EC 8452

ELECTRONIC CIRCUITS-II

UNIT-I

FEEDBACK AMPLIFIERS

2 MARK QUESTIONS:

1). (a) Define feedback. (or) What is meant by feedback?

The process of combining a fraction or part of output energy back to the input is known as feedback.

2).(a) What are the types of feedback? (or) Classify the different types of feedback. (or) What are the 2 types of feedback amplifiers?

The different types of feedback are:

1. Positive feedback. 2. Negative feedback.

3). (a). What is meant by positive feedback? (or) Define direct feedback. (or) Define Regenerative feedback.

If feedback signal applied is in phase with the input signal and thus increases the input, it is called as positive feedback. it is also known as regenerative feedback.

4). (a). What is meant by negative feedback? (or) Define inverse feedback. (or) Define degenerative feedback.

If the feedback signal applied to the input is out of phase with the input signal and thus signal decrease, it is called negative feedback. It is also known as degenerative feedback.

5).How are the amplifiers classified based on the input and output.

The amplifier is basically classified into four types based on the input given and output is obtained. They are

1).Voltage amplifier. 2).Current amplifier. 3).Transconductance amplifier. 4).Transresistance amplifier.

6). What are the effects of negative feedback?[APR-2003] (or) What are the advantages of negative feedback?[APR-2004]

1. It improves the stability of the circuit.

2. It improves the frequency response of the amplifier.

3. It improves the percentage of harmonic distortion.

4. It improves the signal to noise ratio (SNR).

5. It reduces the gain of the circuit.

7). What are the classifications of feedback amplifiers? (or) List the four basic types of negative feedback.

1. Current series feedback.

2. Current shunt feedback.

3. Voltage series feedback

4. Voltage shunt feedback

8).Define the feedback factor β?

It is the ratio between the feedback voltages to the output voltage of the amplifier.

$$\beta = V_f / V_o$$

Where

β is a feedback factor (or) feedback ratio.

V_f is the feedback voltage.

V_o is the output voltage.

9). Define Desensitivity D?[APR – 2004]

Desensitivity is defined as the reciprocal of sensitivity. It indicates the factor by which the voltage gain has been reduced due to feedback network.

Desensitivity factor (D) = $1+A\beta$.

Where

A = Amplifier gain. β = Feedback factor.

10). Define loop gain. (or) What is meant by return ratio?

The signal Vi is multiplied by 'A' in passing through the amplifier is multiplier by 'β' .

In transmission through the feedback network and is multiplied by '-1' in the mixer. The product of '$- A\beta$' is called the loop gain (or) return ratio.

11).What is current-series feedback amplifier. (or) What is Transconductance amplifier?

In a current series feedback amplifier the sampled signal is a current and the feedback signal (Which is fed in series)is a voltage.

$Gm = I_o / Vi$

Where

Gm = Amplifier gain.

I_o = Output current.

Ii = Input current.

12). what is voltage series feedback amplifier? (or) What is voltage amplifier?

In a voltage series feedback amplifier the sampled signal is a voltage and feedback signal(Which is fed in series) is also a voltage.

$A = V_o / Vi$

Where

A = Amplifier gain. V_o = Output voltage. Vi = Input voltage.

13). What is Voltage shunt feedback? (or) What is Transresistance amplifier?.

In voltage shunt feedback amplifier the sampled signal is a voltage and the feedback signal(Which is fed in shunt)is a current.

$$Rm = V_o / Ii \quad (or) \quad V_o = Rm. Ii$$

Where

Rm = Amplifier gain.

V_o = Output voltage.

Ii = Input current.

14). What is current -shunt feedback amplifier? (or) What is current amplifier?

In a current shunt feedback amplifier, the sampled signal is a current and the feedback signal(Which is fed in shunt) is a current.

$$A = I_o / Ii \quad (or) \quad I_o = A\ Ii\ .$$

Where

A = Amplifier gain. I_o = Output current. Ii = Input current.

15). Write the expression for gain with feedback for positive and negative feedback.

For positive feedback:

$$Af = A / (1-A\ \beta)$$

For negative feedback:

$$Af = A / (1+A\ \beta)$$

Where,

Af = Amplifier gain with feedback.

A = Amplifier gain without feedback.

β = Feedback factor.

16). Give an example for current-series feedback amplifier. (or) Give an example for transconductance amplifier.

The common emitter amplifier with Re in the emitter lead and FET common source amplifier stage with source resistor R are the best expel for current series feedback circuit.

17). Give an example for Voltage shunt feedback? (or) Give an example for Transresistance amplifier?

The collector feedback biased common emitter amplifier is an example of voltage – shunt feedback circuit.

18). Give an example for voltage series feedback. (or) Give an example for voltage amplifier.

The common collector (or) emitter follower is an example of voltage series feedback.

19).Distinguish between series and shunt feedback amplifiers.

Series feedback:

(i). In series feedback amplifier the feedback signal is connected in series with the input signal.

(ii). It increases the input resistance.

Shunt feedback:

(i). In shunt feedback amplifier the feedback signal is connected in shunt with the input signal.

(ii). It decreases the input resistance.

20).What is the nature of input and output resistance in negative feedback.

(1). Voltage series feedback:

Input impedance: $Z_{if} = Z_i / (1+A\beta)$

Output impedance: $Z_{of} = Z_o / (1+A\beta)$

(2). Voltage shunt feedback:

Input impedance:

$$R_{if} = R_i * (1+A\ \beta)$$

Output impedance:

$$Zo_f = Zo * (1+ A\ \beta)$$

(3). Current series feedback:

Input impedance:

$$R_{if} = Z_i / (1+A\ \beta)$$

Output impedance:

$$Z_{of} = Z_o / (1+A\ \beta)$$

(4). Current shunt feedback:

Input impedance:

$$R_{if} = R_i / (1+A\ \beta)$$

Output impedance:

$$R_{of} = R_o / (1+A\ \beta)$$

21. Give the effect of negative feedback on amplifier characteristics.

	Characteristics			
Type of feedback	**Voltage gain**	**Bandwidth**	**Input resistance**	**Output resistance**
Current-series	Decreases	Increases	Increases	Increases
Voltage-series	Decreases	Increases	Increases	Decreases
Voltage-shunt	Decreases	Increases	Increases	Decreases
Current-shunt	Decreases	Increases	Increases	Increases

UNIT –II

OSCILLATOR

1. What is Barkhausan criterion? [NOV/DEC 2003] [APRIL- 2004]

The conditions for oscillator to produce oscillation is given by Barkhausan criterion. They are :

(i). The total phase shift produced by the circuit should be 360^o or 0^o

(ii).The Magnitude of loop gain must be greater than or equal to 1

i.e. $|A .\beta 1 \leq |$.

3. What are the types of sinusoidal oscillator? Mention the different types of sinusoidal oscillator?

1.RC phase shift Oscillator.

2.Wein bridge Oscillator.

3.Hartley Oscillator

4.Colpitts Oscillator

5.Crystal Oscillator

4. Name two low frequency Oscillators.

1.RC phase shift.

2.Wein bridge Oscillator.

5. Name two high frequency Oscillators.

i. Hartley Oscillator ii. Colpitts Oscillator iii.Crystal Oscillator

6. Mention the expression for frequency of Oscillation for a Hartley Oscillator? [APRIL - 2003]

$F = 1/ 2\pi \sqrt{C (L_1 + L_2)}$

C = Capacitance Value used in tunning Circuits.

L_1, L_2 = Inductance Value Used in tunning Circuits.

Where

C, L_1, L_2 are elements used in tunning circuit.

7. What is an Oscillator?

An Oscillator is a Circuit, which generates an alternating voltage of any desired frequency. It can generate an a.c output signal without requiring any externally applied input signal.

8. i**).What did you understand by the term stability of an Oscillator?**

(Or)

ii). Define stability of an Oscillator. (or) iii). Why is amplitude stabilization required?

The frequency stability of an Oscillation is a measure of its ability to maintain the required frequency as precisely constant as possible over along period of time interval.

9. **What are the essential parts of an Oscillator?**

i. Tank circuit (or) Oscillatory circuit. ii. Amplifier (Transistor amplifier)

iii. Feedback Circuit.

10. **i. What are the advantages of Rc phase shift Oscillator? (or) ii. List the advantages of Rc phase shift Oscillator.**

i. It is best suited for generating fixed frequency signals in the audio frequency range.

ii. Simple Circuit.

iii.Pure sine wave output is possible.

11. i. List the disadvantages of Rc phase shift Oscillator. (or)

ii. What are the merits of Rc phase shift Oscillator.

i. It is ideal for frequency adjustment over a wide range.

ii. It requires a high β transistor to overcome losses in the network.

12. List the disadvantages of crystal Oscillator.

1.It is suitable for only low power circuits

2.Large amplitude of vibrations may crack the crystal.

3.It large in frequency is only possible replacing the crystal with another one by different frequency.

13. What is meant by resonant Circuit Oscillators?

LC Oscillators are known as resonant circuit oscillator because the frequency of operation of LC Oscillator is nothing but a resonant frequency of tank circuit or LC tank circuit produces sustained Oscillation at the resonant circuit oscillator.

14. Which Oscillator involves both positive and negative feedback?

A wein bridge Oscillator circuit both positive and negative feedback are employed.

15. What is piezo electric effect?

The piezo electric Crystals exhibit a property that if a mechanical stress is applied across one face the electric potential is developed across opposite face. The inverse is also live. This phenomenon is called piezo electric effect.

16 .Classify the different types of Oscillators.

i. According to waveform generation

a. Sinusoidal Oscillator.

b. Relaxation Oscillator.

ii. According to the fundamental mechanism involved

a. Negative resistance Oscillator.

b. Feed back Oscillator.

iii. According to frequency generated

a. Audio frequency Oscillator (Up to 20KHZ)

b. Radio frequency Oscillator (20KHZ)

c. Very high frequency oscillator (30 MHZ to 300 MHZ).

d. Ultra high frequency Oscillator (300 MHX to 3 GHZ).

e.Microwave frequency Oscillator (> 3 GHZ).

iv. According to type coupling.

1.LC Oscillator.

2.RC Oscillator.

17. Why RC phase shift is needed in a RC phase shift Oscillator?

The amplifier used causes a phase shift of 180^o than the feedback network should create phase shift of 180^o , to satisfy the Barkhausen Criterion. Hence in a phase shift oscillators, three sections of RC circuit are connected in cascade, each introducing a shift of 60^o , thus introducing a total phase shift of 180^o, due to feedback network.

18 . What are the advantages of crystal Oscillators over other Oscillator?

To maintain the output frequency of an oscillator at a constant value, a crystal may be used to control the frequency of oscillation.

19. What is negative resistance? Name a few devices which offers this resistance.

It is defined as the resistance of a device which offers when operated in the negative resistance region. Ex :- Tunnel diodes, UJT .. etc.,

20. What are parasitic Oscillators?

In a practical amplifier circuit due to stray capacitances and lead inductances, oscillations result, since the circuit conditions satisfy the Barkhavsen's criterion. These Oscillators are called as unwanted or parasitic Oscillations.

21. Define gain and phase Margin .

Gain Margin : It is defined as the value of /Aβ/ in decibels at the frequency at which the phase angle of Aβ is 180^o, negative gain margin signifies decibel rise in open loop gain a theoretical possibility without oscillation. A positive gain margin signifies that amplifier is potentially unstable.

Phase Margin : It is defined as 180^o minus the Magnitude of angle of Aβ at the frequency at which /Aβ/ is unity.

22. What is a beat frequency oscillator?

Beat frequency Oscillator (BFO) is an Oscillator in which a deserved signal frequency such as the beat frequency produced by combining the different signal frequencies such as on different radio frequencies.

23. What is Master Oscillator?

Master Oscillator is an Oscillator that establishes the carrier frequency of the output of a transmitter.

24. What is damped Oscillation?

The electrical Oscillations in which the amplitude decreases with time are called as damped Oscillation.

25. What is sustained Oscillation?

The electrical oscillations in which amplitude does not change with time are called as sustained oscillations. It is also called as Undamped Oscillation.

UNIT III

TUNED AMPLIFIERS

1. What is meant by tuned amplifiers?

Tuned amplifiers are amplifiers that are designed to reject a certain range of frequencies below a lower cut off frequency ω_L and above a upper cut off frequency ω_H and allows only a narrow band of frequencies.

2. Classify tuned amplifiers.

1.Single tuned amplifier.

2.Double tuned amplifier.

3.Synchronously tuned amplifier.

4.Stagger tuned amplifier.

3. What are the advantages of double tuned amplifier?

* In double tuned amplifiers, the tuning is done both at the primary and secondary.

* The double tuned amplifiers provide a wider bandwidth, flatter pass band and a greater selectivity.

4. Define resonance.

The reactance of the capacitor equals that of the inductor reactance.

i.e $\omega_C = 1 / \omega_L$.

5. What is Quality factor?

The ratio of inductive reactance of the coil at resonance to its resistance is known as quality factor.

$$Q = X_L / R$$

6. Define gain bandwidth product of a tuned amplifier.

The gain bandwidth(GBW) product is a figure of merit defined in terms of mid band gain and upper 3-db frequency f_h as

$$GBW = | A_{im} f_h | = g_m / 2\pi c$$

7. What is the other name for tuned amplifier?

Tuned amplifiers used for amplifying narrow band of frequencies hence it is also known as " narrow band amplifier" or "Band pass amplifier".

8. What is a synchronously tuned amplifier?

When tuned amplifiers are cascaded if all the amplifier stages are identical and tuned to same frequency f_o then it is called as synchronously tuned amplifier. This results in a increased in gain and reduction in bandwidth.

9. What is meant by neutralization?

It is the process by which feedback can be cancelled by introducing a current that is equal in magnitude but 180^o out of phase with the feedback signal at the input of the active device. The two signals will cancel and the effect of feedback will be eliminated. This technique is termed as neutralization.

10. What is unilateralisation?

It is the phenomenon by which a signal can be transmitted from the input to the output alone and not vice versa. In an unilateralised amplifier both resistive and reactive effects are cancelled.

11. What is stagger tuned amplifier?

In this configuration one or more tuned amplifiers are cascaded each amplifier stage is tuned to different frequencies. This results in decreased gain and increased bandwidth.

12. What is the effect of 'Q' on stability?

Higher the value of Provides better selectivity, but smaller bandwidth and larger gain. Hence it provides less stability.

13. What is the application of tuned amplifiers?

The application of tuned amplifiers to obtain a desired frequency and rejecting all other frequency in

(i). Radio and T .V broadcasting as tunning circuit.

(ii). Wireless communication system.

14. What is meant by unloaded and loaded Q of tank circuit. [APR – 2003]

* Unloaded Q is the ratio of stored energy to dissipated energy in a reactor or resonator.

* The loaded Q (or) Q_L of a resonator is determined by how tightly the resonator is coupled to its terminations.

15. Mention the applications of class 'c' tuned amplifier.[APR – 2003]

* One of the most common applications for mixer is in radio receivers. The mixer is used to convert incoming signal to a lower frequency where it is easier to obtain the high gain and selectivity required.

* Mixer circuits are used to translate signal frequency to some lower frequency or to some higher frequency. When it is used to translate signal to lower frequency it is called down converter. When it is used to translate signal to higher frequency, it is called up converter.

16. Mention the need for stagger-tuned amplifier.

The double tuned amplifier gives greater 3 db bandwidth having steeper sides and flat top. But alignment of double tuned amplifier is difficult. To overcome this problem two single tuned amplifiers are cascaded.

17. What are the advantages of tuned circuit?

1. High selectivity
2. Smaller collector supply voltage
3. Small power gain.

18. Mention the bandwidth of a double tuned amplifier.

$$\text{Bandwidth}(\omega_2 - \omega_1) = \omega_o / Q \quad \sqrt{(b^2 - 1) + 2b}$$

Where, ω_o is the resonance frequency in cycle per sec.

Q is the Quality factor of the coil alone. B is a constant.

19. What is principle of Hazel tine neutralization?

Hazel tine introduced a circuit in which the troublesome effect of the collector to base capacitance of the transistor was neutralized by introducing a signal which cancels the signal coupled through the collector to base capacitance.

20. List the performance measure of a tuned amplifier.

1. Selection of a desired radio frequency signal.
2. Effective quality factor.
3. Gain
4. Bandwidth.

21. What are the characteristics of an ideal tuned amplifier?

1. Selects a single radio frequency and amplifiers the same by rejecting all other frequencies.
2. Bandwidth is zero.
3. Harmonic distortion is zero.

22. Write down the relationship between bandwidth and effective Q of a tuned amplifier?

Bandwidth = ω_o / Q effective.

23. What are the different methods of coupling? (or)

Point out different methods of coupling the load to a tuned amplifier.

The different methods of coupling the load to a tuned amplifier are:

1. Capacitive coupling.
2. Inductive coupling.

24. Why tuned amplifier cannot be used at low frequency?

For low frequencies the size L and C are large. So the circuit will be bulky and expensive, hence the tuned amplifiers cannot be used at low frequency.

25. What are band pass amplifiers?

Band pass amplifiers are amplifiers circuits which allows a certain range of frequencies in between two cut off frequencies (f_1,f_2) and attenuates all the other frequencies or rejects all other frequencies.

26. What are the drawbacks of a single tuned amplifier?

1. Narrow bandwidth on smaller pass band, which will result in poor production of the audio signal.
2. The sides (and the top) of a gain versus frequency curve are not steeper.

UNIT-IV

WAVE SHAPING AND MULTIVIBRATOR CIRCUIT

1. What is a linear waveform-shaping circuit?

The process by which the shape of a nonsinusoidal signal is changed by passing the signal through the network consisting of linear elements is called Linear Wave Shaping.

2. Define integrator.

Integrator is a circuit that passes low frequencies of the input and attenuates high frequencies. Integrator implies that the output voltage is an integral of the input voltage.

3. Define differentiator.

Differentiator is a circuit that passes high frequencies of the input and attenuates low frequencies. It implies that the output voltage is the differential of the input.

4. What is meant by clippers?

The circuit with which the waveform is shaped by removing a portion of the input signal without distorting the removing part of the alternating waveform is called a clipper.

5. What is meant by clampers?

Clamping network shifts (clamp) a signal to a different d.c level, i.e., it introduces a d.c level to an a.c signal. Hence, the clamping network is known as d.c restorer.

6. What is meant by multivibrator?

Multivibrators are two stage switching circuits in which the output of the first stage is fed to the input of the second state and vice-versa. The outputs of two stages are complementary.

7. List the types of multivibrator.

I. Astable multivibrator

II. Bistable multivibrator

III. Monostable multivibrator.

8. Define Astable multivibrator.

Astable multivibrator is a multivibrator in which neither state is stable. There are two temporary states. The circuit changes state continuously from one quasi stables state to another at regular intervals without any triggering. This generates continuous square waveform without any external signal.

9. Define monostable multivibrator.

When a trigger pulse is applied to the input circuit, the circuit state is changed abruptly to unstable state for a predetermined time after which the circuit returned to its original stable state automatically.

10. Define the Bistable multivibrator.

Bistable multivibrator signifies a circuit which can exist indefinitely in either of two stable states and which can be induced to make an abrupt transition from one state to other by applying an external triggering signal.

11. What is the use of commutating capacitors?

The Commutating capacitors can be used to reduce the transition time in a low to high level and vice versa.

12. What are the features of a collector coupled Astable multivibrator?

1. In the circuit there exits a capacitive coupling between the stages. So both the transistors cannot remain at cut off.
2. The circuit has two quasi-stable states, between which it can make transitions.

13. What is delay time?

The time required for the current to rise to 10% of its maximum (saturation) value Ics is called the delay time t_d.

14.What is the total turn on time?

The total turn on time is t_{on} is the sum of the delay time and rise time,

$$t_{on} = t_d + t_r$$

Where,

t_d = Delay time.

t_r = Rise time.

15. What is storage time?

The interval that elapses between the transition of the input waveform and the time when the collector current has dropped to 90 % of total output is called the storage time t_s.

16. Define transition time.

The time interval during which the conduction transfer from one transistor to another transistor is defined as transition time.

17. Define resolving time.

It is the minimum time interval between two consecutive trigger pulses and equals to transition time plus the settling time.

18. What is meant by linear wave shaping circuit?

The action of a linear network in producing a waveform at its outputs different from its output is known as linear wave shaping circuit.

19. What is meant by Schmitt trigger?

In a circuit which converts sine wave into a square wave. It also has two opposite operating states as in all multivibrator. In this case the triggering signal is a slowly varying a.c voltage.

20. Define UTP and LTP.

UTP [Upper trigger point] is the point at which the transistor enters into conduction.i.e., OFF to ON state.

LTP [Lower trigger point] is the point at which the transistor enters from ON to OFF state.

21. What are different types of triggering of bistable multivibrator?

1. Asymmetrical triggering.
2. Symmetrical triggering.

22. Define Symmetrical triggering.

It is the method of triggering, by which pulses are applied at only one input and these are steered or directed to appropriate transistors sequentially.

23. What is meant by unsymmetrical triggering?

If two signals from two separate trigger source are used, one signal to cause the change in one direction.i.e.,from ON to OFF and the other signal cause change from OFF to On. It is used in logic circuit.

24. What is meant by hysterisis?

The input voltage difference between UTP and LTP is known as hysterisis.

25. Define Settling time.

It is defined as the time required for recharging of commutating capacitors after transfer of conduction.

26. Distinguish oscillator and multivibrator.

Multivibrator operates in non-linear region of transfer characteristics and oscillator operators linear or active region of its transfer characteristics.

UNIT-V

BLOCKING OSCILLATORS AND TIMEBASE GENERATORS

1. What is blocking oscillator?

The circuit which uses a regenerative feedback, producing a single pulse or pulse train is called a blocking oscillator.

2. Which are the two important elements of a blocking oscillator?

1. Active element like transistor.
2. A pulse transformer.

3. What is the function of pulse transformer in blocking oscillator?

A pulse transformer is used to couple output of the transistor back to the input. The nature of such feedback through pulse transformer is controlled by relative winding polarities of a pulse transformer.

4. What is pulse transformer?[APR-2004]

A pulse transformer is basically a transformer which couples a source of pulses of electrical energy to the load, keeping the shape and other properties of pulses unchanged. The voltage level of the pulse can be raised or lowered by designing the proper turns ratio for the pulse transformer.

5. State the features of pulse transformer.

1. Generally iron cored and small in size.
2. The leakage inductance is minimum.
3. The interwinding capacitance is low.
4. The cores have high permeability.
5. They have high magnetizing inductance.

.6. What is Leading edge response?

At start there is an overshoot and then the pulse settles down. The response till it settles down after the overshoot is called leading edge response.

7. What is trailing edge response?

The response generally extends below the zero amplitude after the end of pulse width is called back swing. The portion of response from backswing till it settles down is trailing edge response.

8. What is flat top response?

The portion of the response between the trailing edge and the leading edge is called flat top response.

9. Define rise time of a pulse.

The rise time is an important parameter related to this part of the response. It is defined by the time required by the pulse to rise from 10 % of its amplitude to 90 % of its amplitude.

10. Define the displacement error e_d of a sweep voltage.(NOV-2003)

It is defined as the maximum difference between the actual sweep voltage and linear sweep voltage which passes through the beginning and end points of the actual sweep. It is another way of specifying the linearity of a sweep waveform.

11. Mention the application of the pulse transformer.(NOV-2003).

1. To change the amplitude and impedance level of a pulse.
2. To invert the polarity of the pulse.
3. To provide dc isolation between source and a load.
4. To differentiate a pulse.
5. For coupling the stages of a pulse amplifier
6. Also used in digital signal transmission.

12. what is current time base generator?

The circuit which produces current which linearly increases with time is called current time base generator.

13.What are the application of the blocking oscillator?(APRIL-2004)

1. The blocking oscillator can be used as low impedance switch used to discharge a capacitor very quickly.
2. To produce large peak power pulses, both the types of oscillators cab be used.
3. The output of the blocking oscillator can be used to produce gating waveform with very low mark space ratio.
4. It may be used as frequency divider or counter in digital circuits.

14. List varies sweep circuit.

1. Exponential charging circuit
2. Constant-current charging circuit.
3. Miller circuit
4. Boot strap circuit
5. Inductor circuit.

15. What do you mean by voltage time base generators?

Circuits used to generate a linear variation of voltage with time are called voltage time-base generators.

16. What do you mean by linear time base generator?

Circuits provide an output waveform which exhibits a linear variation of voltage with time are called linear time base generators.