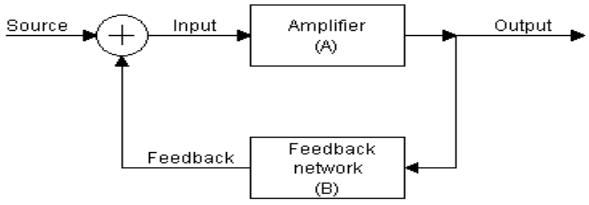
ELECTRONIC CIRCUIT ANALYSIS (15A04401)

Unit wise short answer question and answers

UNIT-I
FEEDBACK AMPLIFIERS AND OSCILLATORS

1. Define feedback?

A portion of the output signal is taken from the output of the amplifier and is combined with the normal input signal. This is known as feedback.



2. **Define positive feedback?**

If the feedback signal is in phase with input signal, then the net effect of the feedback will increase the input signal given to the amplifier. This type of feedback is said to be positive or regenerative feedback.

3. Define negative feedback?

If the feedback signal is out of phase with the input signal then the input voltage applied to the basic amplifier is decreased and correspondingly the output is decreased. This type of feedback is known as negative or degenerative feedback.

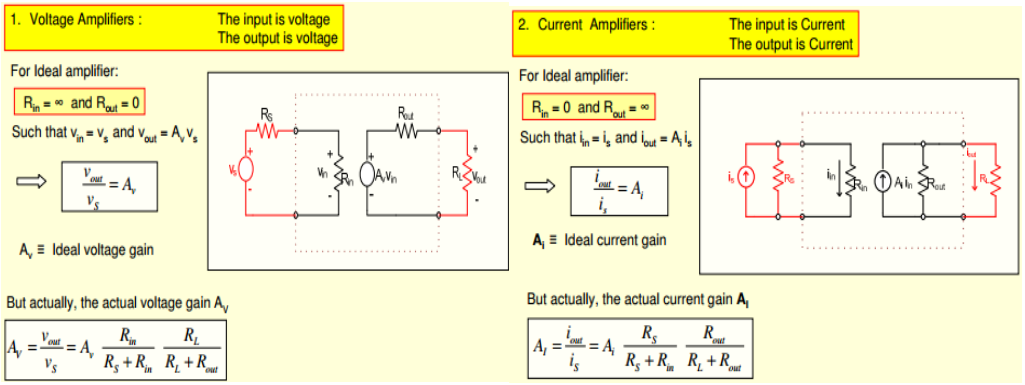
4. Define sensitivity?

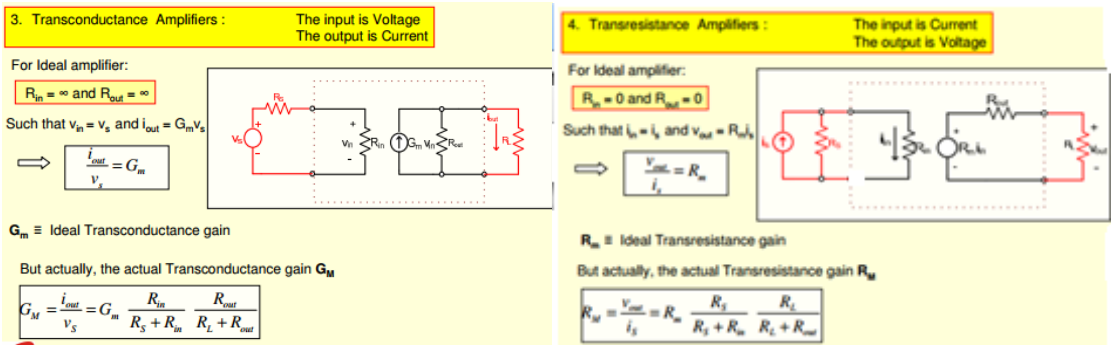
Sensitivity is defined as the ratio of percentage change in voltage gain with feedback to the percentage change in voltage gain without feedback.

5. What are the types of feedback?

i. Voltage-series feedback ii. Voltage-shunt feedback

iii. Current-series feedback iv. Current-shunt feedback





6. Write the expression for input and output resistance of voltage series feedback amplifier.

$R_{if} = \frac{Vs}{Ii} = R_i(1+aß)$ $R_{of} = \frac{V}{I} = \frac{Ro}{(1+aß)}$

7. Give an example for voltage-series feedback.

The Common collector or Emitter follower amplifier is an example for voltage series feedback.

9. What is Oscillator circuit?

A circuit with an active device is used to produce an alternating current is called an oscillator circuit. Or Which generates AC signal without AC inputsignal.

10. What are the types of feedback oscillators?

* RC- Oscillators i) Phase shift Oscillator, ii) Wien bridge Oscillator
* LC-Oscillators
    i. Tuned collector Oscillator
    ii. Tuned emitter Oscillator
    iii. Tuned collector base Oscillator
    iv. Hartley Oscillator
    v. Colpitts Oscillator
    vi. Clap Oscillator

11. What are the conditions for oscillation?

The total phase shift of an oscillator should be 360^o. For feedback oscillator it should satisfies Barhausen criterion.

12. Define Piezoelectric effect.

When applying mechanical energy to some type of crystals called piezoelectric crystals the mechanical energy is converted into electrical energy is called piezoelectric effect.

13. What is Miller crystal oscillator? Explain its operation.

It is nothing but a Hartley oscillator its feedback Network is replaced by a crystal. Crystal normally generate higher frequency reactance due to the miller capacitance are in effect between the transistor terminal.

21.What is feedback amplifier?Ifa amplifier has feedback path exists from output to input then that amplifier is termed as Feedback amplifier. Feed back is the parameter which quantifies the amount of feedback given in a feedback amplifier. **Feedback factor = Feedback signal/input signal.**

22.What are Advantages and disadvantages of Negative feedback?

Some of the Advantages of negative feedback:

a) Input resistance increases b) Output resistance decreases c) Bandwidth increases

d) Non linear distortion decreases e) Frequency distortion decreases f) Sensitivity will be decreased g) Gain stability

The main **disadvantage** of negative feedback is **decrease in overall gain**. The gain and feedback factor in an amplifier are often functions of frequency, so the feedback may lead to positive feedback.

23.What is de-sensitivity factor?

Desensitivity factor is defined as the factor with which the feedback desensitizes the gain. It is also called as return difference.

Desensitivity factor = $(dAfb/Afb)/(dA/A) = 1/(1+A*\beta)$

Where Afb is gain with feedback, A is gain without feedback, β is feedback factor.

24.What is a loop gain in amplifier?

Loop gain in amplifier is defined as the gain of feedback path from output to input. It is the product of loop gain and feedback factor in positive feedback amplifiers. In negative feedback amplifiers it is the negative product of loop gain and feedback factor.

25.What is the effect of negative feedback on voltage gain, BW, Noise, nonlinear distortion, Ri, Ro of a voltage amplifier?

The voltage gain, bandwidth, noise, nonlinear distortion, input resistance, output resistance are

Voltage gain with feedback = Voltage gain without feedback* desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Voltage gain without feedback < gain without feedback).

Band width with feedback = Band width without feedback/ desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Band width without feedback > Band width without feedback).

Noise with feedback = Noise without feedback* desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Noise without feedback > Noise without feedback).

Non linear distortion with feedback = Non linear distortion without feedback* desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Non linear distortion without feedback >Non linear distortion without feedback).

Non linear distortion with feedback = Non linear distortion without feedback* desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Non linear distortion without feedback >Non linear distortion without feedback).

Input resistance with feedback = Input resistance without feedback/ desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Input resistance without feedback > Input resistance without feedback).

Output resistance with feedback = Output resistance without feedback* desensitivity factor (since desensitivity factor << 1 in negative feedback, hence Output resistance without feedback > Output resistance without feedback)

26.What are the different types of feedback topologies?

There are four different types of feedback topologies based on type of output signal and feedback signal (voltage or current signal). Voltage feedback is taken in series with the load and current feedback is taken in shunt with the load. They are

a)**Voltage-series:** Output signal is voltage signal, feedback signal is voltage signal. Also called as series-series feedback. It is employed in voltage amplifiers.

b)**Current series:** Output signal is current signal, feedback signal is voltage signal. Also called as shunt-series feedback. It is employed in Trans conductance amplifiers.

c)**Current shunt:** Output signal is current signal, feedback signal is current signal. Also called as shunt-shunt feedback. It is employed in current amplifiers.

d)**Voltage shunt:** Output signal is voltage signal, feedback signal is current signal. Also called as shunt-shunt feedback. It is employed in current amplifiers.

The first word indicates the type of output signal and the second word indicates the manner in which feedback signal is taken whether it is taken in series or shunt with the load.

27.What is the effect of each feedback network topologies on input and output resistance?

Feedback topology/ Parameter	**Voltage series**		**Current series**	**Current shunt**	**Voltage shunt**

Input resistance	Increases Rif = Ri*(1+A*β)		Increases Rif = Ri*(1+A*β)	Decreases Rif = Ri/(1+A*β)	decreases Rif = Ri*(1+A*β)
Output resistance	Decreases Rof = Ro/(1+A*β)		Increases Rof = Ro*(1+A*β)	Increases Rof = Ro*(1+A*β)	Decreases Rof = Ro/(1+A*β)

28.What is a Nyquist criterion to differentiate the feedback in amplifiers?

If the Nyquist plot of amplifiers encircles (-1, 0) point in nyquist domain, the amplifier is unstable and has positive feedback.

If the Nyquist plot of amplifiers does not encircle (-1, 0) point in nyquist domain, the amplifier is stable and has negative feedback.

29.DefineTransconductance, Transresistance, voltage gain, current gain?

Voltage gain of an amplifier is defined as ratio of output voltage to input voltage fed to amplifier. It is unit less and is denoted by Av.

Voltage gain **Av = Vo/Vi**

Current gain of an amplifier is defined as ratio of output current to input current fed to amplifier. It is unit less and is denoted by Av.

Voltage gain **Ai = Io/Ii**

Transconductance of an amplifier is defined as ratio of output current to input voltage fed to amplifier. It is specified in units of mhos (or) Siemens and is denoted by **Rt**.

Transconductance **Rt = Vo/ Ii**

Trans-resistance of an amplifier is defined as ratio of output voltage to input current fed to amplifier. It is specified in units of ohms and is denoted by **Rt**.

Trans-resistance **Rt = Vo/ Ii**

30.What are the Ideal input and output resistances of various amplifiers?

Parameter/Type of amplifier	**Voltage amplifier**	**Current amplifier**		**Transconductance amplifier**	**Transresistance amplifier**
Input resistance	Infinite	Zero		Infinite	Zero
Output resistance	Zero	Infinite		Infinite	Zero

31.What is an Audio amplifier?

Audio amplifiers are electronic power amplifiers used to amplify low intensity audio signals to a level suitable to drive loud speakers. The audio frequencies are in the range 20 Hz to 20,000 Hz. Normally Class AB power amplifiers are used to do audio amplification. Phase distortion will not create much problem in audio amplifiers.

32.What is a Video amplifier?

These amplifiers are use to amplify video signals. These amplifiers have varying bandwidths based on the type of filter used at each point. Typically a low-pass amplifier will be having a bandwidth in the range from 2 to 10 MHz. Some of the applications are in television receivers, cathode-ray-tube computer terminals, and pulse amplifiers. The phase distortion is of prime concern in video amplifiers; hence extra elements are added to nullify distortion.

33.What is Power amplifier?

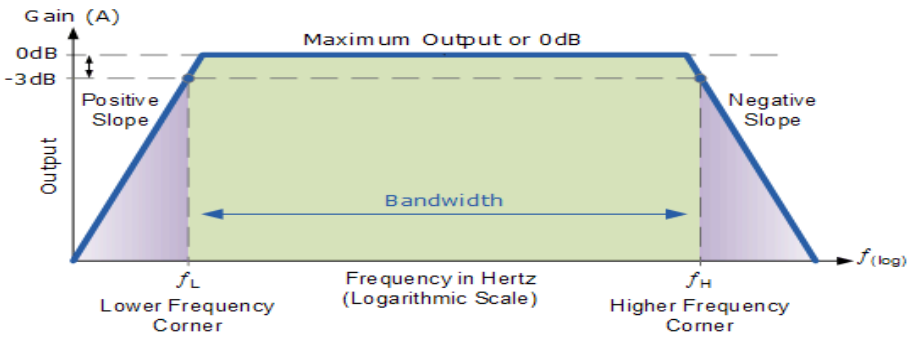
A power amplifier stage is an amplifier optimized to deliver high output power. Special attention has to be paid in designing such amplifiers as the power dissipation across the junction raises its temperature and eventually destroys it. In practice we can observe that the power transistors are bulky in nature to handle high powers as high surface area leads to high heat removing capacity.

UNIT –II

Small Signal High Frequency Transistor Amplifier models

1. Define the frequency response of Amplifier?

The frequency response of an amplifier can be defined as the variation of output of quantity with respect to input signal frequency. In otherwise it can be defined as a graph drawn between the input frequency and the gain of an amplifier.



2. Define lower & upper cut off frequencies of an amplifier.

Lower cut-off frequency :

The frequency (on lower side) at which the voltage gain of the amplifier is exactly 70.0% of the maximum gain is known as lower cut off frequency.

Upper cut-off frequency :

The frequency (on higher side) at which the voltage gain of the amplifier is exactly 70.0% of the maximum gain is known as upper cut off frequency.

3. Define bandwidth?

The range of frequencies occupied by the signal is known as its bandwidth.

Bandwidth = Upper cut-off frequency - Lower cut-off frequency

$BW = f_H - f_L$

4. State the reason for fall in gain at low frequencies.

The coupling capacitance has very high reactance at low frequency. Therefore it will allow only a small part of signal from one stage to next stage and in addition to that the bypass capacitor cannot bypass or shunt the emitter resistor effectively. As a result of these factors, the voltage gain rolls of at low frequency.

5. State the reason for fall in gain at higher frequencies?

At high frequency the reactance of coupling capacitor is very low. Therefore it behaves like a short circuit. As a result of this the loading effect of the next stage increase which reduces the voltage gain. Hence the voltage gain rolls off at high frequencies.

6. Write a note on effects of coupling capacitor.

a. The coupling capacitor Co transmits AC Signal. But blocks Dc. This prevents DC interferences between various stages and the shifting of operating point.

b. It prevents the loading effect between adjacent stages.

7.What is the significance of gain bandwidth product & Why is the gain bandwidth product a constant?

It is very helpful in the preliminary design of a multistage wideband amplifier. This can be used to setup a tentative circuit, which is often used for this purpose. It is defined as the magnitudes of the product of the mid band gain which is a constant and the bandwidth, which is also a constant. Hence the product of two constants should also be a constant.

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10.Definef_T and f_β .

Unity gain frequency (f_T) or Terminal frequency .

It is defined as the frequency at which the common emitter shirt circuit current gain has dropped to unity and is denoted by the symbol (f_T)

Beta cut-off frequency (f_β)

It is defined as the high frequency at which -of a CE transistor drops to 0.707 or 3dB from its lower frequencies

11.What is the need for having a high value of f_T?

Bandwidth of the amplifier is directly proportional to f_T.hencet_p have larger bandwidth, the value of f_T should be high.

12.What is a cascade amplifier?

The cascade configuration is an amplifier stage composed of a direct coupled common emitter / common base combination. This offers the possibility of a very large bandwidth.

13.What are the advantages of representation of gain in decibels?

a. In multistage amplifier, it permits to add individual gains of the stages to calculate overall gain.

b. It allows us to denote, both very small as well as very large quantities of linear scale by considerably small figures.

14. What is the coupling methods used for coupling in multistage amplifiers?

The coupling methods used are,

a. RC coupling b. Transformer coupling c. Direct coupling

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16. Define lower & upper cut off frequencies of an amplifier.

Lower cut-off frequency:The frequency (on lower side) at which the voltage gain of the amplifier is exactly 70.0% of the maximum gain is known as lower cut off frequency.

Upper cut-off frequency:The frequency (on higher side) at which the voltage gain of the amplifier is exactly 70.0% of the maximum gain is known as upper cut off frequency.

17. Why the electrolytic capacitor is not used for coupling?

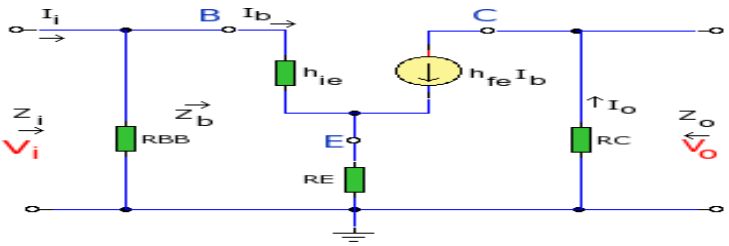
Electrolytic capacitor is a polarized capacitor. So it cannot be used for coupling and also in electrolytic capacitor, the dielectric is not an insulating material but it conducting material which will change the capacitance effect.

18. Write a note on effects of coupling capacitor.

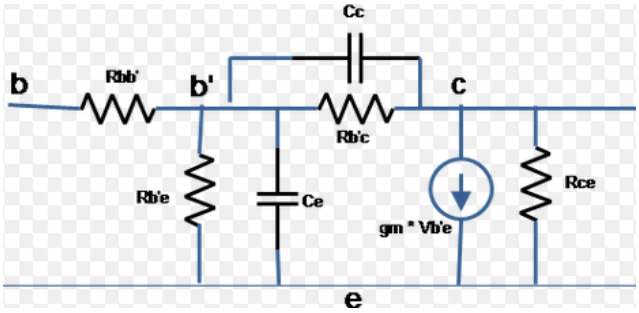
a. The coupling capacitor Co transmits AC Signal. But blocks Dc. This prevents DC interferences between various stages and the shifting of operating point.

b. It prevents the loading effect between adjacent stages.

19. Draw the low frequency simplified h-parameter model of an amplifier with aunbypassed emitter resistor.



20 Draw the high frequency model of BJT CE model.



21.Why an NPN transistor has a better high frequency response than the PNP transistor?

An NPN transistor has a better frequency response than the PNP transistor because the mobility of electron is more and capacitive effect is less.

UNIT-III

MULTI STAGE AMPLIFIERS

1. What are the advantages of Darlington Circuit?

i Very high current gain

ii Very high input impedance

iii Convenient and easy circuit configuration to use

iv Darlington pairs are widely available in a single package or they can be made from

two separate transistors

2. What is the coupling schemes used in multistage amplifiers

When amplifiers are cascaded it is necessary to use a coupling network between the output of one amplifier and the input of the following amplifier. This type of coupling is called as inter stage coupling. They serve the following purposes,

i. It transfers the a.c output of one stage to the input of next stage

ii. It isolates the d.c conditions of one stage to next.

The commonly used coupling schemes are,

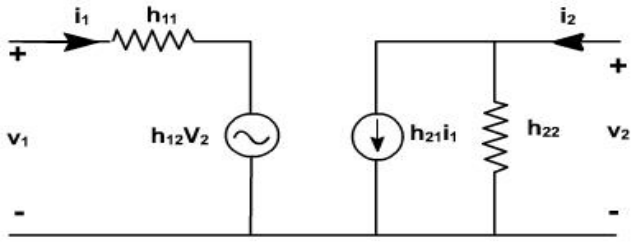
a) Resistance Capacitance (RC) coupling

b) Transformer coupling

c) Direct coupling

3. Why hybrid parameters are called so? Define them. [OR] Define the various h-parameters?

The dimensions of the hybrid parameters are not alike, that is they are hybrid in nature, so they are called hybrid parameters.



$$h_{11} \stackrel{\text{def}}{=} \left.\frac{V_1}{I_1}\right|_{V_2=0} \qquad h_{12} \stackrel{\text{def}}{=} \left.\frac{V_1}{V_2}\right|_{I_1=0}$$

$$h_{21} \stackrel{\text{def}}{=} \left.\frac{I_2}{I_1}\right|_{V_2=0} \qquad h_{22} \stackrel{\text{def}}{=} \left.\frac{I_2}{V_2}\right|_{I_1=0}$$

h11= Input impedance with output port short circuited.

h12= Reverse voltage transfer ratio with input port open circuited.

h21= Forward current gain with output port short circuited.

h22= Output admittance with input port open circuited.

4. Why emitter bypass capacitor C_e is used in CE amplifier circuit.

An emitter bypass capacitor C_e is connected in parallel with the emitter resistance $R_E$to provide a low reactance path to the amplified ac signal. If it is 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

5. What are the salient features of hybrid parameters?

The salient features of hybrid parameters are,

a) h-Parameters are real numbers in audio frequency range.

b) They are easy to measure.

c) They are convenient to use in circuit analysis and design.

d) Easily convertible from one configuration to other.

e) Readily supplied by manufacturers.

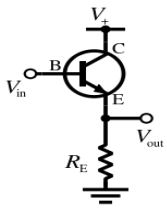
6. What are the limitations of h-parameter?

a) The accurate calculation of h parameter is difficult.

b) A transistor behaves as a two port network for small signals only, hence 'h' parameter can be used to analyze, only the small signal amplifier.

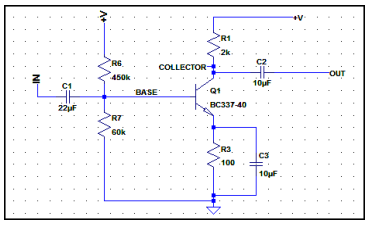
7. What is an emitter follower?

In the common collector circuit emitter terminal follows the signal voltage applied to the base. Hence the common collector circuit is also known as an emitter follower.



8. What is the function of Input capacitor C_1 in CE amplifier circuit?

This capacitor couples the signal to the base of the transistor. It blocks any dc component present in the signal and passes only ac signal for amplification.

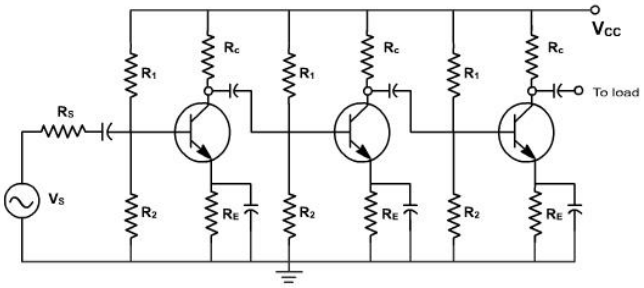


9. What is the need for output coupling capacitor C_2?

The coupling capacitor C_2 couples the output of the amplifier to the load or to the next stage of the amplifier. It blocks dc and passes only ac part of the amplified signal.

10. What is cascade amplifier?

The cascade configuration is an amplifier stage composed of a direct coupled common emitter/ common base combination. This offers the possibility of a very large bandwidth.



11. What are the high frequency effects?

At high frequencies the internal capacitances, commonly known as junction capacitances reducing the circuit gain.

12. write the overall lower cut-off frequency of multistage amplifier.

$$|A_{0L}| = \frac{1}{\sqrt{[1+\left(\frac{f_L}{f}\right)^2]^n}}$$

f_L= Lower 3 dB frequency of identical cascaded stages.

n = Number of stages.

f= Higher 3db frequency of single stage.

13. Write the overall higher cut-off frequency of multistage amplifier.

$$|A_{0H}| = \frac{1}{\sqrt{[1+\left(\frac{f}{f_H}\right)^2]^n}}$$

f_H= Higher 3 dB frequency of identical cascaded stages.

n = Number of stages.

f= Higher 3db frequency of single stage.

14. What is significance of gain bandwidth product?

It is very helpful in the preliminary design of a multistage wide band amplifier. This can be used to setup a tentative circuit which is often used for this purpose.

15. Write a note on effects of coupling capacitor.

a) The coupling capacitor C0 transmits AC signal. But blocks DC. This prevents DC interference between various stages and the shifting of operating point.

b) It prevents the loading effect between adjacent stages.

Coupling capacitors are used to couple different stages so as to prevent DC from the o/p of one stage to go into the i/p of the next stage. For instance in coupling two BJT (bipolar junction transistors) it is required to use coupling capacitor to allow only ac signal from the o/p of first stage to go to i/p of next BJT as incoming dc can disturb the biasing of the other BJT.

Bypass capacitors are used to bypass the ac signal to ground. A capacitor is connected b/w the gnd and the wire. For ac signal capacitor will behave as short and will bypass it. However dc will not be bypassed as capacitor will behave as open for DC.

16. Write an expression for the bandwidth of multistage amplifier.

The bandwidth of multistage amplifier is

$$f_{c-low} = \frac{f_{c1}}{\sqrt{2^{\frac{1}{n}} - 1}} \qquad f_{c-high} = f_{c2}\sqrt{2^{\frac{1}{n}} - 1} \qquad BW_{overall} = f_{c-high} - f_{c-low}$$

17. What are the advantages of representation of gain in decibels?

a) In multistage amplifier, it permits to add individual gains of the stages to calculate overall gain.

b) It allows us to denote, both very small as well as very large quantities of linear scale byconsiderably small figures.

18. State the reason for fall in gain at low frequencies.

The coupling capacitance has very high reactance at low frequency. Therefore it willallow only a small part of signal from one stage to next stage, and in addition to that the bypass capacitor cannot bypass or shunt the emitter resistor effectively. As a result of these factors, the voltage gain rolls off at low frequency.

19. State the reason for fall in gain at high frequencies.

At high frequency the reactance of coupling capacitor is very low. Therefore it behaveslike a short circuit. As a result of this, the loading effect of the next stage increases which reduces the voltage gain. Hence the voltage gain rolls off at high frequencies.

20. What is a Darlington connection in the amplifiers?

A Darlington transistor connection provides a transistor having a very large current gain, typically a few thousand. The main features of the Darlington connection is that the composite transistor acts as a single unit with a current gain, that is the product of current gains of the individual transistors.

21. Give the condition for analyzing the simplified Hybrid model of the transistor amplifier?

The following condition should be satisfied for analyzing the simplified hybrid model of transistor amplifier. $\mathbf{h_{oe}.R_L < 0.1}$

22.What is an amplifier?

An amplifier is a device which produces a large electrical output of similar

characteristics to that of the input parameters.

23.What are the types of distortions encountered in amplifiers?

There are mainly three types of distortions encountered in amplifiers. They are

a) Non linear distortion: It occurs due to non dynamic curve of input output characteristics in amplifiers. New frequencies appear in the output due to non linear distortion. It is often encountered in large signal amplifiers.

b) Frequency distortion: This type of distortion occurs when the signal components of different frequencies are amplified differently.

c) Phase distortion: Phase distortion occurs due to unequal phase shift of signals of different frequencies.

Frequency and phase distortion occurs when the signal frequencies lie outside the band width of amplifier.

UNIT IV

POWER AMPLIFIERS

1. List out the classification of amplifiers?

The amplifiers are classified as follows.

a. Based on the input

i. small signal amplifiers ii. large signal amplifiers

b. Based on the output

i. Voltage amplifier ii. Power amplifier iii. Current amplifier

c. Based on the transistor configuration

i. CE amplifier ii. CB amplifier iii. CC amplifier

d. Based on the number of stages

i. Single stage amplifier ii. Multistage amplifier

e. Based on the Bandwidth

i. Untuned amplifier (wide band amplifier) ii. Tuned amplifier (narrow band amplifier)

f. Based on the frequency response

i. AF (Audio frequency) amplifier ii. IF (Intermediate frequency) amplifier

iii. RF (Radio Frequency) amplifier

g. Based on the Biasing condition

i. Class A amplifier ii. Class B amplifier iii. Class C amplifier iv. Class AB amplifier

v. Class D amplifier vi. Class S amplifier

2. How do you bias the class A operation?

In class A mode, the output current flows through out the entire period of input cycle and the Q point is chosen at the midpoint of AC load line and biased.

3. Which amplifier gives minimum distortion?

Class S amplifier gives minimum distortion.

4. Give the applications of class C power amplifier.

The applications of class C power amplifier are,

a. Used in radio and TV transmitters.

b. Used to amplify the high frequency signals.

c. Tuned amplifiers

5. Give the two draw backs of class C amplifier.

The drawbacks of class C amplifier are,

a. Distortion is high.

b. Figure of merit is low.

6. Define the following modes of operation

(a) Class AB (b) Class C.

a. Class AB

In this mode of operation, the output current flows for more than one half cycle but less than full cycle.

b. Class C

In this mode, the level current flows for less than one half cycled i.e., ¼ th of the input cycle.

7. Define Class B mode of operation and its advantages and disadvantages.

Class B mode of operation The Biasing signal and input signal flow through the circuit for half cycle i.e., 180o.

Advantages

a. Efficiency is increased from 25% to 78.5%

b. Due to push pull configuration all even harmonics are reduced.

So harmonic distortions are reduced.

c. Due to centre-tapped transformer at input and output, the core

Saturation loss is reduced.

Disadvantages

a. Transistor is biased above the cut off region

b. Due to the centre-tapped transformer at both input and output,

the circuit becomes complex

8. What is Class D amplifier?

In order to increase the conversion efficiency, it would be desirable to make the device tooperate as a switch. So that its voltage drop remains almost at minimum value over the half cycle of output current flow. Such a system is called class D amplifier.

9. Why RC coupling is popular?

RC coupling is popular because it is simple, less expensive, less distortion and it provides Uniform bandwidth.

10. List the advantages of transformer coupled amplifier.

The advantages of transformer coupled amplifier are,

a. it is more efficient because the low DC resistance of the primary is connected to the collector circuit.

b. It provides excellence impedance matching, thus voltage and power gains are improved.

11.What is the use of transformer coupling in the output stage of multistage amplifier?

The transformer coupling provides impedance matching between input and output. As a result the power gain is improved.

12.State the reason for fall in gain at low frequencies in the RC coupled amplifier.

a. The coupling capacitance (input) has very reactance at low frequency. Therefore it will allow only a small part signal from one stage to next stage.

b. The bypass capacitor cannot bypass or shunt the emitter resistor effectively. As a result of these factors, the voltage gain rolls off at low frequency.

13.State the reason for fall in gain at high frequencies.

At high frequency, the reactance of coupling capacitor (output) is very low. Therefore it provides like a short circuit. As a result of this, the loading effect of the next stage increase which reduces the voltage gain. Hence the voltage gain falls off at high frequencies.

14.What is amplitude or non linear distortion?

In case of large signal amplifier, the input signals are large in amplitude. So the operation extends to non linear region of its transfers characteristics. Of the signal excursion enters the non-linear region then distortion occurs in the output. Such a distortion is called non-linear distortion.

15.Define figure of merit.

Figure of merit is defined as the ratio of maximum collector current dissipation power to the maximum AC power developed across the load.

16.Write the advantages of heat sink?

The advantages of heat sink are,

a. The temperature of the case gets lowered.

b. The power handling capacity of the transistors can approach the rapid maximum value.

17. Define inter modulation distortion?

Inter modulation distortion is a type of non-linear distortion. Which generate frequency components not harmonically related to the signal frequencies. It occurs when the input signal contains more than the one frequency.

18.What is the use of heat sink?

The heat sink is used to observe the heat produce in the transistor junctions while itsoperation. Usually power amplifiers are provided with heat sinks. The heat sink is a large, black metallic heat-conducting device placed in close contact with the transistor.

19.What is the maximum power dissipation hyperbola?

Maximum power dissipation hyperbola represents focus of all the points at which thecollector dissipation is exactly Pc Max . The Q point must lie on or below the hyperbola for safe operation.

20.Write the maximum power handling of the class C power amplifier?

The maximum power in class C power amplifier is,

$P_{cmax} = 5/12\ (T/To)(Vcc2/R_L)$

21. State the merits of using push pull configuration.

The merits of push pull configurations are,

a. Efficiency is high (78.5%)

b. Figure of merit is high

c. Distortion is less.

d. Ripple present in the output due to power supply is multiplied.

22.What are the advantages of using complementary symmetry configuration?

The advantages of using complementary symmetry configuration are,

a. It does not use centre-tapped transformer either at input or output.

b. It uses one PNP transistor and one NPN transistor hence it provides proper impedancematching. Hence its voltage gain is unity.

23.Define conversion efficiency of a power stage.

The ratio of the AC output power delivered to the load to DC input power applied is referred to as conversion efficiency. It is also called as collector circuit efficiency in case of transistor amplifier.

Signal power delivered to the load x 100 = DC Power supplied at input circuit

24. What is cross over distortion?

In class B mode both transistors are biased at cut off region because the DC bias voltage is zero. So input signal should exceed the barrier voltage to make the transistor conduct. Otherwise the transistor doesn't conduct. So there is a time interval between positive and negative alternations of the input signal when neither transistor is conducting. The resulting distortion in the output signal is cross over distortion.

25. How cross over distortion is eliminated?

To avoid cross over distortion, a light forward bias (0.3Vfor ge 0.6V for Si) voltage is applied to the emitter junction of both the transistors. It causes transistor to conduct immediately when the input signal is applied. So Q point is fixed above cut off.

26.What are the advantages & drawbacks of the transformer coupled amplifier?

The advantages of transformer coupled amplifier are,

a. it is more efficient because the low DC resistance of the primary is connected to the collector circuit.
b. It provides excellence impedance matching, thus voltage and power gains are improved.
c. The transformer coupling provides impedance matching between input and output. As a result the power gain is improved.

The **disadvantages** of transformer-coupled amplifiers are,

a. Transformer are bulky
b. Loss is more
c. Centre-tapped of transformer is difficult.

27.Define conduction angle in power amplifier?

The time during which the transistor conducts i.e. (the collector current is non zero) when an input sinusoidal signal is applied in a power amplifier is defined as Conduction angle.

28.What are types of power amplifier based on conduction angle?

There are mainly four types of amplifiers based on conduction angle. They are

a) Class A amplifiers b) Class B amplifiers c) Class AB amplifiers
d) Class C amplifiers

29.What is class A, Class B, Class AB, Class C amplifiers?

Class A amplifier: In class-A amplifiers the collector is biased at a value greater than the amplitude of AC signal current. Hence the conduction angle is 360 Degrees i.e. the Class A stage conducts for the entire cycle for the input signal.

Class B amplifier: Class B amplifiers are biased at zero DC bias collector current. Hence it conducts only for half of the input signal cycle, so the conduction angle for class B amplifier is 180 Degrees.

Class AB amplifier: In class AB amplifiers the biasing current is non zero but much smaller than the peak current of the sine wave signal. As a result the transistor conducts for interval slightly greater than half a cycle. The conduction angle is slightly greater than 180 Degrees.

Class C amplifier: In class C amplifier the transistor conducts for an interval less than the half cycle. Hence the conduction angle is less than 180 Degrees.

30.What is push-pull amplifier?

A push pull amplifier is a special type of arrangement used in class B amplifiers where the active device pair push (supply) current and pull (absorb) current from load. Push pull amplifiers are more efficient than the single ended power amplifiers. Because of the symmetric construction of two sides of the amplifier the even harmonics are cancelled and output signal distortion can be minimized. Another advantage of the push pull amplifier is the effect of ripple voltage that may be contained in the power supply is balanced out. The main disadvantages of the push pull amplifier are the need for two identical transistors and the requirement of bulky and costly coupling transformers used for phase splitting.

31.What is complementary push-pull amplifier?

Complementary Push-pull amplifiers use two "complementary" or matching transistors, one being an NPN-type and the other being a PNP-type with both power transistors receiving the same input signal together that is equal in magnitude, but in opposite phase to each other. This results in one transistor only amplifying one half of the input waveform cycle while the other transistor amplifies the other half of the input waveform cycle with the resulting "two-halves" being put back together again at the output terminal. In complementary push pull amplifier neither an input nor an output transformer is needed. The main difficulty with this circuit is the if there is unbalance in the characteristic f the two transistors considerable distortion will be introduced.

UNIT V:

TUNED AMPLIFIERS

1. What is a tuned amplifier?

The amplifier with a circuit that is capable of amplifying a signal over a narrow band of frequencies Are called tuned amplifiers.

2. What are the different coil losses?

- Hysteresis loss
- Copper loss
- Eddy current loss

3. What is Q factor?

It is the ratio of reactance to resistance.

4. What is dissipation factor?

It is referred as the total loss within a component i.e1/Q

5. What is the classification of tuned amplifiers?

i) Single tuned ii) Double tuned iii) Stagger tuned

6. What is a single tuned amplifier?

An n amplifier circuit that uses a single parallel tuned circuit as a load is called single tuned amplifier.

7. What are the advantages of tuned amplifiers?

- They amplify defined frequencies.
- Signal to noise ratio at output is good
- They are suited for radio transmitters and receivers

8. What are the disadvantages of tuned amplifiers?

- The circuit is bulky and costly
- The design is complex.
- They are not suited to amplify audio frequencies.

9. What is neutralization?

The effect of collector to base capacitance of the transistor is neutralized by introducing a signal that cancels the signal coupled through collector base capacitance. This process is called neutralization.

10. What are double tuned amplifiers?

The amplifiers having two parallel resonant circuit in its load are called double tuned amplifiers.

11. What is a stagger tuned amplifier?

It is a circuit in which two single tuned cascaded amplifiers having certain bandwidth are taken and their resonant frequencies are adjusted that they are separated by an amount equal to the bandwidth of each stage. Since resonant frequencies are displaced it is called stagger tuned amplifier.

12. What are the advantages of stagger tuned amplifier?

The advantage of stagger tuned amplifier is to have better flat, wideband characteristics.

13. What are the different types of neutralization?

1. Hazeltine neutralization
2. Rice neutralization
3. Neutrodyne neutralization.

14. What is rice neutralization?

It uses center tapped coil in the base circuit. The signal voltages at the end of tuned basecoil are equal and out of phase.

15. What is unloaded Q?

It is the ratio of stored energy to the dissipated energy in a reactor or

16. Write short notes on Tuned amplifiers.

The class C operation is not suitable for audio frequency power amplifier .The class C amplifiers are used in tuned circuits and used in communication areas and in radio frequency circuits with tuned RLC loads. As used in tuned circuits, class C amplifiers are called as tuned amplifier. The class C operation is never used for frequency amplifiers.

17. Define the Frequency distortion.

Distortion can occur because the device characteristic is not linear, in which case nonlinear or amplitude distortion occurs. This can occur with all classes of amplifier operation. Distortion can also occur because the circuit elements and devices respond to the input signal differently at various frequencies, this being frequency distortion. The change in gain of the amplifier with respect to the frequency is called Frequency distortion.

18. What is a harmonic component or harmonics & examples.

One technique for describing distorted but period waveforms uses Fourier analysis, a method that describes any periodic waveform in terms of its fundamental frequency component and frequency components at integer multiples—these components are called harmonic components or harmonics.

examples of harmonic component

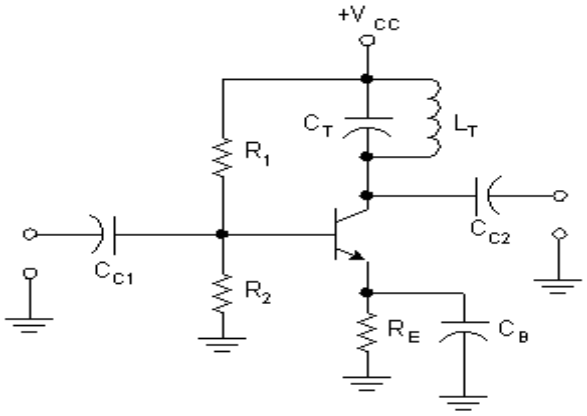
For example, a signal that is originally 1000 Hz could result, after distortion, in a frequency component at 1000Hz (1 kHz) and harmonic components at 2 kHz (2 X1 kHz), 3 kHz (3 X 1 kHz), 4 kHz (4 X 1 kHz), and so on. The original frequency of 1 kHz is called the fundamental frequency; those at integer multiples are the harmonics. The 2-kHz component is therefore called a second harmonic that at 3 kHz is the third harmonic, and so on. The fundamental frequency is not considered a harmonic. Fourier analysis does not allow for fractional harmonic frequencies—only integer multiples of the fundamental.

19. Define harmonic distortion.

In practical circuits, the dynamic characteristic is not perfectly linear. Due to such nonlinearity in the dynamic characteristics, the wave form of the output voltage differs from that of input signal. Such a distortion is called nonlinear distortion or amplitude distortion or harmonic distortion.

20 What is tuned amplifier? Where it is used?

Tuned amplifier is one in which a tuned circuit is introduced in to the output circuit which draws maximum power output only for a specified range of frequencies. Example of a tuned amplifier is shown below



The tuned amplifier shown in the figure will deliver maximum power only in the bandwidth of LC resonant circuit. Tuned amplifiers are used in video and radio frequency applications. They are used as frequency selective amplifiers in multi communication channels such as radio and TV broadcasting through wireless medium where each station is assigned a frequency band. They are used in RF/Wireless transceivers and intermediate stages of IF amplifiers.

21.What is double tuned amplifier?

Double tuned amplifier is one (or) more stages with each stage using coupled circuits having different frequencies of resonance. The two resonant circuits are normally inductively coupled. The tuning is done in both secondary and primary circuits. Following are some of the advantages of double tuned amplifiers:

a) Large gain bandwidth : For simplicity assume the stages are non-interacting (Generally this is the case as these stages are inductively coupled) then the overall voltage Gain = (Av)^n/(1+w^2)^(1/2) and bandwidth = B.W*(2^(1/n)-1)^(1/2) (since for n Non-interacting stages with each stage having lower and upper cut-off frequencies as fl, fh , the upper and lower cut-off frequencies are given as follows fh" = fh*(2^(1/n)-1)^(1/2) , fl" = fl/(2^(1/n)-1)^(1/2) and fh">>fl").

b) Large 3 db bandwidths.

c) Provides a frequency response having flatter sides.

d) Sensitivity can be increased due to increased overall gain. Here sensitivity refers to the ability to receive weak signals.

e) Selectivity can be increased. This is due to decrease in quality factor due to increase in bandwidth. Sensitivity is inversely proportional to quality factor. Selectivity refers to the ability to discriminate the signals in adjacent band.

Quality factor of a double tuned amplifier is given as

$$Qeff = fr*(2^{(1/n)}-2)^{(1/2)}/(B.W)$$

Double tuned amplifier are used in many applications, one of which is IF amplifier in analog communication receiver.

22.What is stagger tuned amplifier?

In stagger tuned amplifiers one or more tuned amplifier stages are cascaded with each stage having different tuned frequencies, i.e. a number of tuned circuits with active elements operated in union. The name stagger tuned amplifier comes from the fact that the resonant frequencies of different tuned circuits are displaced or staggered. They are characterized by increased bandwidth and reduced selectivity.