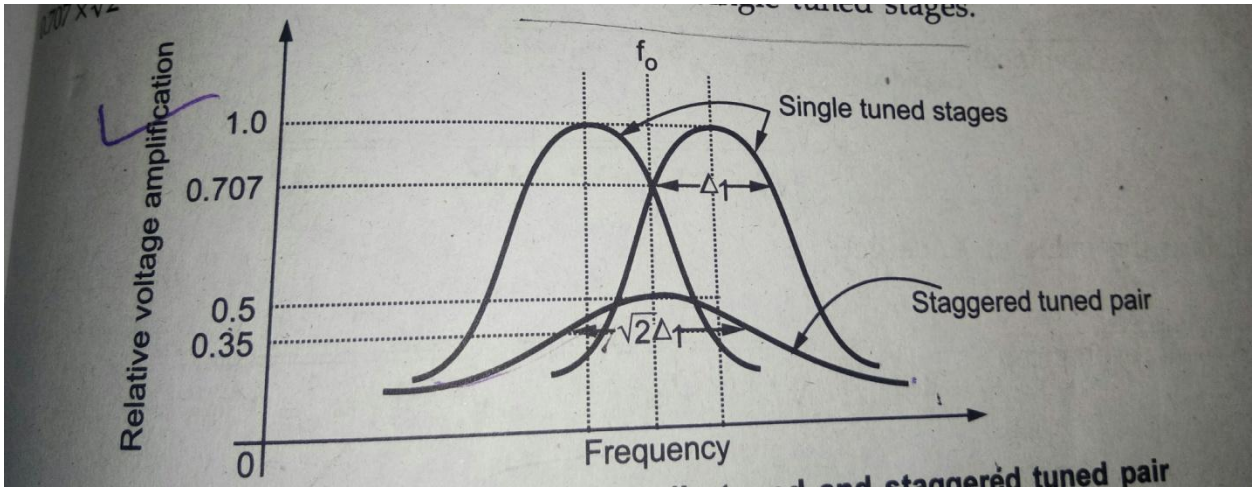


Fig. 3.12.2 Tuned RF amplifier with Hazeltine neutralization

12.



staggered tuned pair

13.

Example 4.4.2 *For a low pass RC circuit it is desired to pass a 2 msec sweep of a ramp input, with less than 0.5 % transmission error. Determine the upper 3-dB frequency.*

AU : May-18, Marks 2

Solution : For a circuit, T = 2 msec and $e_t = 0.5\,\%$

Now $$e_t = \frac{1}{2\pi f_2 T} \quad \text{i.e.} \quad 0.5 = \frac{1}{2\pi f_2 \times 2\times 10^{-3}} \times 100$$ as e_t expressed in %

$$\therefore \quad f_2 = \frac{1}{2\pi \times 0.5 \times 2\times 10^{-3}} \times 100 = \mathbf{15.91\ kHz}$$

Now $$f_2 = \frac{1}{2\pi R C}$$

Hence to get $f_2 > 15.91$ kHz, **RC < 10 μsec**

14. State the condition in which RC high pass filter can act as a differentiator.

For a high pass RC circuit, if time constant is very small as compared to the time required by the input signal to make an appreciable change, the circuit acts as a differentiator.

15. Why clamper circuits are called DC level restore?

- The circuits which are used to add a DC level as per the requirements to the AC output signal are called clamper circuits.
- The capacitor, diode and resistance are the three basic elements of a clamper circuit. The clamper circuits are also called DC restorer or DC inserter circuits.

16. State the role of commutating capacitor in bi-stable multi-vibrator:

For the proper operation of the bi-stable multi-vibrator it is necessary that the transition time of the circuit should be as small as possible.

The role of the coupling capacitor is,

- Allow fast rise and fall times to avoid distortion in the output.
- To bypass the high frequency components of the pulses.