# Unit 1: Linear wave shaping

1. What do you mean by linear wave shaping?

A. Linear wave shaping is the process whereby the form of a non-sinusoidal signal is altered by transmission through a linear network.

2. What do you mean by cut-off frequency?

A. The cut-off frequency is the frequency at which the gain is 1/√2, i.e. 0.707 of its maximum value.

3. What do you mean by time constant of a circuit?

A. The time constant τ of a circuit is defined as the time taken by the output waveform to reach its final value if the initial slope is maintained when a step signal is applied.

The time constant of the circuit is also defined as the time taken by the output waveform to rise to 63.2% of its final value for a step input. For RC circuits, τ=RC and for RL circuits, τ=L/R.

4. Define rise time and write its expression.

A. The rise time is defined as the time taken by the output voltage waveform of a low-pass circuit to rise from 10% to 90% of its final value.

 tr =2.2RC = 0.35/f2 = 0.35/BW

5. When does a low-pass circuit act as an integrator?

A. A low-pass circuits acts as an integrator if its time constant is very large in comparison with the time required for the input signal to make an appreciable change.

6. Why is the capacitor in an RC high-pass circuit called a blocking capacitor?

A. The capacitor in an RC high-pass circuit is called a blocking capacitor because it blocks the dc components from going from input to output.

7. Write the expression for the % tilt of a high-pass circuit excited by a symmetrical square wave.

A. The expression for the % tilt of a high pass circuit excited by a symmetrical square wave is

%tilt=$\frac{1-e^{\frac{-T}{2RC}}}{1+e^{\frac{-T}{2RC}}}\*200\%$ = $\frac{πf1}{f}\*100\%$

8. Define transmission error?

A. The transmission error is defined as the difference between the input and the output divided by the input at the end of the sweep.

9. What do you mean by an attenuator? Why does a resistive attenuator need to be compensated?

A. An attenuator is a resistive network used to reduce the amplitude of the input signal. A resistive attenuator needs to be compensated in order to reduce or eliminate the rise time of out waveform.

10. What is the criterion for good differentiation in terms of steady state analysis?

A. the criterion for good differentiation in terms of steady state analysis is that the phase shift between the input and output sinusoids must be at least 89.4° , i.e. ωRC ≤ 0.01.

11. What is the effect of the output resistance of the generator on an attenuator output?

A. The effect of the output resistance of the generator on an attenuator output is, the output waveform gets distorted.

12.What does the voltage across the parallel RLC network become zero for a step input?

A. The voltage across the parallel RLC network becomes zero for a step input because the inductor acts as a short circuit for dc.

13. In series RLC network, why does the current response to a step input voltage ultimately die to zero?

A. In series RLC network, the current response to a step input voltage ultimately dies to zero because the capacitor acts as an open circuit for dc.

14.what do you mean by perfect compensation, over compensation and under compensation?

A. Perfect compensation means, the value of C1 selected such that

V0(0+)=V0(∞) : C1=R2C2/R1 , i.e. R1C1=R2C2

Over compensation means, the value of C1 selected is such that

V0(0+)˃V0(∞) : C1>R2C2/R1

Under compensation means, the value of C1 selected such that

V0(0+)˂V0(∞) : C1˂R2C2/R1

15. Why is the initial voltage distribution in an attenuator determined by the capacitor?

A. The initial voltage distribution in an attenuator is determined by the capacitors because at t=0, they act as short circuit and so a very large current passes through them and no current passes through the resistors.

16. what do you mean by a ringing circuit? What is it used for?

A. A ringing circuit is a circuit which can provide as nearly undamped oscillations as possible. It may be used to generate a sequence of pulses regularly spaced in time.

17. write the expression for the output of a low pass circuit excited by a step input.

A. The expression for the output of a low pass circuit is expressed as

V0= Vfinal-(Vfinal-Vinitial)$e^{\frac{-t}{RC}}$

18.when is it said that steady condition is reached?

A. For most applications, steady state condition is assumed to be reached at t=5τ.

19.what is the relation between rise time and bandwidth of a low pass circuit?

A. the relation between the rise time and bandwidth of a low pass circuit is

 tr=0.35/BW , i.e. rise time is inversely proportional to bandwidth.

20.write the expression for the output of a low pass circuit excited by a symmetrical square wave.

A. the peak value of the output of a low pass circuit excited by a symmetrical wave is V1=V($ \frac{1-e^{\frac{-T}{2RC}}}{1+e^{\frac{-T}{2RC}}} )$ ,V2=-V1

21. Write an expression for the output of a low pass circuit excited by a ramp input?

A.The output of a low pass circuit excited by a ramp input is given by

V0=αt-αRC+αRC$e^{(\frac{-t}{RC})}$

When RC is very small, V0(t)=α(t-RC)

When RC is very large, V0(t)=αt2/2RC

22.write the expression for the output of a high pass circuit excited by a ramp input?

A. The output of a high pass circuit excited by a ramp input is

V0=αRC(1-$e^{^{-t}/\_{RC}}$), for t<RC, V0(t)=αt(1-t/2RC)

**UNIT 2: Non-linear wave shaping**

1. What do you mean by clipping & what are clipping circuits?
2. Clipping means cutting and removing a part. It is the process of cutting and removing a part of the waveform. The circuits which are used to select for transmission that part of a arbitrary waveform which lies above or below some particular reference level .
3. What are the other names of clipping circuits?
4. The other names of clipping ckts are voltage (or current) limiters, amplitude selectors or slicers.
5. Why should the resistance in the clipping ckt be chosen to be the geometric mean of the diode forward& reverse resistances?
6. The resistance in the clipping ckt is to be chosen as the geometric mean of the diode forward & reverse resistances because in the transmission region of diode clipping ckt, it is required that Rr >> R, i.e., Rr = KR, where K is a larger number, and in attenuation region, it is req. that R >> Rf , i.e., R = KRf

**...** R=√(Rr\*Rf) .

1. What do you mean by a comparator?
2. A comparator is one which may be used to mark the instant when an arbitrary waveform attains a particular reference level.
3. What are the applications of voltage comparators?
4. The applications of voltage comparators are as follows
5. In the accurate time measurements.
6. In pulse time measurements.
7. As timing markers generated from a sine wave.
8. In phase meters.
9. In amplitude distribution analyzers.
10. To obtain square wave from a sine wave.
11. In analog-to-digital converters.
12. What do you mean by a regenerative comparator? Give an example.
13. A regenerative comparator is one in which positive feedback is employed to obtain an infinite forward gain (unity loop gain). The Schmitt trigger, and the blocking oscillator are examples of regenerative comparators.
14. What do you mean by non-regenerative comparator? Give an example.
15. A non-regenerative comparator is one in which positive feedback is not employed. A clipping ckt is an example of non-regenerative comparator.
16. What does the Schmitt trigger comparator generate?
17. The Schmitt trigger comparator generates approximately a step input.
18. What do you mean by clamping? What for clamping ckts are used.
19. Clamping means fixing. Clamping ckts are used to clamp or fix the extremity of a periodic waveform to some constant reference level VR thereby to introduce a dc level.
20. What are the other names of clamper ckts?
21. The other names of clamping ckts are (a) dc restorer and (b) dc re-inserter.
22. Write the relation between the tilts in the forward and reverse directions of the output of a clamping ckt excited by a square wave.
23. The relation between tilts in the forward and reverse direction of the output of a clamping ckt excited by a square wave input is

∆f =∆r\*Rf(R+Rs) / R(Rf+Rs)

1. State clamping ckt theorem.
2. The clamping ckt theorem states that for any input waveform under steady state conditions, the ratio of the area Af under the output voltage curve in the forward direction to that in the reverse direction Ar is equal to the ratio Rf / R, i.e.,

Af /Ar =Rf / R

1. State the clamping ckt theorem considering the source resistance.
2. The clamping ckt theorem considering the source resistance is

 [Af – (VR+VƔ)T1] / Ar=Rf / R

1. In a clamping ckt, when can the tilts in the forward and reverse directions be equal?
2. In a clamping ckt, the tilts in the forward and reverse directions can be equal when Ri=0.
3. The precision of operation of the clamping ckt depends on which conditions?
4. The precision of operation of the clamping ckt depends on the condition that R >> Rf and Rr >> R.
5. What do you mean by biased clamping?
6. A biased clamping is one in which a reference voltage source is connected in series with the diode. So, clamping is not at zero level but at some level.
7. What do you mean by a practical clamping ckt?
8. A practical clamping ckt is one in which Ri ≠ 0, Rf ≠o, VƔ ≠ 0, Rr ≠ ∞ and C is not arbitrarily large.
9. What is the difference between clipping and clamping?
10. Clipping means cutting and removing a part of a waveform. So, the output of the clipping ckt will be different from the input. Clamping means fixing the maximum positive or negative peak of the waveform to a desired level. So, the output of the clamping ckt will be the same as the input.
11. What do you mean by one way clamp?
12. A one way clamp is a clamping ckt which uses only one diode and which restrains the voltage change only in one direction.
13. What do you mean by two way clamp?
14. A two way clamp is a clamping ckt which uses two diodes and which restrains the voltage change in both the directions.

**UNIT 3: Multivibrators & Time based generators**

1. What do you mean by multivibrator? How many states does it have?
2. Multi means many. Vibrator means oscillator. A multivibrator is a ckt which can operate at a no. of frequencies. It has 2 states.
3. How many types of multivibrators are there? Name them.
4. There are 3 types of multivibrators. They are:

 1. Bistable multivibrator: The multi which has 2 stable states.

 2. Monostable multivibrator: The multi which has 1 stable state and 1 quasi stable state.

 3. Astable multivibrator: The multi which has 2 quasi stable states.

1. What do you mean by dc & ac coupling?
2. The dc coupling means resistive coupling & ac coupling means capacitive coupling.
3. What do you mean by quasi stable state?
4. A quasi-stable state means a temporarily stable state.the ckt remains in the quasi-stable state only for a specified time and afterwards, comes back to the other state.
5. What do you mean by the term ‘loop gain’?
6. The loop gain is the gain associated with the path making that loop when a signal is transmitted through it.
7. What do you mean by output swing?
8. The output swing means the change in collector voltage resulting from a transition from one state to another.
9. What is the basis for the selection of various components of a bistable multivibrator?
10. In a bistable multivibrator,
11. Vcc is selected such that Vcc < βVCEO.
12. Rc is selected such that Ic(sat) is less than the maximum permitted collector current.
13. Ri is selected such that it is very large but Ri < hFERc.
14. VBB, R1, R2 are selected such that, in one stable state the base current is large enough to drive the transistor into saturation whereas in the second stable state the emitter junction must be below cut-off.
15. What do you mean by collector catching diodes?
16. The diodes which connect the collectors of the transistors of the binary to an auxiliary voltage source V < VCC to maintain a constant output swing are called collector catching diodes.
17. What is the advantage of a self-biased binary over fixed-biased binary?
18. The advantage of self-biased binary over fixed-biased binary is only one power supply is sufficient.
19. What are commutating capacitors? Why are they required?
20. Commutating capacitors are small capacitors connected in parallel with the coupling resistors. They are required to increase the speed of operation.

# TIME BASE GENERATORS

11. How many types of time base generators are there? Name them.

A. There are two types of time-base generators. They are (a) voltage time-base generators and (b) current time-base generators.

12. What are the applications of time-base generators?

A. Some of the important applications of the time-base generators are found in CROs, in television and radar displays, in precise time measurements and in time modulation.

13. What do you mean by (a) sweep time and (b) restoration time ?

A. (a) sweep time is the time during which the output increases linearly. (b)Restoration time is the time required by the sweep voltage to return to its initial value.

14. How is the deviation from linearity expressed?

A. The deviation from linearity is expressed in three ways: (a)the slope or sweep speed error ed, the displacement error ed and the transmission error et.

15. Define the terms (a) slope error, (b)displacement error and (c)transmission error. How are theyrelated for an exponential sweep circuit?

A.(a) The slope error or the sweep speed error es is defined as the ratio of the difference in slope at the beginning and end of the sweep to the initial value of slope. (b)the displacement error ed is defined as the ratio of the maximum difference between the actual sweep voltage and the linear sweep to the amplitude of the sweep. (c)the transmission error et is defined as the ratio of the difference between the input and the output to the input at the end of the sweep. es =2et =8et is the relation between es , et and ed for exponential sweep circuit.

16. What are the methods of generating time-base waveforms?

A. a. Exponential charging.

 b. Constant current charging.

 c. The miller circuit.

 d. The phantastron circuit.

 e. The bootstrap circuit.

 f. Compensating networks.

 g. An inductor circuit.

17. Which devices can be used as a switch in sweep circuits?

A. A UJT can be used as the switch in sweep circuits. In fact any current controlled negative resistance device can be used as a switch to discharge the sweep capacitor.

18. What type of currents are required for magnetic deflection applications?

A. Linearly varying currents are required for magnetic deflection applications.

19.How can a linearly varying current waveform be generated?

A. A linearly varying current waveform can be generated by applying a linearly varying voltage waveform generated by a voltage time-base generator across a resistor. It can also be generated by applying a constant voltage across an inductor.

20. What type of voltage input is required to obtain a linear current sweep?

A. To obtain a linear circuit sweep, a trapezoidal rather than a step voltage input is required.