



ANALOG ELECTRONICS VIVA & INTERVIEW QUESTIONS

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Q-1 What do you mean by operational amplifier?

Ans An operational amplifier is a direct-coupled, high gain amplifier used for some mathematical operation such as addition, subtraction, multiplication and integration.

Q-2 List the ideal characteristics of an op-amp?

Ans An ideal-opamp would have the following characteristics:-

- 1 Infinite voltage gain
- 2 Infinite input resistance
- 3 Zero o/p resistance
- 4 Zero o/p voltage when (i/p voltage is zero)
- 5 Infinite Band with
- 6 infinite common mode Rejection ratio
- 7 infinite slew rates.

Q-3 What are the main features of Ics 741?

Ans the main features of Ics 741 are:-

- 1 No external frequency compensation required.
- 2 short circuit protection.
- 3 offset null capability.
- 4 large common mode and differential voltage range
- 5 low power consumption
- 6 No latch up problem

Q-4 What do you mean by input offset current?

Ans The algebraic difference between the current in the inverting terminals is as known as Input offset current.

Q-5 What do you mean by input offset voltage?

Ans Input offset voltage that must be applied between the two input terminals of an Op-amp to null the output.

Q-6 What do you mean by input biased current?

Ans Input biased current is the average of the current that flow into the inverting and Non Inverting input terminals of the op-amps.

Q-7 What do you mean by differential input resistance?

Ans Differential input resistance is the equivalent resistance that can be measured at either the inverting and non-inverting input terminal with the other terminal connected to ground.

Q-8 What do you mean common mode rejection ratio (CMMR).

Ans Common mode rejection ratio define as “it is the ratio of the differential voltage Gain to the common mode gain of an op-amp.

$$\text{CMMR} = \frac{\text{differential gain}}{\text{common mode gain}}$$

Q-9 What do you mean by SVRR (supply voltage rejection ratio).

Ans. The change in an op-amp input –offset voltage, caused by variation in supply voltage is called supply voltage rejection ratio (SVRR).

Q-10 What do you mean by output resistance of an op-amp?

Ans The output resistance is the equivalent resistance that can be measured between the Terminal of the op-amp and ground.

Q-11 What do you mean by slew rate of an op-amp.?

- Ans** Slew rate is the maximum rate of change of output voltage per unit of time.
- Q-12** **What do you mean by gain band width product of an op-amp?**
- Ans** The gain bandwidth of an op-amp is the “bandwidth when the voltage gain is unity”.
- Q-13** **What do you mean by an open loop configuration of an op-amp?**
- Ans** The open loop configuration of an op-amp indicate the No connection, exist between The output signal is not fed-back in any form into the input.
- Q-14** **How many configuration in open-loop op-amp configuration?**
- Ans** there are three open-loop op-amp configurations:
- 1 Differential –amplifier.
 - 2 Inverting amplifier
 - 3 Non- inverting amplifier
- Q-15** **What do you mean by voltage follower?**
- Ans** The lowest gain that can be obtained from a non-inverting amplifier with feedback Is 1. When the non-inverting amplifier is configured for unity, it is called a voltage Follower.
- Q-16** **What do you mean by a comparator?**
- Ans** Comparator is an open-loop op-amplifier which compares the input voltage at other one terminal to a reference voltage at other terminal and produce a voltage at their output terminal.
- Q-17** **What do you mean by a zero-crossing detector?**
- Ans** Zero-detector is a comparator in which a zero reference is applied at their non-inverting terminal. Zero-crossing detector switches their output from one state to another state if the input voltage crosses the zero point.
- Q-18** **What do mean by a Schmitt trigger?**
- Ans** Schmitt trigger is a type of comparator which uses positive feedback. Schmitt trigger convert a sinusoidal signal to a square wave signal.
- Q-19** **How many types of Schmitt trigger used?**
- Ans** There are two types Schmitt trigger are used.
1. Inverting Schmitt trigger.
 2. Non-inverting Schmitt trigger.
- Q-20** **What do you mean by threshold voltage of Schmitt trigger?**
- Ans** The input voltage of Schmitt trigger for which the Schmitt trigger changes their output is called threshold voltage.
- Q-21** **What do you mean by hysteresis of Schmitt trigger?**
- Ans** Hysteresis is the voltage difference between turn-on and turn-off voltage of comparator.
- Q-22** **Explain the main effect of a hysteresis?**
- Ans** The main effect of hysteresis are-
1. It improves the noise immunity.
 2. It reduces the response time.
 3. It reduces the false triggering.
 4. When hysteresis increases then sensitivity reduce.
- Q-23** **What do you mean by a voltage to frequency converter?**
- Ans** A device which convert an analog voltage into a pulse signal which frequency is proportional to the applied input voltage.
- Q-24** **What is the function of frequency to voltage converter?**

Ans A device which convert the frequency of the input signal into a proportional output voltage.

Q-25 **What are main application of frequency to voltage converter?**

Ans The main applications of these are follows-

1. It is used to control the speed of motor.
2. It is used for rotational measurement.
3. It is used for digital to analog conversion.

Q-26 **Explain the Timer IC-555?**

Ans IC-555 is timer IC which is used in a stable, multivibrator, square wave generator, triangular wave generator, pulse modulator and pulse detector circuit.

Q-27 **Explain the function of phase detector?**

Ans The main function of phase detector is to compare the signal with feedback voltage and produce a D.C. output voltage

Q-28 **Define an Integrated circuit.**

Ans An integrated circuit(IC) is a miniature, low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon. The active components are transistors and diodes and passive components are resistors and capacitors.

Q-29 **Explain the main feature of IC-723.**

Ans The main feature of IC-723 are-

1. Input voltage (9.5 Volt-40 volt)
2. Regulated output voltage (2 to 37 v)
3. Maximum load current = 150 ma.
4. Internal power dissipation is 800 mV

Q-30 **What is function of pulse width modulator?**

Ans In pulse width modulator the width of the output pulse is varying according to the variation in the amplitude of modulating signal

Q-31 **What are the two important properties of SiO₂?**

Ans

1. SiO₂ is an extremely hard protective coating & is unaffected by almost all reagents except by hydrochloric acid. Thus it stands against any contamination.
2. By selective etching of SiO₂, diffusion of impurities through carefully defined Windows in the SiO₂ can be accomplished to fabricate various components.

Q-32 **What is oxidation induced defects in semiconductor?**

Ans

1. Stacking faults
2. Oxide isolation defects

Q-33 **What are the advantages of ICs over discrete circuits?**

Ans

1. Minimization & hence increased equipment density.
2. Cost reduction due to batch processing.
3. Increased system reliability
4. Improved functional performance.
5. Matched devices.
6. Increased operating speeds
7. Reduction in power consumption

Q-34 **What is OPAMP?**

Ans An operational amplifier is a direct coupled high gain amplifier consisting of one or more differential amplifiers, followed by a level translator and an output stage. It is a versatile device that can be used to amplify ac as well as dc input signals & designed

for computing mathematical functions such as addition, subtraction, multiplication, integration & differentiation.

Q-35 List out the ideal characteristics of OPAMP?

Ans

- (i) Open loop gain infinite
- (ii) Input impedance infinite
- (iii) Output impedance low
- (iv) Bandwidth infinite
- (v) Zero offset, ie, $V_O=0$ when $V_1=V_2=0$

Q-36 What do you mean by sample and hold circuit?

Ans

Sample and hold circuit is an analog device that samples (captures, grabs) the voltage of a continuously varying analog signal and holds (locks, freezes) its value at a constant level for a specified minimal period of time.

Q-37 What is the use sample and hold circuit?

Ans

Sample and hold circuits are typically used in analog-to-digital converters to eliminate variations in input signal that can corrupt the conversion process.

Q-38 What are the component used in sample and hold circuit?

Ans

A typical sample and hold circuit stores electric charge in a capacitor and contains at least one fast FET switch and at least one operational amplifier.

Q-39 What is the function of buffer amplifier in sample and hold circuit?

Ans

The buffer amplifier charges or discharges the capacitor so that the voltage across the capacitor is practically equal, or proportional to, input voltage.

Q-40 Explains the function sample and hold circuit in Hold mode?

Ans

In hold mode the switch disconnects the capacitor from the buffer. The capacitor is invariably discharged by its own leakage currents and useful load currents, which makes the circuit inherently volatile

Q-41 What is the function of FET used in sample and hold circuit?

Ans

The FET is used as a switch in sample and hold circuit.

Q-42 What do you mean by sample rate?

Ans

The number of times an analog signal is measured (sampled) per second. The unit of sample rate is samples per second. This is often expressed in kilohertz (kHz). For example, CD quality sound has a sample rate of 44 kHz.

Q-43 What is the range of capacitor use in sample and hold circuit?

Ans

In the circuit, the storage capacitor (C_1) value is only 200pF. Larger value capacitors give longer "hold" periods but with slower slew rates.

Q-44 What happened if the value capacitor is increased in sample and hold circuit?

Ans

If we increased C to 2000pF, the "hold-droop" rate will decrease to 0.085uV/us, and the slew rate would decrease to 0.25V/us. (*u=mhu)

Q-45 What is function of pulse width modulator?

Ans

In pulse width modulator the width of the output pulse is varying according to the variation in the amplitude of modulating signal.

Q-46 What do you mean by PLL?

Ans

PLL is a close-loop system which is used to track a system.

Q-47 Explain the main component PLL?

Ans

The main component of PLL are-

1. Phase detector.
2. Low pass filter.

3. Error amplifier.
4. Voltage control oscillator.

Q-48 Explain the function of phase detector?

Ans The main function of phase detector is to compare the signal with feedback voltage and produce a D.C. output voltage.

Q-49 What do you mean by lock range of PLL?

Ans The range of input frequency for which PLL maintain lock is called lock range.

Q-50 Explain the types of PLL?

Ans Their are two types of PLL-

1. First order PLL
2. Second order PLL.

Q-51 Explain 1st order PLL?

Ans In first-order PLL the output of the phase detectors linear-relation with phase difference. In first order PLL, phase detector and filter block connected in cascade and PLL is in locked.

Q-52 Explain the function of loop filter?

Ans The main function of loop filter are-

1. It improve the interference rejection
2. It reduces/eliminate the high frequency error component.
3. It also provide short term memory for PLL
4. It controls the transient and capture response

Q-53 What are the main application of PLL?

Ans The main application of PLL are-

1. It is used in frequency demodulation.
2. It is used in a phase shifter.
3. It is used as a signal synchronizer.
4. It is used in tracking filter.
5. It is used in frequency division and multiplication.

Q-54 What is the value of pulse drop during the hold interval in sample and hold circuit?

Ans Pulse “droop” during the hold interval is $170\text{pA}/200\text{pF}$ which is 0.85uV/us (i.e., $170\text{pA}/200\text{pF}$), this 170pA represents the typical leakage current

Q-55 What is the different kinds of packages of IC741?

Ans

- a) Metal can (TO) package
- b) Dual-in-line package
- c) Flat package or flat pack

Q-56 Explain the function of each pin of timer IC?

Ans These are follows-

1. Ground pin- It is ground pin which connect the supply voltage into ground terminal.
2. Trigger pin- This pin is used for triggering the timer IC-555.
3. Output pin- This pin is connected to the output load and it is connected between ground and output pin.
4. Reset pin- This pin is used to reset the timer IC-555. If timer is resetted then a $-v$ voltage is applied into pin no. 4.
5. Control pin- if a modulated pulse is required then an AC signal is applied into pin no. 5 otherwise this pin is connected to ground.

6. Threshold pin- It is non inverting terminal of the upper if the voltage at this terminal is greater than $2/3 V_{CC}$ then output of upper comparator is high.

7. Discharge pin- If the voltage at pin 7 is equal to $2/3 V_{CC}$ then output voltage is zero.

8. Supply pin- This pin used to connect a supply $+V_{CC}$ to timer –IC-555.

Q-57 Explain the main feature of IC-723.

Ans The main feature of IC-723 are-

- 1 Input voltage (9.5 Volt-40 volts)
- 2 Regulated output voltages (2 to 37 v)
- 3 Maximum load current = 150 ma.
- 4 Internal power dissipation is 800 mvolt.
- 5 Short circuit protection.
- 6 Very low temperature drift.
- 7 High ripple rejection.

Q-58 Define an Integrated circuit.

Ans An integrated circuit(IC) is a miniature, low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon. The active components are transistors and diodes and passive components are resistors and capacitors.

Q-59 What is the basic processes involved in fabricating ICs using planar technology?

- Ans**
1. Silicon wafer (substrate) preparation
 2. Epitaxial growth
 3. Oxidation
 4. Photolithography
 5. Diffusion
 6. Ion implantation
 7. Isolation technique
 8. Metallization
 9. Assembly processing & packaging

Q-60 List out the steps used in the preparation of Si – wafers.

- Ans**
1. Crystal growth & doping
 2. Ingot trimming & grinding
 3. Ingot slicing
 4. Wafer polishing & etching
 5. Wafer cleaning

Q-61 What is the assumptions made from ideal opamp characteristics?

- Ans**
- i) The current drawn by either of the input terminals (noninverting/inverting) is negligible.
 - ii) The potential difference between the inverting & non-inverting input terminals is zero.

Q-62 Mention some of the linear applications of op – amps?

Ans Adder, subtractor, voltage –to- current converter, current –to- voltage converters, instrumentation amplifier, analog computation, power amplifier, etc are some of the linear op-amp circuits.

Q-63 Mention some of the non – linear applications of op-amps?

Ans Rectifier, peak detector, clipper, clamper, sample and hold circuit, log amplifier, anti –log amplifier, multiplier are some of the non – linear op-amp circuits.

Q-64 List the broad classification of ADCs?

Ans

1. Direct type ADC.
2. Integrating type ADC.

Q-65 List out the direct type ADCs.**Ans**

1. Flash (comparator) type converter
2. Counter type converter
3. Tracking or servo converter
4. Successive approximation type converter

Q-66 List out some integrating type converters.**Ans**

1. Charge balancing ADC
2. Dual slope ADC

Q-67 What is integrating type converter?**Ans**

An ADC converter that perform conversion in an indirect manner by first changing the analog I/P signal to a linear function of time or frequency and then to a digital code is known as integrating type A/D converter.

Q-68 Explain in brief the principle of operation of successive Approximation ADC?**Ans**

The circuit of successive approximation ADC consists of a successive approximation register (SAR), to find the required value of each bit by trial & error. With the arrival of START command, SAR sets the MSB bit to 1. The O/P is converted into an analog signal & it is compared with I/P signal. This O/P is low or high. This process continues until all bits are checked.

Q-69 What are the main advantages of integrating type ADCs?**Ans**

- i. The integrating type of ADC's do not need a sample/hold circuit at the input.
- ii. It is possible to transmit frequency even in noisy environment or in an isolated form.

Q-70 Define conversion time?**Ans**

It is defined as the total time required to convert an analog signal into its digital output. It depends on the conversion technique used & the propagation delay of circuit components. The conversion time of a successive approximation type ADC is given by $T(n+1)$

Where T---clock period

Tc---conversion time

n----no. Of bits

Q-71 Define resolution of a data converter?**Ans**

The resolution of a converter is the smallest change in voltage which may be produced at the output or input of the converter. Resolution (volts) = $V_{FS}/2^n - 1 = 1$ LSB increment. The resolution of an ADC is defined as the smallest change in analog input for a one-bit change at the output.

Q-72 Explain in brief stability of a converter?**Ans**

The performance of converter changes with temperature age & power supply variation. So all the relevant parameters such as offset, gain, linearity error & monotonicity must be specified over the full temperature & power supply ranges to have better stability performances.

Q-73 What is meant by linearity?**Ans**

The linearity of an ADC/DAC is an important measure of its accuracy & tells us how close the converter output is to its ideal transfer characteristics. The linearity error is usually expressed as a fraction of LSB increment or percentage of full-scale voltage. A good converter exhibits a linearity error of less than $\pm 1/2$ LSB.

Q-74 What is filter?

Ans A filter circuit is a device that converts pulsating output of a rectifier into a steady dc level. Hence, it becomes essential to reduce the ripples from the pulsating dc supply available from rectifier circuits to the minimum. This is achieved by using a filter or smoothing circuit which removes (or filters out) the ac components and allows only the dc component to reach the load. Obviously, a filter circuit should be placed between, the rectifier and the load.

Q-75 **What is filter circuit?**

Ans A filter is generally a combination of inductors L and Capacitors C. The filtering action of L and C depends upon the facts that an inductor allows only dc and a capacitor allows ac only to pass. So a suitable L and C network can effectively filter out (or remove) the ac components from the rectified output.

Q-76 **What are the commonly used types of filter circuits?**

Ans

- (1) Series Inductor Filter ,
- (2) Shunt Capacitor Filter ,
- (3) Choke Input Filter,
- (4) Capacitor input or pie filter

Q-77 **Series Inductor Filter?**

Ans In this arrangement a high value inductor or choke L is connected in series with the rectifier element and the load, the filtering action of an inductor filter depends upon its property of opposing any change in the current flowing through it. The function of the inductor filter may be viewed in terms of impedances. The choke offers high impedance to the ac components but offers almost zero resistance to the desired dc components. Thus ripples are removed to a large extent.

Q-78 **What is shunt capacitor filter?**

Ans In this arrangement a high value Capacitor is connected in parallel with the rectifier element and the load, the function of the capacitor filter may be viewed in terms of impedances. The capacitor offers zero impedance to the ac components but offers high resistance to the desired dc components, so C bypasses the dc. Thus ripples are removed to a large extent

Q-79 **What is the drawback of series inductor and shunt capacitor filter?**

Ans A simple shunt capacitor filter reduces the ripple voltage but increases the diode current. The diode may get damaged due to large current and at the same time it causes greater heating of supply transformer resulting in reduced efficiency. In an inductor filter, ripple factor increases with the increase in load resistance R_L while in a capacitor filter it varies inversely with load resistance R_L . From economical point of view also; neither series inductor nor shunt capacitor type filters are suitable.

Q-80 **What is practical filter circuit?**

Ans Practical filter-circuits are derived by combining the voltage stabilizing action of shunt capacitor with the current smoothing action of series choke coil. By using combination of inductor and capacitor ripple factor can be lowered, diode current can be restricted and simultaneously ripple factor can be made almost independent of load resistance (or load current). Two types of most commonly used combinations are choke-input or L-section filter-and capacitor-input or Pi-Filter.

Q-81 **What is Choke-input filter?**

Ans Choke-input filter consists of a choke L connected in series with the rectifier and a capacitor C connected across the load. This is also sometimes called the L-section filter The choke L on the input side of the filter readily allows dc to pass but opposes the

flow of ac components Any fluctuation that remains in the current even after passing through the choke are largely by-passed around the load by the shunt capacitor However, a small ripple still remains in the filtered output and this is considered negligible if it than 1%.

Q-82 **What is Capacitor-Input or Pi-Filter?**

Ans

Such a filter consists of a shunt capacitor C1 at the input followed by an L-section filter formed by series inductor L and shunt capacitor C2. This is also called the filter the input capacitor C1 is selected to offer very low reactance to the ripple frequency. Hence major part of filtering is accomplished by the input capacitor C1. Most of the remaining ripple is removed by the L-section filter consisting of a choke L and capacitor C2.

Q-83 **Salient Features of L-Section and Pi-Filters?**

Ans

1. In pi-filter the dc output voltage is much larger than that can be had from an L-section filter with the same input voltage.
2. In pi-filter ripples are less in comparison to those in shunt capacitor or L-section filter. So smaller valued choke is required in a pi-filter in comparison to that required in L-section filter.
3. In pi-filter, the capacitor is to be charged to the peak value hence the rms current in supply transformer is larger as compared in case of L-section filter.
4. Voltage regulation in case of pi-filter is very poor, as already mentioned. So n-filters are suitable for fixed loads whereas L-section filters can work satisfactorily with varying loads provided a minimum current is maintained.
5. In case of a pi-filter PIV is larger than that in case of an L-section filter.

Q-84 **What is clipper?**

Ans

In electronics, a clipper is a device designed to prevent the output of a circuit from exceeding a predetermined voltage level without distorting the remaining part of the applied waveform. Series clippers are employed as noise limiters in FM transmitters by clipping excessive noise peaks above a specified level.

Q-85 **Can you explain clipping circuit?**

Ans

A clipping circuit consists of linear elements like resistors and non-linear elements like junction diodes or transistors. Thus a clipper circuit can remove certain portions of an arbitrary waveform near the positive or negative peaks. Clipping may be achieved either at one level or two levels Clipping Circuits are also called as Slicers, amplitude selectors or limiters.

Q-86 **Clipping using Zener Diode?**

Ans

One or two zener diodes are used to clip the voltage V_{IN} . In the first circuit, the voltage is clipped to the reverse breakdown voltage of the zener diode. In the second, it is limited to the reverse breakdown voltage plus the voltage drop across one zener diode.

Q-87 **Classification of clipper?**

Ans

Practical clippers may be classified into two types: (a) Shunt Clippers, and (b) Series Clippers. The series configuration is defined as one where diode is in series with the load In a shunt clipper which uses a diode in conjunction with a resistor the diode forms a parallel path across the output. The network must have capacitor, a diode, and a resistive element, but it also employs an independent dc supply to introduce an additional shift.

Q-88 **Application of clipper?**

Ans

It is used in television sets and FM receivers. It is also used for amplifier and different types of opamps through which we can do some mathematical operations.

Q-89 What is positive and negative clipping?

Ans Depending on the orientation of the diode, the positive or negative region of the input signal is “clipped” off and accordingly the diode clippers may be positive or negative clippers.

Q-90 What is Positive Clipper circuit?

Ans Positive Clipper: The clipper which removes the positive half cycles of the input voltage is called the positive clipper. The positive series clipper circuit (that is, diode in series with the load). While the input is positive, diode D is reverse biased and so the output remains at zero that is, positive half cycle is clipped off. During the negative half cycle of the input, the diode is forward biased and so the negative half cycle appears across the output.

Q-91 What is negative clipper circuit?

Ans If the positive clipper circuit is reconnected with reversed polarity, the circuits will become for a negative clipper and the operation will be same.

Q-92 What is Combination Clipper?

Ans When a portion of both positive and negative of each half cycle of the input voltage is to be clipped (or removed), combination clipper is employed.

Q-93 Drawbacks of Series Diode Clippers?

Ans In series clippers, when diode is in ‘off’ position, there should be no transmission of input signal to output. But in case of high frequency signals transmission occurs through diode capacitance which is undesirable. This is the drawback of using diode as a series element in such clippers.

Q-94 What are oscillators?

Ans Oscillators produce a waveform (mostly sine or square waves) of desired amplitude and frequency. They can take input from the output itself. For a complete oscillator circuit we require a feedback device, amplifier and feedback factor. Oscillators designed to produce a high-power AC output from a DC supply are usually called inverters

Q-95 Application of electronic oscillator?

Ans An electronic oscillator is an electronic circuit that produces a repetitive electronic signal, often a sine wave or a square wave. They are widely used in innumerable electronic devices. Common examples of signals generated by oscillators include signals broadcast by radio and television transmitters, clock signals that regulate computers and quartz clocks, and the sounds produced by electronic beepers and video games.

Q-96 Types of electronic oscillator?

Ans. There are two main types of electronic oscillator: the harmonic oscillator and the relaxation oscillator.

Q-97 What is Harmonic oscillator?

Ans The harmonic, or linear, oscillator produces a sinusoidal output. The basic form of a harmonic oscillator is an electronic amplifier with the output attached to an electronic filter, and the output of the filter attached to the input of the amplifier, in a feedback loop. When the power supply to the amplifier is first switched on, the amplifiers output consists only of noise. The noise travels around the loop, being filtered and re-amplified until it increasingly resembles the desired signal.

Q-98 Types of Harmonic oscillator?

Ans There are many ways to implement harmonic oscillators, because there are different ways to amplify and filter. Some of the different circuits are:

- Hartley oscillator
- Colpitts oscillator
- Cross-coupled LC oscillator
- crystal oscillator
- Phase-shift oscillator
- RC oscillator (Wien Bridge and Twin-T)

Q-99 **What are LC oscillators?**

Ans Inductive oscillators also known as LC oscillators are built of a tank circuit, which oscillates by charging and discharging a capacitor through an inductor. These oscillators are typically used when a tuneable precision frequency source is necessary, such as with radio transmitters and receivers

Q-100 **What is phase-shift oscillator?**

Ans A phase-shift oscillator is a simple electronic oscillator. It contains an inverting amplifier, and a feedback filter which shifts the phase of the amplifier output by 180 degrees at the oscillation frequency. The filter produces a phase shift that increases with frequency. It must have a maximum phase shift of considerably greater than 180 degree at high frequencies, so that the phase shift at the desired oscillation frequency is 180 degree.

Q-101 **How to produced 180° phase shift?**

Ans The most common way of achieving this kind of filter is using three identical cascaded resistor capacitor filters, which together produce a phase shift of zero at low frequencies, and 270 degrees at high frequencies. At the oscillation frequency each filter produces a phase shift of 60 degrees and the whole filter circuit produces a phase shift of 180 degrees.

Q-102 **How to implement the phase-shift oscillator?**

Ans A version of this circuit can be made by putting an op-amp buffer between each R-C stage which simplifies the calculations. The voltage gain of the inverting channel is always unity.

Q-103 **What is the applications of 555 Timer?**

- Ans**
- Astable multivibrator
 - Monostable multivibrator
 - Missing pulse detector
 - Linear ramp generator
 - Frequency divider
 - Pulse width modulation
 - FSK generator
 - Pulse position modulator
 - Schmitt trigger

Q-104 **List the applications of 555 timers in monostable mode of operation?**

- Ans**
- * pulse detector
 - * Linear ramp generator
 - * Frequency divider
 - * Pulse width modulation.

Q-105 **List the applications of 555 timers in Astable mode of operation?**

- Ans**
- * FSK generator

* Pulse-position modulator

Q-106 Define 555 IC?

Ans The 555 timer is an integrated circuit specifically designed to perform signal generation and timing functions.

Q-107 List the basic blocks of IC 555 timers?

Ans

- A relaxation oscillator
- S flip flop
- Two comparator
- Discharge transistor.

Q-108 List the features of 555 Timer?

Ans It has two basic operating modes: monostable and astable

- It is available in three packages. 8 pin metals can, 8 pin dip, 14 pin dip.
- It has very high temperature stability.

Q-109 Define duty cycle?

Ans The ratio of high output and low output period is given by a mathematical parameter called duty cycle. It is defined as the ratio of ON Time to total time.

Q-110 Define VCO.

Ans A voltage controlled oscillator is an oscillator circuit in which the frequency of oscillations can be controlled by an externally applied voltage.

Q-111 List the features of 566 VCO.

Ans Wide supply voltage range (10-24V)

- Very linear modulation characteristics
- High temperature stability

Q-112 What does u mean by PLL?

Ans PLL is a basically a closed loop system designed to lock output frequency and Phase to the frequency and phase of an input signal. 11. Define lock range.

Q-113 What is the areas of application of non-linear op- amp circuits?

Ans

1. Industrial instrumentation,
2. Communication
3. Signal processing

Q-114 What happens when the common terminal of V+ and V- sources is not grounded?

Ans If the common point of the two supplies is not grounded, twice the supply voltage Will get applied and it may damage the op-amp.

Q-115 Define input offset voltage.

Ans A small voltage applied to the input terminals to make the output voltage as zero when the two input terminals are grounded is called input offset voltage.

Q-116 Define input offset current. State the reasons for the offset currents at the input of the Op-amp.?

Ans The difference between the bias currents at the input terminals of the op-amp is called as input offset current. The input terminals conduct a small value of dc current to bias the input transistors. Since the input transistors cannot be made identical, there exists a difference in bias currents.

Q-117 Define CMRR of an op-amp.

Ans The relative sensitivity of an op-amp to a difference signal as compared to a Common –mode signal is called the common –mode rejection ratio. It is expressed in decibels.
 $CMRR = A_d/A_c$

- Q-118** **In practical op-amps, what is the effect of high frequency on its performance?**
Ans The open-loop gain of op-amp decreases at higher frequencies due to the Presence of parasitic capacitance. The closed-loop gain increases at higher frequencies and leads to instability.
- Q-119** **What is the need for frequency compensation in practical op-amps?**
Ans Frequency compensation is needed when large bandwidth and lower closed loop gain is desired. Compensating networks are used to control the phase shift and hence to improve the stability.
- Q-120** **Mention the frequency compensation methods.**
Ans
 1. Dominant-pole compensation
 2. Pole-zero compensation.
- Q-121** **What is the merits and demerits of Dominant-pole compensation?**
Ans
 - * Noise immunity of the system is improved.
 - * Open-loop bandwidth is reduced.
- Q-122** **Define slew rate.**
Ans The slew rate is defined as the maximum rate of change of output voltage caused By a step input voltage. An ideal slew rate is infinite which means that op-amp's output Voltage should change instantaneously in response to input step voltage.
- Q-123** **Why IC 741 is not used for high frequency applications?**
Ans IC741 has a low slew rate because of the predominance of capacitance present in the circuit at higher frequencies. As frequency increases the output gets distorted due to limited slew rate.
- Q-124** **What causes slew rate?**
Ans There is a capacitor with-in or outside of an op-amp to prevent oscillation. It is this capacitor which prevents the output voltage from responding immediately to a fast changing input.
- Q-125** **Define thermal drift?**
Ans The bias current, offset current & offset voltage change with temperature. A circuit carefully nulled at 25°C may not remain so when the temperature raises to 35oC.This is called thermal drift. Often, offset current drift is expressed in nA/°C and offset voltage drift in mV/°C.
- Q-126** **Define supply voltage rejection ratio (SVRR)?**
Ans The change in OPAMP's input offset voltage due to variations in supply voltage is called the supply voltage rejection ratio. It is also called Power Supply Rejection Ratio (PSRR) or Power Supply Sensitivity (PSS).
- Q-127** **What is the need for an instrumentation amplifier?**
Ans In a number of industrial and consumer applications, the measurement of physical quantities is usually done with the help of transducers. The output of transducer has to be amplified So that it can drive the indicator or display system. This function is performed by an instrumentation amplifier.
- Q-128** **List the features of instrumentation amplifier:**
Ans
 1. High gain accuracy
 2. High CMRR
 3. High gain stability with low temperature co-efficient
 4. Low dc offset
 5. Low output impedance

Q-129 What is a comparator?

Ans A comparator is a circuit which compares a signal voltage applied at one input of an op-amp with a known reference voltage at the other input. It is an open loop op - amp with output + V_{sat} .

Q-130 What is the applications of comparator?

Ans

1. Zero crossing detectors
2. Window detector
3. Time marker generator
4. Phase detector

Q-131 What is a Schmitt trigger?

Ans Schmitt trigger is a regenerative comparator. It converts sinusoidal input into a square wave output. The output of Schmitt trigger swings between upper and lower threshold voltages, which are the reference voltages of the input waveform.

Q-132 What is a multivibrator?

Ans Multivibrators are a group of regenerative circuits that are used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square output. It has two states stable or quasi- stable depending on the type of multivibrator.

Q-133 What is the rectifier?

Ans The process of converting A.C. voltage into D.C. voltage which is in only one direction, a process known as rectification is called rectification and it is done by rectifier.

Q-134 Write the application of Bistable multivibrator.

Ans

1. The bistable multivibrator is used as memory element in shift registers counters, and so on.
2. It is used to generate square waves of symmetrical shape by sending regular triggering pulses to the input. By adjusting the frequency of the input trigger pulse, the width of the square wave can be altered.

Q-135 What is the application of rectifier?

Ans Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components. Rectifiers also find a use in detection of amplitude modulated radio signals

Q-136 What is the type of rectifier?

Ans There are two type of rectifier:-

1. Half wave rectifier
2. Full wave rectifier:- centre tape full wave Bridge full wave

Q-137 What is the ripple factor of the rectifier?

Ans The ripple factor of the rectifier: - Half wave rectifier:-1.21, Centre tape wave rectifier:-0.48 Bridge full wave:-0.48

Q-138 What is the PIV of all type rectifiers?

Ans The PIV of rectifier: -

Half wave rectifier = V_m ,
 Centre tape wave rectifier = $2V_m$
 Bridge full wave = V_m

Q-139 Half wave rectifier?

Ans In a half wave rectifier only one half cycle of ac voltage is taking. The circuit is given. Here only one diode is using. During the positive half cycle of ac voltage the diode

conducts. So current flows through load. During the negative half cycle, the diode is reverse biased. So no current flows through the diode. Half-wave rectification can be achieved with a single diode in a one-phase supply, or with three diodes in a three-phase supply.

Q-140 **Full wave bridge rectifier?**

Ans

Full wave bridge rectifier: In full wave bridge rectifiers 4 diodes are using. During positive half cycle, D1 and D4 are in forward biased condition. In the negative half cycle of ac D3 and D2 are in forward biased condition. So in both the half cycles current through the load is in single direction. This circuit does not need a centre tap rectifier. But it requires more number of diodes than centre tap and half wave rectifiers

Q-141 **Full wave centre tap rectifier?**

Ans

In this method only two diodes are using. But it requires a centre tap transformer. During the positive half cycle diode D1 conducts. In the negative half cycle diode D2 conducts. So in both half cycles current flowing through load in same direction. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient.

Q-142 **Why we use Filter?**

Ans

While half-wave and full-wave rectification suffice to deliver a form of DC output, neither produces constant-voltage DC. In order to produce steady DC from a rectified AC supply, a smoothing circuit or filter is required. In its simplest form this can be just a reservoir capacitor or smoothing capacitor, placed at the DC output of the rectifier. There will still remain an amount of AC ripple voltage where the voltage is not completely smoothed.

Q-143 **Difference between half wave and full wave rectifier?**

Ans

The efficiency of half wave rectifier is not as good as that of full wave rectifier. Because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer. The ripples are maximum in the single phase half-wave rectifier and being reduced in the full-wave rectifier and being reduced further with the increase in the number of phases.

Q-144 **What do you mean by monostable multivibrator?**

Ans

Monostable multivibrator is one which generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state. Application of a trigger causes a change to the quasi-stable state. An external trigger signal generated due to charging and discharging of the capacitor produces the transition to the original stable state.

Q-145 **What is an astable multivibrator?**

Ans

Astable multivibrator is a free running oscillator having two quasi-stable states. Thus, there are oscillations between these two states and no external signals are required to produce the change in state.

Q-146 **What is a bistable multivibrator?**

Ans

Bistable multivibrator is one that maintains a given output voltage level unless an external trigger is applied. Application of an external trigger signal causes a change of state, and this output level is maintained indefinitely until a second trigger is applied. Thus, it requires two external triggers before it returns to its initial state

Q-147 **What is the requirements for producing sustained oscillations in feedback circuits?**

Ans

For sustained oscillations,

1. The total phase shift around the loop must be zero at the desired frequency of oscillation, fo. ie, $\angle A\beta = 0$ (or) 360°
2. At fo, the magnitude of the loop gain $|A\beta|$ should be equal to unity

Q-148 What is the different types of filters?

Ans Based on functions: Low pass filter, High pass filter, Band pass filter, Band reject filter
Based on order of transfer function: first, second, third higher order filters. Based on configuration: Bessel, Chebychev, Butterworth filters.

Q-149 What is a sample and hold circuit? Where it is used?

Ans A sample and hold circuit is one which samples an input signal and holds on to its last sampled value until the input is sampled again. This circuit is mainly used in digital interfacing, analog to digital systems, and pulse code modulation systems.

Q-150 Define sample period and hold period?

Ans The time during which the voltage across the capacitor in sample and hold circuit is equal to the input voltage is called sample period. The time period during which the voltage across the capacitor is held constant is called hold period.

Q-151 Why use Monostable Multivibrators?

Ans Monostable Multivibrators deliver a single output pulse when it is triggered externally only returning back to its first original and stable state after a period of time determined by the time constant of the RC coupled circuit.

Q-152 Disadvantage of Monostable Multivibrators?

Ans One main disadvantage of Monostable Multivibrators is that the time between the applications of the next trigger pulse has to be greater than the preset RC time constant of the circuit to allow the capacitor time to charge and discharge

Q-153 Application of Monostable Multivibrators?

Ans Monostable Multivibrators can therefore be considered as triggered pulse generators and are generally used to produce a time delay within a circuit as the frequency of the output signal is the same as that for the trigger pulse input the only difference being the pulse width.

Q-154 What is a voltage regulator?

Ans A voltage regulator is an electronic circuit that provides a stable dc voltage independent of the load current, temperature, and ac line voltage variations.

Q-155 Give the classification of voltage regulators:

Ans *Series / Linear regulators
*Switching regulators.

Q-156 What is a linear voltage regulator?

Ans Series or linear regulator uses a power transistor connected in series between the unregulated dc input and the load and it conducts in the linear region. The output voltage is controlled by the continuous voltage drop taking place across the series pass transistor.

Q-157 What is a switching regulator?

Ans Switching regulators are those which operate the power transistor as a high frequency on/off switch, so that the power transistor does not conduct current continuously give improved efficiency over series regulators.

Q-158 What is the advantages of IC voltage regulators?

Ans *low cost
*high reliability
*reduction in size

*excellent performance

Q-159 Give some examples of monolithic IC voltage regulators:

Ans 78XX series fixed output, positive voltage regulators
79XX series fixed output, negative voltage regulators
723 general purpose regulators.

Q-160 What is the purpose of having input and output capacitors in three terminal IC Regulators?

Ans A capacitor connected between the input terminal and ground cancels the inductive effects due to long distribution leads. The output capacitor improves the transient response.

Q-161 Define line regulation.

Ans Line regulation is defined as the percentage change in the output voltage for a change in the input voltage. It is expressed in millionths or as a percentage of the output voltage.

Q-162 Define load regulation.

Ans Load regulation is defined as the change in output voltage for a change in load current. It is expressed in millivolts or as a percentage of the output voltage.

Q-163 What is meant by current limiting?

Ans Current limiting refers to the ability of a regulator to prevent the load current from increasing above a preset value.

Q-164 Give the drawbacks of linear regulators:

Ans *the input step down transformer is bulky and expensive because of low line frequency.
*Because of low line frequency, large values of filter capacitors are required to decrease the ripple.
*Efficiency is reduced due to the continuous power dissipation by the transistor as it operates in the linear region.

Q-165 What is the advantage of switching regulators?

Ans *Greater efficiency is achieved as the power transistor is made to operate as low impedance switch. Power transmitted across the transistor is in discrete pulses rather than as a steady current flow.
*By using suitable switching loss reduction technique, the switching frequency can be increased so as to reduce the size and weight of the inductors and capacitors.

Q-166 What is an opto-coupler IC?

Ans Opto-coupler IC is a combined package of a photo-emitting device and a photo sensing device.

Q-167 What is the types of opto couplers?

Ans LED and a photo diode,
· LED and photo transistor,
· LED and Darlington.

Q-168 Mention the advantages of opto-couplers:

Ans *Better isolation between the two stages.
*Impedance problem between the stages is eliminated.
*Wide frequency response.
*Easily interfaced with digital circuit.
*Compact and light weight.
*Problems such as noise, transients, contact bounce, are eliminated.

Q-169 Give two examples of IC optocouplers?

Ans . Examples for opto-coupler IC
MCT 2F
MCT 2E.

Q-170 What is an isolation amplifier?

Ans An isolation amplifier is an amplifier that offers electrical isolation between its input and output terminals.

Q-171 What is the features of isolation amplifier?

Ans Easy to use
· Ultra low leakage
· 18 pin DIP package

Q-172 What is LM380?

Ans It is a power amplifier produced by national semiconductor. It is capable of delivering 2.5 W min, to 8 ohm load.

Q-173 Define capture range.

Ans The range of frequencies over which the PLL can acquire lock with the input signal is called as capture range.

Q-174 Define pull-in time.

Ans The total time taken by the PLL to establish lock is called pull-in time.

Q-175 List the applications of 565 PLL.

Ans Frequency multiplier
· Frequency synthesizer
· FM detector

Q-176 What are the two types of analog multiplier ICs?

Ans a) IC AD 533
b) IC AD 534

Q-177 What is ICAD 533?

Ans It is a multiplier IC by analog devices. It is a low cost IC comprising a Trans conductance multiplying element, stable reference and an output amplifier.

Q-178 What is the time period of monostable multivibrator?

Ans The time of period monostable multivibrator remains in unstable state is given by $t = \ln(2) R_2 C_1$. If repeated application of the input pulse maintains the circuit in the unstable state, it is called a retrigger able monostable. If further trigger pulses do not affect the period, the circuit is a non-retrigger able multivibrator.

Q-179 Mention the advantages of integrated circuits.

Ans *Miniaturisation and hence increased equipment density.
*Cost reduction due to batch processing.
*Increased system reliability due to the elimination of soldered joints.
*Improved functional performance.
*Matched devices.
*Increased operating speeds.
*Reduction in power consumption.

Q-180 Write down the various processes used to fabricate IC's using silicon planar technology.

Ans *Silicon wafer preparation.
* Epitaxial growth

- *Oxidation.
- *Photolithography.
- *Diffusion.
- *Ion implantation.
- *Isolation.
- *Metallisation.
- *Assembly processing and packaging.

Q-181 What is the purpose of oxidation?

Ans

- *SiO₂ is an extremely hard protective coating and is unaffected by almost all reagents.
- *By selective etching of SiO₂, diffusion of impurities through carefully defined windows can be accomplished to fabricate various components.

Q-182 Why aluminium is preferred for metallization?

Ans

- *It is a good conductor.
- *it is easy to deposit aluminium films using vacuum deposition.
- *It makes good mechanical bonds with silicon.
- *It forms a low resistance contact.

Q-183 What are the popular IC packages available?

Ans

- Metal can package.
- Dual-in-line package.
- Ceramic flat package.

Q-184 Define an operational amplifier.

Ans

An operational amplifier is a direct-coupled, high gain amplifier consisting of one or more differential amplifier. By properly selecting the external components, it can be used to perform a variety of mathematical operations.

Q-185 Define CMRR of an op-amp.

Ans

The relative sensitivity of an op-amp to a difference signal as compared to a common –mode signal is called the common –mode rejection ratio. It is expressed in decibels.
 $CMRR = A_d/A_c$

Q-186 What are the applications of current sources?

Ans

Transistor current sources are widely used in analog ICs both as biasing elements and as load devices for amplifier stages.

Q-187 Justify the reasons for using current sources in integrated circuits.

Ans

- *superior insensitivity of circuit performance to power supply variations and temperature.
- *more economical than resistors in terms of die area required to provide bias currents of small value.
- *When used as load element, the high incremental resistance of current source results in high voltage gain at low supply voltages.

Q-188 What is the advantage of widlar current source over constant current source?

Ans

Using constant current source output current of small magnitude (microamp range) is not attainable due to the limitations in chip area. Widlar current source is useful for obtaining small output currents. Sensitivity of widlar current source is less compared to constant current source.

Q-189 Mention the advantages of Wilson current source.

Ans

- *provides high output resistance.
- *offers low sensitivity to transistor base currents.

Q-190 Define sensitivity.

Ans Sensitivity is defined as the percentage or fractional change in output current per percentage or fractional change in power-supply voltage.

Q-191 **What are the limitations in a temperature compensated zener-reference source?**

Ans A power supply voltage of atleast 7 to 10 V is required to place the diode in the breakdown region and that substantial noise is introduced in the circuit by the avalanching diode.

Q-192 **What do you mean by a band-gap referenced biasing circuit?**

Ans The biasing sources referenced to V_{BE} has a negative temperature co-efficient and V_T has a positive temperature co-efficient. Band gap reference circuit is one in which the output current is referenced to a composite voltage that is a weighted sum of V_{be} and V_t so that by proper weighting, zero temperature co-efficient can be achieved.

Q-193 **What are the applications of V-I converter?**

Ans

- * Low voltage dc and ac voltmeter
- * LED
- * Zener diode tester

Q-194 **What do you mean by a precision diode?**

Ans The major limitation of ordinary diode is that it cannot rectify voltages below the cut \pm in voltage of the diode. A circuit designed by placing a diode in the feedback loop of an op \pm amp is called the precision diode and it is capable of rectifying input signals of the order of millivolt.

Q-195 **Write down the applications of precision diode.**

Ans

- * Half - wave rectifier
- * Full - Wave rectifier
- * Peak \pm value detector
- * Clipper
- * Clamper

Q-196 **List the applications of Log amplifiers:**

Ans

1. Analog computation may require functions such as $\ln x$, $\log x$, $\sin hx$ etc. These functions can be performed by log amplifiers
2. Log amplifier can perform direct dB display on digital voltmeter and spectrum analyzer
3. Log amplifier can be used to compress the dynamic range of a signal

Q-197 **What are the limitations of the basic differentiator circuit?**

Ans

- * At high frequency, a differentiator may become unstable and break into oscillations /n
- *The input impedance decreases with increase in frequency, thereby making the circuit sensitive to high frequency noise.

Q-198 **Write down the condition for good differentiation :-**

Ans For good differentiation, the time period of the input signal must be greater than or equal to $R_f C_1$

$$T \geq R_f C_f$$

Where, R_f is the feedback resistance

C_f is the input capacitance

Q-199 **Mention any two audio frequency oscillators :**

Ans

1. RC phase shift oscillator
2. Wein bridge oscillator

Q-200 **What are the characteristics of a comparator?**

- Ans**
1. Speed of operation
 2. Accuracy
 3. Compatibility of the output

Q-201 **What mean by a filter?**

Ans Filter is a frequency selective circuit that passes signal of specified band of frequencies and attenuates the signals of frequencies outside the band

Q-202 **What are the demerits of passive filters?**

Ans Passive filters works well for high frequencies. But at audio frequencies, the inductors become problematic, as they become large, heavy and expensive. For low frequency applications, more number of turns of wire must be used which in turn adds to the series resistance degrading inductor's performance i.e. low Q, resulting in high power dissipation.

Q-203 **What are the advantages of active filters?**

Ans Active filters used op- amp as the active element and resistors and capacitors as passive elements.

1. By enclosing a capacitor in the feedback loop , inductor less active filters can be obtained
2. Op-amp used in non \pm inverting configuration offers high input impedance and low output impedance, thus improving the load drive capacity.

Q-204 **Mention some commonly used active filters :**

- Ans**
1. Low pass filter
 2. High pass filter
 3. Band pass filter
 4. Band reject filter.

Q-205 **Mention some areas where PLL is widely used:**

- Ans**
- *Radar synchronisation
 - *satellite communication systems
 - *air borne navigational systems
 - *FM communication systems
 - *Computers.

Q-206 **List the basic building blocks of PLL:**

- Ans**
- *Phase detector/comparator
 - *Low pass filter
 - *Error amplifier
 - *Voltage controlled oscillator

Q-207 **What are the three stages through which PLL operates?**

- Ans**
- *Free running
 - *Capture
 - *Locked/ tracking

Q-208 **Define lock-in range of a PLL:**

Ans The range of frequencies over which the PLL can maintain lock with the incoming signal is called the lock-in range or tracking range. It is expressed as a percentage of the VCO free running frequency.

Q-209 **Define capture range of PLL:**

Ans The range of frequencies over which the PLL can acquire lock with an input signal is called the capture range. It is expressed as a percentage of the VCO free running frequency.

Q-210 Define in which factors Pull-in time depend?

Ans The total time taken by the PLL to establish lock is called pull-in time. It depends on the initial phase and frequency difference between the two signals as well as on the overall loop gain and loop filter characteristics.

Q-211 For perfect lock, what should be the phase relation between the incoming signal and VCO output signal?

Ans The VCO output should be 90 degrees out of phase with respect to the input signal.

Q-212 Give the classification of phase detector:

Ans *Analog phase detector
*Digital phase detector

Q-213 What is a switch type phase detector?

Ans An electronic switch is opened and closed by signal coming from VCO and the input signal is chopped at a repetition rate determined by the VCO frequency. This type of phase detector is called a half wave detector since the phase information for only one half of the input signal is detected and averaged.

Q-214 What are the problems associated with switch type phase detector?

Ans *The output voltage V_e is proportional to the input signal amplitude. This is undesirable because it makes phase detector gain and loop gain dependent on the input signal amplitude.

*The output is proportional to $\cos\phi$ making it non-linear.

Q-215 What is a voltage controlled oscillator?

Ans Voltage controlled oscillator is a free running multivibrator operating at a set frequency called the free running frequency. This frequency can be shifted to either side by applying a dc control voltage and the frequency deviation is proportional to the dc control voltage.

Q-216 On what parameters does the free running frequency of VCO depend on?

Ans *External timing resistor, R_T
*External timing capacitor, C_T
*The dc control voltage V_c .

Q-217 Give the expression for the VCO free running frequency.

Ans $f_0 = 0.25/R_T.C_T$

Q-218 Define Voltage to Frequency conversion factor.

Ans Voltage to Frequency conversion factor is defined as,
 $K_V = \Delta f_0 / \Delta V_c = 8f/V_{cc}$

Where ΔV_c , is the modulation voltage required to produce the frequency shift Δf_0

Q-219 What is the purpose of having a low pass filter in PLL?

Ans *It removes the high frequency components and noise.
*Controls the dynamic characteristics of the PLL such as capture range, lock-in range, band-width and transient response.
*The charge on the filter capacitor gives a short- time memory to the PLL.

Q-220 Discuss the effect of having large capture range.

Ans The PLL cannot acquire a signal outside the capture range, but once captured, it will hold on till the frequency goes beyond the lock-in range. Thus, to increase the ability of lock range, large capture range is required. But, a large capture range will make the PLL more susceptible to noise and undesirable signal.

Q-221 Mention some typical applications of PLL:

Ans Frequency multiplication/division

- Frequency translation
- AM detection
- FM demodulation
- FSK demodulation.

Q-222 What is a compander IC? Give some examples.

Ans The term companding means compressing and expanding. In a communication system, the audio signal is compressed in the transmitter and expanded in the receiver. Examples: LM 2704- LM 2707; NE 570/571.

Q-223 What are the merits of companding?

Ans

- *The compression process reduces the dynamic range of the signal before it is transmitted.
- *Companding preserves the signal to noise ratio of the original signal and avoids nonlinear distortion of the signal when the input amplitude is large.
- *It also reduces buzz, bias and low level audio tones caused by mild interference.

Q-224 List the applications of OTA:

Ans OTA can be used in

- programmable gain voltage amplifier
- sample and hold circuits
- voltage controlled state variable filter
- Current controlled relaxation oscillator.

Q-225 Where are the successive approximation type ADC's used?

Ans The Successive approximation ADCs are used in applications such as data loggers & instrumentation where conversion speed is important.

Q-226 What is the main drawback of a dual-slop ADC?

Ans The dual slope ADC has long conversion time. This is the main drawback of dual slope ADC.

Q-227 State the advantages of dual slope ADC:

Ans It provides excellent noise rejection of ac signals whose periods are integral multiples of the integration time T.

Q-228 Define accuracy of converter.

Ans **Absolute accuracy:**

It is the maximum deviation between the actual converter output & the ideal converter output.

Relative accuracy:

It is the maximum deviation after gain & offset errors have been removed. The accuracy of a converter is also specified in form of LSB increments or % of full scale voltage.

Q-229 What is settling time?

Ans It represents the time it takes for the output to settle within a specified band $\frac{1}{2}$ LSB of its final value following a code change at the input (usually a full scale change). It depends upon the switching time of the logic circuitry due to internal parasitic capacitance & inductances. Settling time ranges from 100ns. 10 μ s depending on word length & type circuit used.

Q-230 What is monotonic DAC?

Ans A monotonic DAC is one whose analog output increases for an increase in digital input

Q-231 What is multiplying DAC?

Ans A digital to analog converter which uses a varying reference voltage V_R is called a multiplying DAC (MDAC). If the reference voltage of a DAC, V_R is a sine wave given by:

$$V(t) = V_{in} \cos 2\pi f t,$$

Then

$$V(o) = V_{om} \cos(2\pi f t + 180^\circ)$$

Q-232 What is meant by delta modulation?

Ans Delta modulation is a technique capable of performing analog signal quantisation with smaller bandwidth requirements. Here, the binary output representing the most recent sampled amplitude will be determined on the basis of previous sampled amplitude levels.

Q-233 Mention some applications of 555 timer:

Ans

- *Oscillator
- *pulse generator
- *ramp and square wave generator
- *mono-shot multivibrator
- *burglar alarm
- *traffic light control.

Q-234 What is the need for a tuned amplifier?

Ans In radio or TV receivers, it is necessary to select a particular channel among all other available channels. Hence some sort of frequency selective circuit is needed that will allow us to amplify the frequency band required and reject all the other unwanted signals and this function is provided by a tuned amplifier.

Q-235 Give the classification of tuned amplifier:

Ans

(i) Small signal tuned amplifier

- *Single tuned
- *Double tuned
- *Stagger tuned

(ii) Large signal tuned amplifier

Q-236 What is an ideal diode?

Ans An ideal diode is one which offers zero resistance when forward biased and infinite resistance when reverse biased.

Q-237 Compare ideal diode as a switch.

Ans An ideal diode when forward biased is equivalent a closed (ON) switch and when reverse biased, it is equivalent to an open (OFF) switch.

Q-238 Define knee/cut-in/threshold voltage of a PN diode.

Ans It is the forward voltage applied across the PN diode below which practically no current flows.

Q-239 What is the effect of junction temperature on cut-in voltage of a PN diode?

Ans Cut-in voltage of a PN diode decreases as junction temperature increases.

Q-240 What is the effect of junction temperature on forward current and reverse current of a PN diode?

Ans For the same forward voltage, the forward current of a PN diode increases and reverse saturation current increases with increase in junction temperature.

Q-241 Differentiate between breakdown voltage and PIV of a PN diode.

Ans The breakdown voltage of a PN diode is the reverse voltage applied to it at which the PN junction breaks down with sudden rise in reverse current. Whereas, the peak inverse voltage (PIV) is the maximum reverse voltage that can be applied to the PN junction without damage to the junction.

Q-242 **Differentiate avalanche and zener breakdowns.**

Ans **Zener Breakdown**

1. Breakdown occurs due to heavily doped junction and applied strong electric field.
2. Doping level is high.
3. Breakdown occurs at lower voltage compared to avalanche breakdown.

Avalanche Breakdown

1. Breakdown occurs due to avalanche multiplication between thermally generated ions.
2. Doping level is low.
3. Breakdown occurs at higher voltage.

Q-243 **Differentiate between drift and diffusion currents**

Ans **Drift Current**

1. It is developed due to potential gradient.
2. This phenomenon is found both in metals and semiconductors.

Diffusion Current

1. It is developed to charge concentration gradient.
2. It is found only in semiconductors.

Q-244 **List the PN diode parameters.**

Ans

1. Bulk Resistance. (r_B)
2. Static Resistance/Junction Resistance (or) DC Forward Resistance (R_f or r_f)
3. Dynamic Resistance (or) AC Forward Resistance (r_d or r_f or R_{ac})
4. Reverse Resistance (R_r)
5. Knee Voltage (V_k)
6. Breakdown Voltage (V_b)
7. Reverse Current (or) Leakage Current

Q-245 **State the PN diode ratings.**

Ans

Even PN-Junction has limiting values of maximum forward current, peak inverse voltage and maximum power rating.

Q-246 **Define reverse recovery time.**

Ans

It is maximum time taken by the device to switch from ON to OFF stage.

Q-247 **List the PN diode switching times.**

Ans

1. Recovery Time
2. Forward Recovery Time
3. Reverse Recovery Time
4. Reverse recovery time, (R_{tt})
5. Storage and Transition Times

Q-248 **Define transition capacitance of a diode.**

Ans

Transition Capacitance (CT) or Space-charge Capacitance: When a PN-junction is reverse-biased, the depletion region acts like an insulator or as a dielectric.

The P- and N-regions on either side have low resistance and act as the plates. Hence it is similar to a parallel-plate capacitor. This junction capacitance is called transition or space-charge capacitance (CT).

Its typical value is 40 pF.

Since the thickness of depletion layer depends on the amount of reverse bias, C_T can be controlled with the help of applied bias.

This property of variable capacitance is used in varicap or varactor diode.

Q-249 Define diffusion capacitance of a diode.

Ans Diffusion or Storage Capacitance (CD):

This capacitive effect is present when the junction is forward-biased.

It is called diffusion capacitance due to the time delay in minority charges across the junction by diffusion process. Due to this fact, this capacitance cannot be identified in terms of a dielectric and plates. It varies directly with forward current. When a forward-biased PN-junction is suddenly reverse biased, a reverse current flows which is large initially, but gradually decreases to the level of saturation current, I_0 .

This effect can be likened to the discharging, of a capacitor and is, therefore called diffusion capacitance, CD. Its typical value is $0.02\mu\text{F}$

Q-250 List some applications of zener diode.

Ans

Zener diode find wide commercial and industrial applications. Some of their common applications are:

- As voltage regulators.
- As peak clippers or voltage limiters.
- For wave shaping.
- For meter protection against damage from accidental application of excessive voltage.

As a fixed reference voltage in a network for biasing and comparison purposes and for calibrating voltmeters.

Q-251 State the ratings of zener diode.

Ans

1. Zener voltage (V_Z): The voltage at which a zener diode breaks in the reverse bias condition is called zener voltage. In fact, it is the voltage at which a zener diode is to operate. The value of zener voltage depends upon doping-more the doping, lesser the breakdown voltage.

2. Tolerance: The range of voltages about the breakdown voltage in which a zener diode conducts in reverse direction is called tolerance.

3. Power Rating (PZM): The maximum power which a zener diode can dissipate (or handle) without damage is called its power rating.

4. Maximum Current Rating (I_{ZM}): The maximum value of current which a zener diode can handle at its rated voltage without damage is called maximum current rating (I_{ZM}).

5. Zener resistance (R_Z): The opposition offered to the current flowing through the zener diode in the operating region is called zener resistance (R_Z) or zener impedance (Z_Z).

$$*P_{ZM} = I_{ZM} \times V_Z$$

Q-252 State the principle of operation of an LED.

Ans

When a free electron from the higher energy level gets recombined with the hole, it gives out the light output. Here, in case of LEDs, the supply of higher level electrons is provided by the battery connection.

Q-253 State any four advantages of LED.

Ans

- They are small in size.
- Light in weight.
- Mechanically rugged.
- Low operating temperature.

- Switch on time is very small.
- Available in different colours.
- They have longer life compared to lamps.
- Linearity is better.
- Compatible with ICs.
- Low cost.

Q-254 State some disadvantages of LED.

- Ans**
- Output power gets affected by the temperature radiation.
 - Quantum efficiency is low.
 - Gets damaged due to over-voltage and over-current.

Q-255 List the applications of LED.

- Ans**
- They are used in various types of displays.
 - They are used as source in opto-couplers.
 - Used in infrared remote controls.
 - Used as indicator lamps.
 - Used as indicators in measuring devices.

Q-256 State the principle of operation of an LCD.

- Ans**
- Basically this type of display consists of liquid crystal molecules.
 - These molecules have a special property. They change their orientation when an electrical signal is applied to them.
 - The display consists of two glass plates and liquid crystal molecules are placed in between the glass plates.
 - When no electrical signal is applied to the liquid crystal cell, then all the liquid crystal molecules have random orientation with respect to their axis. The incoming light passes through the gap of molecules. So, the light also gets twisted.
- Now, when an electrical signal is applied to this structure, then all the liquid crystal molecules get oriented by 90° to the glass plate. In this case, this light passes in straight way along the molecular arrangement.

Q-257 State any four advantages of LCD

- Ans**
- Less amount of power per digit is required.
 - LCDs have best contrast ratio.
 - No external interfacing circuitry is required.
 - They have low threshold voltage.
 - They can be driven directly.
 - LCDs and MOS compatible.
 - Small size and low cost.

Q-258 State any four application of LCD.

- Ans**
- LCDs are generally applicable in the field of medical, domestic and industrial electronics. Some of the applications of LCD are:
- Wrist watches.
 - Telephones and cellular phones.
 - Digital panel meters.
 - PCO monitors.
 - Calculators.
 - For space applications.
 - In digital clocks.
 - Televisions.
 - Automobiles, etc.

Q-259 Compare LEDs and LCDs.

Ans LEDs

1. More power is required.
2. Fastest displays.
3. More life.
4. LED is light source.
5. More temperature range.
6. Mounting is easy.

LCDs

1. Less power is required
2. Slowest displays.
3. Less life.
4. LCD is not light source. It is a light reflector.
5. Less temperature range.
6. Mounting is difficult.

Q-260 Define rectifier. Mention the types.

Ans

Rectifier: A rectifier is a circuit that converts AC into pulsing DC. It uses unidirectional conducting devices like PN diodes.

Rectifiers are classified into two types based on the conduction of AC input.

They are:

- Half wave rectifier (HWR)
- Full wave rectifier (FWR).

There are two types of FWRs.

- Centre-tapped FWR.
- Bridge rectifier.

Q-261 Define rectifier efficiency.

Ans

It is defined as the ratio of DC power output to the applied AC power in put

Q-262 Define ripple factor of a rectifier.

Ans

The purpose of a rectifier is to convert AC into DC. But the pulsating output of a rectifier contains a DC component and an AC component, called ripple.

The ratio of RMS value of AC components to the DC component in the rectifier output is called 'ripple factor'.

The ripple factor is very important in deciding the effectiveness of a rectifier. It indicates the purity of the DC power output. The smaller the ripple factor, the lesser the effective AC component and hence more effective is the rectifier.

Q-263 Define TUF of a rectifier.

Ans

Most of the rectifier circuits make use of transformer whose secondary feeds the AC power. The transformer rating is necessary to design a power supply.

Transformer utilization factor (TF) is defined as the ratio of DC power delivered to the load to the AC power rating of transformer secondary.

Q-264 Give the advantages and disadvantages of half wave rectifier (HWR) and full wave rectifier (FWR).

Ans

Half Wave Rectifier (HWR)

Advantages

- Simple circuit.

- Low cost.

Disadvantages.

- Rectification efficiency is low (40.6percent).
- Very high amount of ripple ($\gamma = 1.21$)
- Low TUF (0.287)
- Saturation of transformer core occurs.

Q-265 What is the need for a filter in rectifier?**Ans**

The output of a rectifier is pulsating and contains a steady DC component with undesirable ripples. If such pulsating DC is given to the electronic circuits, it produces disturbances and other interferences. Hence ripples have to be kept far from the load. This is achieved by use of a filter circuit in between the rectifier and load

Q-266 What is a rectifier-filter? List the different types of filters.**Ans**

A filter circuit is a device which removes the AC component but allows the DC components of the rectifier to reach the load.

Ripples can be removed by one of the following filtering methods.

- (i) A capacitor, in parallel to the load, provides a easier bypass for the ripples due to low impedance to AC at ripple frequency and leave the DC appear across the load.
- (ii) An inductor, in series with the load, prevents the passage of ripples due to high impedance at ripple frequency, while allowing the DC due to low resistance to DC.
- (iii) Various combinations of capacitor and inductor, such has L-section filter, π -section filter, etc., which make use of both the properties depicted above.

Types of filter circuits: Depending upon the components used in the filter circuits and the way they are connected, the filter circuits are classified as:

- (i) Shunt capacitor filter
- (ii) Series inductor filter
- (iii) Choke-input (LC) filter
- (iv) Capacitor-input (π) filter.

Q-267 List some advantages and disadvantages of Choke-input filter[CLC] filters.**Ans**

- It can be used with both HWRs and FWRs.
- More output voltage is obtained.
- Output is almost pure DC.

Q-268 What is the need for voltage regulators? What are the drawbacks of unregulated power supply?**Ans**

An ordinary (unregulated) power supply from the following drawbacks:

- Poor regulation
- The DC output voltage varies with the AC supply voltage which fluctuates at different times of the day and is different at different locations.
- The DC output voltage varies with temperature, in case semiconductors are used.
- For certain applications the output of the filter even with small amount of ripples is not acceptable.

Q-269 Define voltage regulator? List some types.**Ans**

A voltage regulator is a circuit which makes the rectifier-filter output voltage constant regardless of the variations in the input voltage or load.

Types of regulators: There are three principal types of regulators, viz.,

- Shunt regulator
- Series regulators
- Switch-mode regulators or switched mode power supply(SMPS)

- Q-270** Define Minimum load resistance.
Ans The change in DC output voltage from no load to full load with respect to full load voltage of a power supply is called its voltage regulation.
- Q-271** For normal operation, how is emitter-base junction biased?
Ans Forward.
- Q-272** For normal operation, how is collector-base junction biased?
Ans Reverse.
- Q-273** What is the relation between the currents of a transistor?
Ans $I_E = I_B + I_C$
- Q-274** What are the types of circuit connections known as configurations, for operating a transistor?
Ans Common-Base (CB)
Common-Emitter (CE)
Common-Collector (CC)
- Q-275** What is the relation between α and β of a transistor?
Ans $\alpha = \beta / \beta + 1$
- Q-276** What are the regions used when BJT is used as a switch?
Ans Saturation and cut-off regions.
- Q-277** What is the thermal resistance of power BJT?
Ans Thermal resistance is the resistance to the flow of heat. Heat flows from the junction to the surrounding air. Larger the transistor case, smaller the thermal resistance and vice-versa. Thermal resistance is reduced by providing heat sink with the transistor.
- Q-278** Why must the base be narrow for the transistor (BJT) action?
Ans Beta (β) is the ratio of I_C to I_B . I_B becomes less if the base width is narrow. Higher value of β can be obtained with lower value of base current.
- Q-279** What is the value of cut-in voltage for a BJT?
Ans For Silicon BJT - 0.7V
For Germanium - 0.3V
- Q-280** Why an ordinary transistor is called bipolar?
Ans Because the transistor operation is carried out by two types charge carriers—majority and minority carriers.
- Q-281** Why transistor (BJT) is called current controlled device?
Ans The output voltage, current or power is controlled by the input current in a transistor. So, it is called the current controlled device.
- Q-282** What are “emitter injection efficiency” and “base transport factor” of a transistor?
Ans The ratio of current of injected carriers at emitter junction to the total emitter current is called the emitter injection efficiency.
- Q-283** Why silicon type transistors are more often used than Germanium type?
Ans Because silicon has smaller cut-off current I_{CBO} , small variations in I_{CBO} due to variations in temperature and high operating temperature as compared to those in case of Germanium.
- Q-284** Why collector is made larger than emitter and base?
Ans Collector is made physically larger than emitter and base because collector is to dissipate much power.

- Q-285** Why the width of the base region of a transistor is kept very small as compared to other regions?
Ans Base region of a transistor is kept very small and lightly doped so as to pass most of the injected charge carriers to the collector.
- Q-286** Why emitter is always forward biased with respect to base?
Ans To supply majority charge carrier to the base.
- Q-287** Why collector is always reverse biased with respect to base?
Ans To remove the charge carriers away from the collector-base junction.
- Q-288** Why CE configuration is most popular in amplifier circuits?
Ans Because its current, voltage and power gains are quite high and the ratio of output impedance and input impedance are quite moderate.
- Q-289** Why is CC configuration seldom used?
Ans Because its voltage gain is always less than unity.
- Q-290** How many h-parameters are there for a transistor?
Ans Four – h_i , h_o , h_r h_f or h_{11} , h_{12} , h_{21} , h_{22} .
- Q-291** What are the units for h_{11} and h_{22} ?
Ans h_{11} – ohm; h_{22} – mho (or) siemen.
- Q-292** What are the parameters h_r and h_o called?
Ans h_r – reverse transfer voltage.
 h_o – output admittance.
- Q-293** Why h-parameters are called hybrid parameters?
Ans Because they have different units are mixed with other parameters.
- Q-294** Which is the smallest of the four h-parameters of a transistor?
Ans h_o or h_{12}
- Q-295** What is the typical value of h_{ie} ?
Ans 1 k Ω
- Q-296** Which of the BJT configuration is suitable for impedance matching application and why?
Ans CC configuration is suitable for impedance matching applications because of very high input impedance and low output impedance.
- Q-297** Give the current gain expression for a common emitter transistor configuration?
Ans $\gamma = \Delta I_E / \Delta I_B$
- Q-298.** What are the tools used for small signal analysis of BJT?
Ans i. h – Parameter circuit model.
 ii. z – Parameter circuit model.
 iii. y – Parameter circuit model.
 iv. Trans conductance parameter circuit model.
 v. Physical model.
 vi. T-model.
- Q-299** What is the significance of ICBO and ICO?
Ans ICBO is the leakage current from the collector to base with emitter open. ICO is the leakage current from collector to emitter with base open (ICO = ICEO).
- Q-300** Why field effect transistor are called unipolar transistors?
Ans Because current conduction is by only one type of majority carriers.

- Q-301** Why FET's are so called? (or) Why FETs are voltage controlled devices?
Ans The output characteristics of a FET can be controlled by the applied electric field (voltage) and hence the name FET and are voltage controlled devices.
- Q-302** How is drain current controlled in a JFET?
Ans By controlling the reverse bias given to its gate, i.e., V_{GS} .
- Q-303** What is the pinch-off voltage in a JFET?
Ans The value of V_{DS} at which the channel is pinched-off, i.e., all the free charges from the channel get removed, is called the pinch-off voltage in a JFET.
- Q-304** What are the parameters that control the pinch-off voltage of JFET?
Ans Electron charge, donor/acceptor concentration density, permittivity of channel material and half-width of channel bar.
- Q-305** How does the FET behave
(i) For small values of $|V_{DS}|$ and
(ii) For large values of $|V_{DS}|$?
Ans (i) FET behaves as an ordinary resistor for small values of $|V_{DS}|$, i.e., in ohmic region.
(ii) FET behaves as a constant current source for large values of $|V_{DS}|$ till breakdown occurs.
- Q-306** What is meant by saturation region?
Ans The region of drain characteristic of a FET in which drain current remains fairly constant is called the saturation or pinch-off region.
- Q-307** What is meant by drain-source saturation current I_{DSS} ?
Ans The drain current in pinch-off region with $V_{DS} = 0$ is called I_{DSS} .
- Q-308** Why is the input impedance of FET very high?
Ans Because it's input circuit (gate-to-source) is reverse biased and the input gate current is very small (nA).
- Q-309** Why MOSFET is called IGFET?
Ans MOSFET is constructed with the gate terminal insulated from the channel. So it is called as insulated gate FET or IGFET.
- Q-310** Why E-MOSFET is called sometimes normally-off MOSFET?
Ans E-MOSFET operates with large positive gate voltages only and does not conduct when $V_{GS} = 0$. So, it is called normally-off MOSFET.
- Q-311** What is meant by gate-to-source threshold voltage V_{GST} in E-MOSFET?
Ans It is the minimum value of V_{GS} that is required to form the inversion layer.
- Q-312** Why MOSFETs are never connected or disconnected in the circuit when power is ON?
Ans If a MOSFET is connected or disconnected in a circuit when power is ON, the transient voltages caused by inductive kickback and other effects may exceed $V_{GS(max)}$ and thus wipe out the MOSFET.
- Q-313** Name the factors which make the JFET superior to BJT?
Ans High input impedance, low output impedance and low noise level.
- Q-314** List the JFET parameters.
Ans Trans conductance (g_m), drain resistance (r_d) and amplification factor (μ)
 $\mu = g_m r_d$
- Q-315** List some applications of JFETs.

- Ans**
1. Used as buffers in measuring equipment, receivers and other general purpose devices.
 2. Used in RF amplifiers of FM tuners and communication equipment.
 3. Used in mixer circuits in FM and TV receivers and communication equipment.
 4. Used in cascade amplifiers in measuring and test equipment.
 5. Used as voltage variable resistor (VVR) in OP-AMPS and tone controls.
 6. Used in hearing aids and inductive transducers.
 7. Used in oscillator circuits.
 8. As the physical size is small, it finds use in digital circuits in computers, large scale integration (LSI) and memory circuits.
 9. Used as current sources.

Q-316 List some advantages of MOSFETs.

- Ans** MOSFETs combine the inherent advantages of solid-state devices such as:
1. Small size
 2. Low power consumption
 3. Simplicity of construction
 4. Mechanical ruggedness.

With the inherent advantages of electron tubes such as:

1. Very high input impedance
2. Square law transfer characteristics.

Q-317 What is a differential amplifier?

- Ans** An amplifier, which is designed to give the difference between two input signals, is called the differential amplifier.

Q-318 What is the function of a differential amplifier?

- Ans** The function of a differential amplifier is to amplify the difference of two signal inputs

Q-319 When two signals V_1 and V_2 are connected to the two inputs of a difference amplifier, define a difference signal V_d and common-mode signal V_c

- Ans** The difference signal V_d is defined as the difference of the two signal inputs, i.e., $V_d = V_1 - V_2$

The common-mode signal V_c is defined as the average of the two signals, i.e., $V_c = .5(V_1 + V_2)$

Q-320 What is the differential-mode voltage gain of a differential amplifier?

- Ans** It is given by, $A_d = .5(A_1 - A_2)$

Q-321 What is the common-mode gain A_c in terms of A_1 and A_2 ?

- Ans** It is given by $A_c = A_1 + A_2$

Q-322 Define CMRR.

- Ans** The common-mode rejection ratio (CMRR) of a differential amplifier is defined as the ratio of the differential-mode gain to common-mode gain.

$$CMRR = |A_d/A_c|$$

Q-323 What are the ideal values of A_d and A_c with reference to the differential amplifier?

- Ans** Ideally, A_c should be zero and A_d should be large, ideally infinite.

Q-324 Express CMRR in d

- Ans** $CMRR (dB) = 20 \log A_d - 20 \log A_c$.

Q-325 What are advantages of differential amplifier?

- Ans** It has high gain and high CMRR.
- Q-326** **List some applications of differential amplifiers?**
- Ans** Used in IC applications, AGC circuits and phase inverters.
- Q-327** **Define (i) feedback (ii) positive feedback and (iii) negative feedback.**
- Ans** **i. Feedback:** The process of combining a fraction of the output (of a Device-amplifier) back to its input is called feedback.
ii. Positive Feedback: If the feedback is in phase to the input, it is called positive feedback.
iii. Negative Feedback: When the feedback is in opposition (out of phase) to the input, it is called negative feedback.
- Q-328** **What loop gain of a feedback amplifier.**
- Ans** In a feedback amplifier, when the signal passes through an amplifier
- Q-329** **Define pulse and pulse circuits.**
- Ans** The word “pulse” is applied to waveforms that exist for a very short period. The word “pulse circuits” refer to the active and passive circuits intended to handle, generate, shape and store pulse signals.
- Q-330** **Define switching circuit.**
- Ans** A circuit which can turn ON or OFF the current in the electronic circuits is called switching circuit
- Q-331** **Define wave shaping and wave shaping circuits.**
- Ans** The process of generating new wave shapes from older wave forms using some network is called wave shaping. The circuits which perform wave shaping are called wave shaping circuits.
Eg: Clippers, Clampers, Integrator, Multipliers, etc.
- Q-332** **Give some examples of linear and non-linear wave shaping circuits.**
- Ans** Linear wave shaping circuits – use R, L, and C.
Examples: RC, RL, RLC circuits, Integrator, Summer, etc.
Non-linear wave shaping circuits – uses R,L,C diodes,
Examples: Clippers, Clampers, etc.
- Q-333** **Why the capacitor in a high pass RC circuit is called blocking capacitor?**
- Ans** Because of the blocking property of the capacitor for DC or low frequency input signals, the capacitor acts like an open circuit and blocks the signal. So the capacitor in high-pass RC circuits is called “blocking capacitor”.
- Q-334** **Why a high-pass RC circuit is called differentiator?**
- Ans** Because it gives the output voltage proportional to the differentiation of input voltage.
- Q-335** **What are the conditions for a series RC circuit to act as a differentiator?**
- Ans** i. RC Time constant(RC) lesser than Time period of input signal(T)
ii. $XC \geq 10R$
- Q-336** **List the applications of high-pass RC circuits.**
- Ans** 1. To generate a step from ramp input.
2. To generate a square wave from a triangular wave.
3. To generate a series of narrow pulses called “pips” from rectangular or square waves.
4. Used in R-C coupling of amplifiers where distortion and differentiation of waveform is to be avoided.
- Q-337** **Why a low-pass RC circuit is called an integrator?**

Ans Because it gives the output voltage proportional to the integral of input voltage.

Q-338 What are the conditions for a series RC circuit to act as an integrator?

Ans
i. RC Greater than T
ii. $R \geq 10XC$

Q-339 List the applications of low-pass RC circuits.

Ans
1. Used as bypass capacitors.
2. To perform mathematical integration in analog computers.
3. To generate triangular and ramp waveforms.
4. Used to discriminate pulses of different lengths.

Q-340 What are the characteristics of pulse waveforms?

Ans Rise time, fall time and tilt.

Q-341 Define Clamping.

Ans Clamping is the process of shifting the input signal above or below the zero level. By clamping the input signal suitably, we can introduce (insert) any required DC level into the signal. So clampers are also called DC level restorers.

Q-342 What is a Clamper?

Ans The circuit with which the waveform can be shifted, such that, a particular part of it (say positive or negative peak) is maintained at a specified level, is called a “clamping circuit or simply, clamper”.

Q-343 List the types of Clampers.

Ans
1. Positive Clamper
2. Negative Clamper
3. Biased Clamper

Q-344 What is the function of a positive clamper?

Ans It shifts the signal towards the positive side such that the negative side of the signal reduces to zero.

Q-345 What is the function of a negative clamper?

Ans It shifts the signal towards to negative side such that the positive side of the signal reduces to zero.

Q-346 What is biased clamper?

Ans A biased clamper means that clamping can be done at any voltage level other than zero.

Q-347 List the applications of Clampers.

Ans
1. They are used in T.V. receivers to restore the original DC reference signal (corresponding to the brightness level of the picture) to the video signal.
2. They are used to produce a DC voltage is a multiple of peak AC input voltage i.e., they are used as voltage multipliers.
3. They are used to supply power to high voltage/low current devices like CRTs used in T.V receivers, CROs and computer displays.

Q-348 Define clipper?

Ans The circuit with which the waveform is shaped by removing (or clipping) a certain portion of the input signal voltage above or below a present level is called clipping circuit or simply, clipper. They are used to limit the amplitude of the input signal.

Q-349 List the types of clippers.

Ans
. Based on limiting action:
1. Positive Clipper
2. Negative Clipper

3. Biased Clipper
4. Combination Clipper

Q-350 What is the difference between the output from a clipper and a clamper?

Ans The output of a clipper appears as if a portion of the input signal were clipped off, but a clamper simply shifts the input to a different DC level.

Q-351 What is the difference between positive and negative clippers?

Ans The positive clippers removes the positive half cycles, while the negative clipper removes the negative half cycles, of the input waveform.

Q-352 What is the difference between positive and negative clampers?

Ans A positive clamper pushes the signal on the positive side or upward while a negative clamper pushes the signal on the negative side or downward.

Q-353 A clamper circuit sometimes uses a DC battery in addition to diode, a capacitor and a resistor. Why?

Ans To cause an additional shift.

Q-354 How does a clamper affect the peak-to-peak and RMS values of a waveform?

Ans No change.

Q-355 List the applications of clippers.

- Ans**
1. They are used to remove unwanted portions like noise accumulated on peaks of waveforms.
 2. They are used in T.V receivers to separate sine pulses from the composite video signal.
 3. Two level clippers are used as square wave generators.
 4. They are used in PPM modulators.

Q-356 What is a multivibrator? List the different types of multivibrators.

Ans A Multivibrator is basically a two stage amplifier with 100% feedback between the two stages such that output of one is fed back to the other.

The feedback from one stage to the other is so arranged that when one transistor is drive to cut-off, the other is driven to saturation. Thus at any particular instant of time, one transistor is ON and the other is OFF.

Types: There are three basic types of multivibrators depending on the type of coupling network used. They are:

1. Astable multivibrators (AMV) or free running generator.
2. Monostable multivibrator (MMV) or one-shot multivibrator or univibration.
3. Bistable multivibrator (BMV) or flip-flop.
4. An AMV uses capacitive coupling.
5. An MMV uses RC coupling.
6. An BMV uses resistive coupling.

Q-357 What is AMV? Why is it called a square wave generator?

Ans An AMV is essentially a two-stage RC coupled amplifier with output of one stag supplied back to the input of another stage.

An AMV generates square wave of known frequency (or period). So, it is called a "square wave generator".

Q-358 How does a MMV circuit be constructed from a AMV?

Ans By replacing one R-C timing circuit by a DC voltage divider.

Q-359 What is the function of commutating capacitors in multivibrator?

Ans To improve the switching characteristics of the circuit.

Q-360 Why are monostable Multivibrators called one-shot Multivibrators?

Ans They generate one output pulse for every trigger pulse and hence the name “one shot Multivibrators or univibrators”.

Q-361 Why the BMV is called a flip-flop?

Ans In a BMV, one trigger pulse causes the Multivibrator to flip from one state to the other state and the next pulse causes it to flop back to its original state. So, it is called the flip flop.

Q-362 What are the applications of AMVs?

Ans AMVs are used as

1. Square wave generators.
2. Voltage to frequency converters.
3. Pulse synchronization circuits.
4. Clock for binary logic signals.

Q-363 What are the applications of MMVs?

Ans MMVs are used for

1. Generation of well-defined pulses
2. Logic design of pulse delay
3. Variable pulse width

Q-364 What are the applications of BMVs?

Ans BMVs are used as

1. Memory elements in shift registers, counters, etc.,

Q365 What are the applications of Schmitt trigger?

Ans

1. Amplitude comparator
2. Squaring circuit
3. Flip flop

Q-366 Why an AMV is called free running relaxation oscillator?

Ans Because it runs and relaxes alternately.

Q-367 Which portion of the UJT characteristic is used to make UJT to generate saw tooth waves?

Ans Negative resistance region.

Q-368 Define PN junction.

Ans When a p type semiconductor is joined to an N type semiconductor the contact surface is called PN junction.

Q-369 Explain the forward bias of diode (PN junction).

Ans If p type terminal is connected to Anode (positive electrode), and N type terminal is connected to cathode (Negative electrode) it is known as forward bias. At forward bias, large current will flow in the range of milli amperes (10-3A). Forward bias is equivalent to short circuit.

Q-370 Explain reverse bias of diode (PN Junction).

Ans If p type is connected to cathode and N type is connected to anode, it is reverse bias. At reverse bias, small current will flow in the range of micro amperes (10^{-6}). Reverse bias is equivalent to open circuit.

Q-371 Explain the V-I characteristics of PN Junction diode.

Ans It is a graph drawn between voltage in x axis and current in y axis.

Q-372 Define knee voltage.

Ans It is the forward voltage of a PN diode at which the current through the junction starts increasing rapidly.

Q-373 Define breakdown voltage.

Ans It is the reverse voltage of a PN junction diode at which the junction breaks down with sudden rise in the reverse current.

Q-374 Explain the Half wave circuit.

Ans Half wave rectifier circuit consists of one Semiconductor Diode D1 and load Resistance RL. That is current will flow during positive half cycle and no current will be conducted during negative half cycle.

Q-375 List the advantages of full bridge rectifier.

Ans

1. Centre-tapped transformer is not needed.
2. For the same secondary voltage, the output is doubled than that of the centre-tap circuit.

Q-376 Define Zener diode.

Ans A zener diode is a properly doped crystal diode which has a sharp breakdown voltage.

Q-377 Compare between half wave and full wave rectifiers.

Ans

1. The efficiency of a full wave rectifier is double that of a half wave rectifier
2. The ripple factor is large and frequency of voltage is low in a half wave rectifier, hence the waveform cannot be easily smoothed whereas in full wave rectifier, the frequency is large therefore can be filtered easily with simple filtering circuits.

Q-378 Define ripple factor

Ans The ripple factor is a measure of purity of the dc output of a rectifier and is defined as $r = \text{rms value of the component of wave} / \text{average or dc value}$

Q-379 What is rectifier efficiency?

Ans The rectification efficiency tells us what percent of total input ac power is converted into useful dc output power. Thus rectification efficiency is defined as $\eta = \text{dc power delivered to load} / \text{ac input power from transformer secondary}$

Q-380 Define voltage regulation(rectifier)

Ans Voltage regulation is a measure of the ability of a rectifier to maintain a specified output voltage with the variation of load resistance and is defined as follows.
Voltage regulation = (output at no load - output at full load) / output at full load

Q-381 List the classification of filters

Ans

1. Low pass filter which transmits low frequencies to the load and attenuates high frequencies.
2. High pass filter which transmit high frequencies.
3. Band pass filter which transmits a band of frequencies.

Q-382 Define LED.

Ans The PN junction diode can emit light through a process known as electroluminescence. When a diode is forward biased, majority of the carriers on both side of the junction will cross the junction potential barrier. This recombination emission is responsible for the diode emitting light.

Q-383 Define LCD (Liquid Crystal Display).

Ans A thin film of LC fluid is sandwiched between two glass plates. The glass plates are coated with conductive transparent in the film formed of the desired alpha numeric image. LCD's consume less power and have the shortest life.

Q-384 Mention the types of LCD.

Ans 1. Dynamic scattering
2. Field effect.

Q-385 **Mention the materials used in LED.**

Ans 1. Gallium Arsenic Zinc Antimony.
2. Gallium Phosphorous.
3. GA As Ps.
4. Ga PN.

Q-386 **Define Amplifier.**

Ans Amplifier is a device which amplifies the given input signal.
Example: transistor

Q-387 **Define Transistor.**

Ans It consists of two PN Junctions formed by sandwiching either p-type or n-type semiconductor between a pair of opposite types.

Q-388 **Mention the types of transistor?**

Ans 1. NPN Transistor
2. PNP Transistor

Q-389 **Mention the terminals of transistor.**

Ans The transistor has three terminals namely emitter, base and collector.

Q-390 **Define doping.**

Ans The emitter is heavily doped. The base is lightly doped and the collector is moderately doped.

Q-391 **Define current amplification factor.**

Ans The ratio of change in output current to the change in input current at constant other side voltage is called current amplification factor.

Q-392 **Explain the input characteristics of transistor.**

Ans It is a graph drawn between output voltage and input current keeping other side voltage as constant.

Q-393 **Explain the output characteristics of transistor.**

Ans It is a graph drawn between output voltages and output current keeping other side current (I/P) as constant.

Q-394 **Mention the types of connection in a transistor.**

Ans 1. Common base connection.
2. Common emitter connection
3. Common collector connection.

Q-395 **Differentiate FET and BJT .**

Ans FET

1. Unipolar device (that is current conduction by only one type of either electron or hole).
2. High input impedance due to reverse bias.
3. Gain is characterized by trans conductance
4. Low noise level

BJT

1. Bipolar device (current conduction by both electron and hole).
2. Low input impedance due to forward bias.
3. Gain is characterized by voltage gain.
4. High noise level.

Q-396 What are the biasing conditions to operate transistor in active region?

Ans Emitter-base junction has to be forward biased and collector-base junction to be reverse biased.

Q-397 What is thermal runaway?

Ans The power loss in transistor is primarily at the collector junction because the voltage there is high compared to the low voltage at the forward biased emitter junction. If the collector current increases, the power developed tends to raise the junction temperature. This causes an increase in β and α further increase in collector current in temperature may occur resulting in “thermal run away.”

Q-398 In a transistor operating in the active region although the collector junction is reverse biased, the collector current is quite large.

Ans Forward biasing the input side and reverse biasing the output side are the requirements of a transistor in the active region. The collector current is experimentally equal to the emitter current. Therefore the collector current will be large as emitter current is large on the other hand, in CE operation I_B is multiplied by β , hence we get large collector current.

Q-399 Why CE configuration is considered to be the most versatile one?

Ans The common emitter configuration provides very good voltage gain about 500CE configuration finds excellent usage in audio frequency applications, hence used in receivers and transmitter.

Q-400 Define bipolar junction transistors.

Ans These devices operate with both holes and electrons and hence are called bipolar junction.

Q-401 Write the junction transistor operation may be drawn from the analysis.

Ans

1. The major charge carriers in the PNP junction transistor are holes.
2. The major charge carriers in the NPN junction transistor are electrons.

Q-402 Define JFET

Ans A Junction field effect Transistor is a three terminal semiconductor device in which current conduction is by one type of carrier (i.e., either electron or holes)

Q-403 Define channel.

Ans It is a bar like structure which determines the type of FET. Different types of N channel are FET and P channel FET.

Q-404 Explain the biasing of JFET.

Ans Input is always reverse biased and output is forward biased. (Note: In transistor input is forward biased and output is reverse biased).

Q-405 Define Drain resistance.

Ans It is the ratio of change in Drain – source voltage (ΔV_{DS}) to the change in Drain current (ΔI_D) at constant gate source voltage (V_{GS}).

Q-406 Define Trans conductance.

Ans It is the ratio of change in drain current (ΔI_D) to the change in Gate – Source Voltage (ΔV_{GS}) at constant Drain – Source voltage (V_{DS})

Q-408 Write the advantages of JFET

Ans

1. Input impedance of JFET is very high. This allows high degree of Isolation between the Input and Output circuit.
2. Current carriers are not crossing the junction hence noise is reduced drastically

Q-409 Mention the two types of field effect transistors

Ans 1. N-channel FET
2. P-channel FET

Q-410 Define pinch off voltage.

Ans As the reverse bias is further increased, the effective width of the channel decreases, the depletion region or the space charge region widens, reaching further into the channel and restricting the passage of electrons from the source to drain. Finally at a certain gate to source voltage $V_{GS} = V_P$.

Q-411 Explain the depletion mode of operation in MOSFET.

Ans When the gate is at negative bias, the thickness of the depletion layer further increases owing to the further increase of the induced positive charge. Thus the drain current decreases, as the gate is made more negative. This is called depletion mode of operation.

Q-412 Explain the term Drain in FET.

Ans The drain is the terminal through which the current leaves the bar. Conventional current entering the bar is designated as I_D .

Q-413 Explain the terms source in FET.

Ans The source is the terminal through which the current enters the bar. Conventional current entering the bar is designated as I_S .

Q-414 Define the term Gate in FET.

Ans The gate consists of either P+ or N+ impurity regions, heavily doped and diffused to the bar. This region is always reverse biased and in fact, controls the drain current I_D .

Q-415 Write the relative disadvantages of an FET over that of a BJT.

Ans 1. The gain bandwidth product in case of a FET is low as compared with a BJT.
2. The category, called MOSFET, is extremely sensitive to handling therefore additional precautions have to be considered while handling.

Q-416 Mention the methods used for biasing circuits in FET.

Ans 1. Self-bias.
2. Potential divider bias.

Q-417 Explain the term MOSFET.

Ans In the insulated gate FET, conductivity is controlled by the potential on the insulated metal plate lying on the top of the channel the insulated gate field effect transistor is often called metallic oxide semiconductor FET.

Q-418 Mention the types of feedback.

Ans 1. Positive or regenerative feedback.
2. Negative or degenerative feedback.

Q-419 Define feedback.

Ans The process of injecting a fraction of the output voltage of an amplifier into the input so that it becomes a part of the input is known as feedback.

Q-420 Define positive feedback.

Ans It is the feedback voltage in phase with the input from the source; it reinforces the original input signal and is called positive or regenerative feedback.

Q-421 Define Negative feedback.

Ans If the feedback voltage is opposite in phase to the input from the source, i.e., opposes the original input signal and is called negative or degenerative feedback

Q-422 Mention the four connections in Feedback

Ans 1. Voltage series feedback.

2. Voltage shunt feedback
3. Current series feedback.
4. Current shunt feedback.

Q-423 Explain the voltage series feedback.

Ans

In this case, the feedback voltage is derived from the output voltage and fed in series with input signal. The input of the amplifier and the feedback network are in series is also known as series parallel in parallel, hence this configuration is also known as series parallel feedback network.

Q-424 Explain the voltage shunt feedback.

Ans

The input of amplifier and the feedback network are in parallel and known as parallel – parallel feedback network. This type of feedback to the ideal current to voltage converter, a circulating having very low input impedance and very low output impedance.

Q-425 Explain the current series feedback.

Ans

When the feedback voltage derived from the load current and is fed in series with the input signal, the feedback is said to be current series feedback, the inputs of the amplifier and the feedback network are in series and the output are also in series. This configuration is also called as series-series feedback configuration.

Q-426 Explain the current shunt feedback.

Ans

When the feedback voltage is derived from the load current and a fed in parallel with the input signal, the feedback is said to be current shunt feedback. Herein the inputs of the amplifier and the feedback network are in parallel and the outputs are in series. This configuration is also known as parallel series feedback.

Q-427 Write the effects of negative feedback.

Ans

1. The gain becomes stabilized with respect to changes in the amplifier active device parameters like h_{fe} .
2. The non-linear distortion is reduced there by increasing the signal handling capacity or the dynamic range of the amplifier.

Q-428 Write the conditions for a circuit to oscillate.

Ans

1. The oscillator circuit should consist of an amplifier and a portion of the output should be feedback to the input. For sustained oscillations, the feedback voltage must be in phase with the input, i.e., total phase shift around the loop must be 360° .
2. The amount of energy or power feedback to the input must be sufficient to the input circuit.

Q-429 Mention the classification of oscillators.

Ans

According to the frequency determining networks,

1. RC oscillators
2. LC oscillators
3. Crystal oscillators

Q-430 List the advantages of phase shift oscillator.

Ans

1. The phase shift oscillator does not required conductance or transformers.
2. It is suitable for the low frequency range i.e., from a few hertz to several hundred KHz. The upper frequency is limited because the impedance of RC network may become so small that it loads the amplifier heavily.

Q-431 Write the disadvantages of Phase shift oscillator.

Ans

1. It is necessary to change the C or R in all the three RC networks simultaneously for changing the frequency of oscillations. This is practically difficult.

2. It is not suitable for high frequencies.

Q-432 Write the main drawback of LC oscillators

Ans

1. The frequency stability is not very good.
2. They are too bulky and expensive and cannot be used to generate low frequencies.

Q-433 Define Piezo electric effect.

Ans

Certain crystal, when suitable wt, develop a potential difference between opposite faces, magnitude and polarity of which depends on pressure or tension applied to the other pair of perpendicular faces. This effect is called Piezo electric effect.

Q-434 Define differential amplifier.

Ans

When two or more input is applied to the amplifier and receive the single output is called differential amplifier.

$$V_O = V_1 - V_2$$

Q-435 Define stability.

Ans

The variation of input is applied to the system; to get the constant output is called stability.

Q-436 Define switch.

Ans

A switch is a device which opens or closes the electrical circuit, i.e., can turn on or off current in an electrical circuit. An ideal switch has zero internal resistance when it is closed an infinite leakage resistance when it is open.

Q-437 What is the function of Clamper circuit?

Ans

Clamper circuit introduces a d.c level to an a.c signal. Hence, the damper circuit or network is also known as d.c restorer. These circuits find applications in television receivers to restore the d.c reference signal to the video signal.

Q-438 Define rise time.

Ans

The time during which the voltage or current reaches to a maximum positive or negative value is called the rise time. The rise time is zero for the square wave.

Q-439 Define sinusoidal waveform.

Ans

A sine wave varies continuously in amplitude in proportion to the sine of an angle which varies from 0 to 360°.

Q-440 Define market pips.

Ans

Circuits make use of the transient properties of R, C and L to realize the mathematical operations of differentiations, integration and summation. The differentiating circuit is extensively used to convert summation. The different circuit is extensively used to convert pulse trains to a series of timing pips known as market pips.

Q-441 Mention the classification of switches.

Ans

1. Mechanical switch.
2. Electronic switch.

Q-442 Define ramp function generator.

Ans

The shape of the pulse resemble the teeth or a saw, therefore the name saw tooth waveform. A saw tooth generator is also called ramp function generator.

Q-443 Define Multi vibrators.

Ans

There is a class of RC coupled oscillators called Multivibrators which generate non-sinusoidal waveforms such as triangular square and saw tooth.

Q-444 Define free running multi vibrators.

Ans

A Multivibrator is a form of relaxation oscillators. They may need no external excitation, i.e., they are self-excited; if so they are termed as free running Multivibrator.

Q-445 Mention the types of Multivibrators.

- Ans**
1. Monostable multivibrator.
 2. Bistable multivibrator.
 3. Astable multivibrator.

Q-446 Define Astable multivibrator.

Ans The change in the output state is regenerative. The output never remains permanently at a particular state. Hence, this multivibrator is called astable multivibrator.

Q-447 Define bistable multivibrator.

Ans Since in the absence of an external signal, either transistor can continue indefinitely in ON or OFF state, they are equally stable in both states. Therefore, the name Bistable multivibrator.

Q-448 Define Monostable multivibrator.

Ans It is also called the one shot multivibrator. The one shot multivibrator is driven, it is not free running unlike the bistable trigger, and the monostable has one stable state to which it returns after the external driving pulse has caused it to execute its cycle.

Q-449 Define Schmitt Trigger.

Ans When the input is sinusoidal signal and converted to square waveform in output is called Schmitt trigger. Generation of pulses when the voltage level rises to a certain value is achieved by using a circuit.

Q-450 Define high pass filter.

Ans At very high frequencies the capacitor acts as a virtual short circuit and the output falls to zero. Hence this circuit passes the low frequencies of the input and attenuates the high frequency is called low pass filter.

Q-451 Define duty cycle.

Ans It is the ration of the ON period to the total period.
($T = T_{ON} + T_{OFF}$)
Therefore, Duty cycle = T_{on}/T

Q-452 Write the application of Astable Multivibrator.

- Ans**
1. The astable multivibrator is used as square wave generator, voltage to frequency convertor and in pulse synchronization, as clock for binary logic signals and so on.
 2. Since it produces square waves it is a source of production of harmonic frequencies of higher order,

Q-453 Write the applications of monostable multivibrator.

- Ans**
1. The monostable multivibrator is used to function as an adjustable pulse width generator.
 2. It is used to generate uniform width pulses from a variable width input pulse train.