TWO MARK QUESTIONS AND ANSWERS
UNIT-I
PN JUNCTION DEVICES

1) Define semiconductor.

Semiconductor is a substance, which has resistivity in between Conductors and insulators.

Eg. Germanium, Silicon.

2) Define intrinsic semiconductor. (Nov 2007)

Semiconductor in an extremely pure form is called intrinsic semiconductor.

3) What are the types of extrinsic semiconductor?

a) N-type semiconductor

b) P-type semiconductor.

4) Define doping. (May-2004 & May 2006)

The process of adding impurities to an intrinsic semiconductor is called doping.

5) What is 'peak inverse voltage '? What is its value for the HWR?

The peak inverse voltage is the peak voltage across the diode in the reverse direction i.e. when the diode reverse biased. HWR when the diode is reverse biased and hence the maximum value of voltage that can exist across the diode is nothing but Em.

6) Define efficiency of a half wave rectifier along with its maximum value.

The efficiency of a half wave rectifier is defied as ratio of d.c output power to a.c input power.

Efficiency = d.c output power / a.c input power.

$$= P_{dc} / P_{ac}$$

The maximum efficiency is 40.6 %

7) Define breakdown voltage?(May 2006)

It is the reverse voltage of a PN diode at which the junction breakdown and there will be a sudden increase in reverse current.

8) What are the types of junction capacitances?

a) Transition capacitance or space charge capacitance.

b) Diffusion or storage capacitance.

9) Define diffusion?

It is defined as the gradual flow of charge from a region of high density to a region of low density.

10) Define Hall effect.

When a transverse magnetic field is applied to a thin strip of metal or a semiconductor carrying current I, an electric field E is induced in the direction perpendicular to both I and B.

11) What are the applications of Hall effect?

- **Used to determine whether a semiconductor is of N-type or P-type.**
- **Used to find carries concentration.**
- **Used to measure the conductivity of the material.**
- **Used to find carrier mobility.**

12) List the advantages of Zener regulator.

- **Simple circuits**
- **Only 2 or 3 components are required to be used**
- **Low cost.**

13) What are the two mechanism of break down in zener diodes?

- **Zener break down**
- **Avalanche break down.**

14) Define zener breakdown. (May 2006)

In a heavily doped PN region, direct rupture of covalent bonds takes place because of the strong electric field applied. This new electron hole pair increases the reverse current.

15) Define avalanche breakdown. (May-2007)

In a zener diode if the applied reverse bias voltage exceeds 6 volts, then the breakdown is through avalanche multiplication. Here a thermally generated carrier falls down the junction barrier and acquire energy from the applied voltage. This collides with a crystal ion and a new electron hole pair gets created. These in turn may acquire enough energy, collide with another crystal ion and create still another electron hole pair. This is a cumulative process and known as avalanche multiplication.

16) What is rectifier?

Rectifier is a device, which converts a.c voltage to pulsating D.C voltage, using one or more pn junction.

17) Define forbidden energy gap. (April-2008)

It is the separation between conduction band and valence band on energy band diagram.

18) Define form factor.

It is the ratio between rms value and average value of voltage or current.

Rms value / Average value.

19) Define Ripple factor and give the value of for half wave rectifier.

The ratio of rms value of the a.c component to the d.c component in the output is know as ripple factor (r).

$$R = \sqrt{(Vrms / Vdc)^2 - 1}$$

Mathematically the value of r is calculated to be 1.21 for a half wave rectifier.

20) Define biasing? (Dec-2006)

Applying external d.c. Voltage to any electronic device is called biasing.

21) What is forward biasing?

Forward biasing means connecting P- region to +ve and N - region to-ve of the battery.

22) Define form factor.

It is the ratio between rms value and average value of voltage or current.

Rms value / Average value.

23) Give the expression for ripple factor (r) and its value incase for a full wave rectifier.

$$R = \sqrt{(Vrms/Vdc)^2 - 1}$$

For the full wave rectifier the value of ripple factor r = 0.428.24) Give the value of form factor and peak factor for a full wave rectifier.

For a full wave rectifier ,

Form factor = 1.11

Peak factor = $\sqrt{2}$

24) what is a LED?

A PN junction diode which emits light when forward biased is known as Light emitting diode (LED).

25) What is TUF?

The factor, which indicates how much, is the utilization of the transformer in the circuit, is called Transformer utilization factor.

Its value is 0.287 for the HWR
Its value is 0.812 for the FWR

26) What are the uses of bridge rectifier?

- **The only disadvantage of Bridge rectifier is the use of four diodes as compared to normal full wave rectifier.**
- **This cause the additional voltage drop.**

27) Compare half wave rectifier and full wave rectifier. (Nov 2007)

S.NO	Half wave rectifier	Full wave rectifier
1	DC load current is half that of half wave rectifier.	DC load current is twice that of half wave rectifier.
2	DC load voltage is half that of half wave rectifier.	DC load voltage is twice that of half wave rectifier.
3	Losses in transformer is less	Losses in transformer is more
4	Dc power output is small	Dc power output is four times large as compared to half wave rectifier

28) Define percentage regulation of a rectifier.

It is defined as the variation of DC output voltage with respect to load.

Percentage regulation = ($V_{noload} - V_{load}$) / V_{load}.

29) What is depletion region in PN junction?

The region around the junction from which the mobile charge carriers (electrons and holes) are depleted is called as depletion region. Since this region has immobile ions, which are electrically charged, the depletion region is also known as space charge region.

30) What is barrier potential?

Because of the oppositely charged ions present on both sides of PN junction an electric potential is established across the junction even without any external voltage source which is termed as barrier potential.

31)What is meant by biasing a PN junction?

Connecting a PN junction to an external voltage source is biasing a PN junction.

32) What is forward bias and reverse bias in a PN junction?

When positive terminal of the external supply is connected to P region and negative terminal to N region, the PN junction is said to be forward biased. Under forward biased condition the PN region offers a very low resistance and a large amount of current flows through it.

33) What is reverse bias in a PN junction?

When positive terminal of the external supply is connected to N type and negative terminal to P type then the PN junction is said to be in reverse bias. Under reverse biased condition the PN region offers a very high resistance and a small amount of current flows through it.

34) What is Reverse saturation current?

The current due to the minority carriers in reverse bias is said to be reverse saturation current. This current is independent of the value of the reverse bias voltage.

35) What is the static resistance of a diode?

Static resistance R of a diode can be defined as the ratio of voltage V across the diode to the current flowing through the diode.

$$R = V/I$$

Where
R - Static resistance of a diode
V - Voltage across the diode
I - current across the diode

36) what is recovery time? Give its types.

When a diode has its state changed from one type of bias to other a transient accompanies the diode response, i.e., the diode reaches steady state only after an interval of time " tr" called as recovery time. The recovery time can be divided in to two types such as

(i) forward recovery time
(ii) reverse recovery time

37) What is meant by forward recovery time?

The forward recovery time may be defined as the time interval from the instant of 10% diode voltage to the instant this voltage reaches 90% of the final value. It is represented as t f r.

38) What is meant by reverse recovery time?

The reverse recovery time can be defined as the time required for injected or the excess minority carrier density reduced to zero , when external voltage is suddenly reversed.

13 MARK QUESTIONS:

1. **Describe the operation of PN junction diode with its VI characteristics. (NOV 2008, 2006) T_1 Pg – 1.34**
2. **Derive the expression for diffusion capacitance of a PN junction diode. (NOV 2005) T_1 Pg – 1.49**
3. **What is Zener breakdown and Avalanche breakdown? Explain the characteristics of Zener diode. (NOV 2005,2006) T_1 Pg – 1.42**
4. **Briefly explain diffusion capacitance and space charge capacitance of a diode. (NOV 2004, 2006) T_1 Pg – 1.49**
5. **Derive the expression for drift current density and diffusion current density in extrinsic semiconductor. (NOV 2004) T_1 Pg – 1.38**
6. **Explain the working principle of diode under forward and reverse bias conditions and draw its VI characteristics. (NOV 2005) (MAY 2006) T_1 Pg – 1.32**
7. **What is Hall Effect and how it is used to find carrier concentration in a semiconductor? (NOV 2005) T_1 Pg – 1.21**
8. **Derive the expression for drift current density in intrinsic and extrinsic semiconductors. (NOV 2005) (MAY 2006) T_1 Pg – 1.38**
9. **Describe the effect of temperature on PN junction diode characteristics. (MAY 2006) T_1 Pg – 1.27**
10. **Explain the characteristics of Zener diode as a regulator. (MAY 2006) T_1 Pg – 5.19**
11. **Explain the following (MAY 2006) T_1 Pg – 1.54**

- **Storage time Transition time Reverse recovery time**

12. **Explain the working principle of half wave rectifier. T_2 Pg - 470**
13. **Explain the working principle of full-wave rectifier. (Dec 2007) T_2 Pg - 474**
14. **Briefly explain the working principle of bridge rectifier. (Apr 2006) T_2 Pg - 477**
15. **Briefly explain the principle of LED characteristics.(8) (June 2006) T_2 Pg – 557**
16. **Briefly explain the principle of LCD characteristics. T_2 Pg – 559**
17. **Briefly explain zener break down. (6) (Nov 2006)**
18. **Write a note on power transistor. (6) (Nov 2006)**
19. **Discuss the temperature effect of PN junction diodes. (8) (Nov 2006)**
20. **Describe the behaviour of PN junction diode under forward & reverse bias conditions. (8) (June 2009)**
21. **Describe the application of LED in seven segment display. (8) (June 2009)**
22. **Describe the construction & principle of operation of LCD & LED. (16)(DEC 2005)**

TWO MARK QUESTIONS AND ANSWERS
UNIT – II
TRANSISTORS

1) Define Transistor.

Transistor consists of two junctions formed by sand witching either P-type or N-type semiconductor between a pair of opposite types.

Transistor is a three terminal device whose output current, voltage and /or power is controlled by input current.

Three terminals: emitter, base, collector

2) Why FET is called voltage controlled device?

The output characteristics of FET is controlled by its input voltage thus it is voltage controlled.

3) What is pinch off voltage?

It is the voltage at which the channel is pinched off (ie) all the free charge from the channel get removed.

Drain source voltage above which the drain current become constant is known as pinch off voltage. The point N is called as pinch off point. Above the pinch off voltage the channel width becomes narrow and drain current remains constant.

4) Comparison between JFET & MOSFET.

MOSFET	JFET
It has only one substrate.	It has two substrate.
MOSFET's gate is insulated from the channel.	JFET gate is not insulated.
It has high input impedance.	Less input impedance than MOSFET.
Easy to fabricate.	Difficult to fabricate.

5) Comparison between BJT & JFET.

BJT	JFET
Low input impedance.	High input impedance.
High output impedance.	Low output impedance.
Bipolar device	Unipolar device.
Noise is more.	Less noise.
Gain is more.	Gain is less.
Current controlled device.	Voltage controlled device.

6) Define delay time Nov-2005

It is defined as the time required for the current to rise from 0 to 10% of its maximum value.

7) Define rise time.

It is the time required for the current to rise from 0 to 90 percentage of the maximum value.

8) Define turn-on time.

It is the time required for the current to rise from 0 to 90 percentage of the maximum value

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

9) Define fall time

It is the time required for the Collector current to fall from 90 to 10 percentages of Ics.

10) Define Storage time. Nov -2005

It is the time required to fall from 100 to 90 percent of Ics.

11) Define turn-off time.

It is the time required to fall from 100 to 90 percent of Ics.

$$T_{off} = t_s + t_r$$

12) Define power transistors

Power transistors are those which handles a large amount of current and also dissipates large amount of power across collector base junction.

13) Which is the most commonly used transistor configuration? Why?

The CE Configuration is most commonly used. The reasons are

- **High Current gain**
- **High voltage gain**
- **High power gain**
- **Moderate input to output ratio.**

14) What are the advantages of transistors?

- **Low operating voltage.**
- **Higher efficiency.**
- **Small size and ruggedness.**

15) What are the types of transistors?

- **Unipolar junction transistor.**
- **Bipolar junction transistor.**

16) What is mean by characteristics of transistor?

The interrelation of the various currents and voltages can be plotted graphically which are commonly known as the characteristics of transistor.

17) What are the types of BJT?

- **N-P-N type.**
- **P-N-P type.**

18) Why do we choose q point at the center of the loadline?

The operating point of a transistor is kept fixed usually at the center of the active region in order that the input signal is well amplified. If the point is fixed in the saturation region or the cut off region the positive and negative half cycle gets clipped off respectively.

19) List out the different types of biasing. ._

Voltage divider bias, Base bias,
Emitter feed back bias, Collector feedback bias,
Emitter bias.

20) What do you meant by thermal runway?

Due to the self heating at the collector junction, the collector current rises. This causes damage to the device. This phenomenon is called thermal runway.

21) Why is the transistor called a current controlled device?

The output characteristics of the transistor depend on the input current. So the transistor is called a current controlled device.

22) Define current amplification factor?

It is defined as the ratio of change in output current to the change in input current at constant.

23) What are the requirements for biasing circuits?

• The q point must be taken at the Centre of the active region of the output characteristics.

• Stabilize the collector current against the temperature variations.

• Make the q point independent of the transistor parameters.

• When the transistor is replaced, it must be of same type.

24) When does a transistor act as a switch?

The transistor acts as a switch when it is operated at either cutoff region or saturation region.

25) What is biasing?

To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the transistor. This is called biasing.

26) What is stability factor?

The rate of change of collector current with respect to the rate of change of reverse saturation current.

13 MARK QUESTIONS:

1. Explain the working of NPN transistor.(T:p:no:81) May 2003

2. Explain the working of PNP transistor.(T:p:no:83)Nov 2003

3. Explain the current components of the transistor.(T:p:no:85)Dec2004

4. What are the basic techniques used for the construction of a transistor?(T:p:no:87)May2004

5. Explain the currents in a transistor.(T:p:no:90) May 2003

6. Explain the common base configuration.(T:p:no:94)May 2004

7. Draw the hybrid model for CE configuration. (T: p:no:117) Nov 2003

8. Draw the EBERS-MOLL model for a p-n-p transistor. (T: p:no:124) Dec2004

9. Explain transistor switching times. (T:p:no:129) Nov 2003

10. Explain thermal resistance (T: p:no:139) May 2003

11. What do you mean by safe operating area and explain it?(T:p:no:144) May 2003

12. Explain about the characteristics of a transistor?

TWO MARK QUESTIONS AND ANSWERS
UNIT - III
AMPLIFIERS

1) Write the current amplification factor for a CB transistor.

α = Change in Collector Current / at constant V_{CB}
Change in emitter current

2) Write the formula for input resistance in a CB transistor

Input resistance = Change in base - emitter voltage /
Change in emitter current/at constant V_{CB}

3) Write the current amplification factor for a CE transistor.

β = Change in Collector Current /
Change in base current at constant V_{CE}

4) Explain about the various regions in a transistor?

The three regions are active region, saturation region & cutoff region.

5) What is transconductance in JFET?

It is the ratio of small change in drain current (ΔI_d) to the corresponding change in gate to source voltage (ΔV_{gs}) at constant drain to source voltage(ΔV_{ds}).

$g_m = \Delta I_d / \Delta V_{gs}$, ΔV_{ds} = constant

6) What is amplification factor in JFET?

It is the ratio of small change in Drain to Source voltage ,(ΔV_{ds})to the corresponding change in Gate to Source voltage (ΔV_{gs}) at a constant drain current (I_d).

$\mu = \Delta V_{ds} / \Delta V_{gs}$, I_d = constant

7) Define hybrid parameters.

Any linear circuit having input and output terminals can be analysed by four parameters(one measured on ohm, one in mho and two dimensionless) called hybrid or h-parameters.

8) What are the use of h - Parameters?

It perfectly isolates the input and output circuits.
Its source and load currents are taken into account.

9) What are advantages of FET?

- **It is a voltage control, constant current driven device that is the variation in input voltage controls the output current.**
- **The input impedance is very high so it allows a high degree of isolation between the input and the output circuit.**
- **The carriers are not crossing the junction hence the noise is highly reduced.**
- **It has a negative temperature co-efficient of resistance. This can avoid thermal runaway.**

10) What are the two types of small signal model?

The small signal model is of two types,

i. Low frequency small signal model.

ii. High frequency small signal model.

11) What are the values of input resistance in CB, CE & CC Configuration.

CB - Low about 75

CE - Medium About 750

CC - Very high about 750

12) Write the voltage and current equation for hybrid parameters.

$$V_1 = h_{11} i_1 + h_{12} V_2$$

$$I_2 = h_{21} i_1 + h_{22} V_2$$

13) What are the values of h-parameters?

$h_{11} = V_1 / i_1$ $\quad$ $h_{12} = V_1 / V_2$

$h_{21} = i_2 / i_1$ $\quad$ $h_{22} = i_2 / v_2$

14) Define amplification factor?

It is the product of drain resistance and transconductance.

It is the ratio of small change in drain to source voltage to the corresponding change in Gate to source voltage.

15) What is Darlington pair?

The Darlington connection of two BJTs is, the two transistors Q_1 and Q_2 are directly connected in the Darlington connection. It is also known as Darlington pair.

As seen, the collectors of the two transistors are connected together, emitter of Q_1 is connected to the base of Q_2 and emitter of Q_2 acts as the emitter of Darlington connection.

A Darlington pair behaves like a single transistor with a high current gain (approximately the product of the gains of the two transistors). In fact, integrated

devices have three leads (B, C and E), broadly equivalent to those of a standard transistor.

16) Explain Why N-channel FET's have a better high frequency response than P-channel FET's.

N-channel FET's have a better high frequency response than P-channel FET's due to

i) Mobility of electrons is large in N-channel FET, whereas mobility of holes is poor in P-channel FET.

ii) The input noise is less in N-channel FET than that of P-channel FET.

iii) The transconductance is larger in N-channel FET than that of P-channel FET.

17) What are disadvantages of Darlington pair?

- **The leakage current of the first transistor is also amplified by the second stage. Hence the overall leakage current may be high, so darlington connection of 3 or more is impractical.**

18) Define cascode amplifier?

The cascode is a two-stage amplifier composed of a transconductance amplifier followed by a current buffer. Compared to a single amplifier stage, this combination may have one or more of the following advantages: higher input-output isolation, higher input impedance, higher output impedance, higher gain or higher bandwidth. In modern circuits, the cascode is often constructed from two transistors, with one operating as a common emitter or common source and the other as a common base or common gate. The cascode improves input-output isolation (or reverse transmission) as there is no direct coupling from the output to input. This eliminates the Miller effect and thus contributes to a higher bandwidth.

19) Define CS amplifier.

In this amplifier, the input is applied between the gate & source and the amplified output voltage is developed across a resistor Rs in the source circuit.

20) What are the applications of MOSFET?

- **It can be used as input amplifiers in oscilloscope, electronic voltmeters**
- **It is used in computer memories.**
- **It is used in logic circuits.**

13 MARK QUESTIONS:

1. Describe the depletion & enhancement mode of working of MOSFETs. Explain the operation of enhancement MOSFET.
2. Show how JFET can be used as an amplifier & as a variable resistor with circuit diagram.
3. Explain the operation of MOSFET in Enhancement & depletion modes.(10) (June2009)
4. Describe the constructional details of JFET & also describe the various parameter of JFET. (10) (June2009)
5. Describe the function of JFET as a variable resistor. (6) (June2009)
6. Explain the construction, working principle & characteristics of N-channel Enhancement MOSFET. (16) (Dec2005)(June2008)
7. List three basic JFET bias circuits & compare the performance of the three. (6) (Dec2007)
8. Write the construction, operation & characteristics behaviour of JFET under various biasing conditions. Give the necessary figures. (16) (Dec2007)
9. Draw the low frequency equivalent circuit of JFET & explain the parameters in it. (8) (Dec2007)
10. Describe the construction & working principle of JFET. (10) (11) (Apr2008)(Dec2006)
11. Write the constructional details, explain the characteristics of enhancement type MOSFET. (10) (Dec2007)
12. Distinguish between JFET & MOSFET. (6)(5) (Dec2007) (Apr2008)
13. Derive an expression for o/p impedance, i/p impedance, voltage gain & current gain of CS amplifier.
14. Derive an expression for o/p impedance, i/p impedance, voltage gain & current gain of CS amplifier.
15. With a neat sketch explain the principle of operation of CE amplifiers using small signal model device an expression for its performance.
16. With a neat sketch explain the principle of operation of cascade amplifier & also derive an expression for its performance measures.
17. Briefly explain the operation of Darlington emitter follower & also derive an expression for its performance measures.

TWO MARK QUESTIONS AND ANSWERS
UNIT - IV
MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

1. Define pulse and wave shaping circuits.

Pulse circuits:

The circuits producing various types of pulses like square pulse and triangular pulse are known as Pulse circuits.

Wave shaping circuits:

The circuit which operates on the input signal to produce an output signal of the required shape is known as wave shaping circuit.

2.What is clipper?

Clippers:

The clipping circuits using diodes have the ability to "clip" off or remove a portion of the input signal without distorting the remaining part of the waveform.

3. What are the requirements for producing sustained oscillations in feedback Circuits?

For sustained oscillations, The total phase shift around the loop must be zero at the desired frequency of oscillation, At desired frequency, the magnitude of the loop gain should be equal to unity

4. What is clamper?

The circuits which are used to add a d.c level as per the requirements to the a.c output signal are called clamper circuits.

5. Mention types of clippers and clampers:

Types of clippers:

- **Series clippers**
- **2. Parallel clippers**

Types of clampers:

- **Positive clampers**
- **Negative clampers**

6.What is meant by Schmitt trigger?

Schmitt trigger is type of bistable multi-vibrator using transistors.

7. What is meant by unsymmetrical triggering?

In unsymmetrical triggering, two trigger inputs are used, one to set the circuit in one particular stable state and other to reset the circuit to the opposite state. It is also called set-reset triggering.

8.What is meant by multi-vibrator?

The electronic circuits which are used to generate non -sinusoidal wave forms are called multivibrators.

9.What is the advantage of UJT relaxation oscillator?

The UJT relaxation oscillator maintains constant output frequency even though the supply voltage fluctuates.

10. What is the application of saw tooth oscillators?

- **Used in time – base signal generators**
- **Used in power control circuits**
- **Used in SCR triggering circuits**

11.Mention Various square wave generator circuits

- **Astable multivibrator.**
- **Monostable multivibrator.**
- **Bistable multivibrator.**
- **Schmitt trigger**

12. Mention Various saw tooth generator circuit

- **Exponential charging**
- **Miller circuit.**
- **Bootstrap circuit.**
- **Phantastron circuit.**
- **Inductor circuit**

13. .Define Clamper

It can be explained as introducing a dc level into an ac signal or shifting the ac signal to a predetermined dc level other than zero. These also called as dc restorers.

14.Define Clipper

Clipping or limiter circuits are designed to reduce the positive or negative extremities of an input waveform to a predetermined value, which may zero.

15.How Frequency of oscillation varied in an astable multivibrator

1/T = 1/ 1.38RC, so by varying the value of R or C, the frequency of oscillation can be varied.

16. Define Multivibrator

The multivibrator is a relaxation oscillator used to produce non- sinusoidal waveforms such as square, rectangle, saw tooth. It is basically s two stage resistance coupled amplifier with the output of each stage-coupled regenerative to the other.

17.Define Duty cycle

It is the ratio of pulse width to the pulse period is known as duty cycle.
Duty cycle = on time / (on + off time)

18.Define Pulse circuit

The word pulse circuits refer to the active and passive circuits intended to handle, generate shape and store pulse signals. The different pulse signals and circuits to generate some of them are discussed.

19.Mention Types of clipper

Positive clipper - series and shunt.

- **Negative clipper - series and shunt.**
- **Biased clipper**
- **Combined clipper**

20. What is a Schmitt trigger?

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.

21. What is a multivibrator?

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.

22. What do you mean by monostable multivibrator?

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.

23. What is an astable multivibrator?

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

24. What is a bistable multivibrator?

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

13 MARK QUESTIONS:

1. **Explain astable multivibrator with neat sketch.**
2. **Draw a differential amplifier and its ac equivalent circuit .derive for Ad and Ac.**
3. **With neat sketch explain the BJT differential amplifier with active load and derive for Ad, Ac, and CMRR. How CMRR can be improved.**
4. **Briefly explain neutralization used in tuned amplifier for stabilization.**
5. **Explain in detail about power amplifier and types.**
6. **Draw the circuit diagram of single tuned amplifier and derive an expression for bandwidth.**
7. **Analysis of dc differential amplifier using BJT**

UNIT - V
FEEDBACK AMPLIFIERS & OSCILLATORS

1. What is an amplifier?

An amplifier is a device which produces a large electrical output of similar Characteristics to that of the input parameters.

2. Define an operational amplifier.

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.

3. Define input offset voltage.

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.

4. Define input offset current. State the reasons for the offset currents at the input of the op-amp.

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.

5. Define CMRR of an op-amp. (Dec2007)

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.

$$\text{CMRR} = A_d/A_c$$

The ratio of the differential voltage gain Ad to common mode voltage gain AC.

The ratio of the difference gain to the common gain. And it is expressed as ρ.

$$\text{CMRR} = \rho = |A_d / A_c| \ \& \ \text{CMRR (log)} = 20 \log_{10} (A_d / A_c)$$

6. What are the basic rules of an operating amplifier?

The operating point should be fixed on the load line. The upper end of the load line lies on the saturation region &lower end lies on the cutoff region.

7. How are amplifiers classified according to the input?

- **Small – signal amplifier**
- **Large – signal amplifier**

8. How are amplifiers classified according to the transistor configuration?

- **Common emitter amplifier**
- **Common base amplifier & Common collector amplifier.**

9. What is the different analysis available to analyze a transistor?

- **AC analysis**
- **DC analysis**

10. How can a DC equivalent circuit of an amplifier be obtained?

By open circuiting the capacitor.

11. How can a AC equivalent circuit of a amplifier be obtained?

By replacing dc supply by a ground and short- circuiting capacitors.

12. What is Darlington pair? (Dec2007)

The Darlington connection of two BJTs is as shown in fig. the two transistors Q1 and Q2 are directly connected in the Darlington connection. It is also known as Darlington pair.

13. What is difference between voltage amplifier and power amplifier?

Small signal amplifiers are also known as "Voltage amplifiers". This is because these amplifiers are used primarily for voltage amplification but they are not capable of supplying a large power to the loads such as loud speakers.

The large signal amplifier (power amplifier) will increase the current sourcing and sinking capability. So at its output we get a high voltage, high current signal that means a high power signal. Thus the power amplifier is basically a current amplifier.

14. What is a common mode signal? State its characteristics.

The output of the practical differential amplifier not only depends on the difference voltage but also depends on the average common level of the two inputs. Such an average level of the two input signals is called common mode signal denoted as Vc.

15. What is differential input impedance? How it can be decreased?

It is also called as differential input resistance(Rin) and it is defined as the equivalent resistance between one of the inputs to ground terminal when the other input terminal is connected to ground. Rin should ideally be and practically as high as possible.

The various methods of realizing the high input resistance for the differential amplifier circuit are, 1) use of Darlington pair. 2) use of FET 3) use of swamping resistors.

16. What are the applications of differential amplifiers?

- **As basic building block of OP-AMP.**
- **As input stage of many bio-medical instruments.**
- **As input stage of power oscilloscope**

17. What are the different configurations of a differential amplifier?

The four important configurations of a differential amplifier as follows:

- **Dual input, balanced output differential amplifier.**
- **Dual input, unbalanced output differential amplifier.**
- **Single input, balanced output differential amplifier.**
- **Single input, unbalanced output differential amplifier.**

18. What is the concept of feedback?

Feedback is defined as the process in which a part of output signal (voltage or current) is returned back to the input. In the feed back process a part of output is sampled and fed back to the input . Thus at the input of an amplifier using feedback two signals will be simultaneously present. One of them is the original input signal itself and the other one is the fed back signal. The fed back signal can be in phase with or out of phase with the original input signal.

19. Define positive and negative feedback.

If the original input signal and the feedback signal are in phase, the feed back is called as "positive feed back". However if these two signals are out of phase then the feedback is called as "negative feedback"

Positive feed back used in oscillators and negative feedback is used in amplifiers.

20. What are the classifications of feedback?

- **Voltage series feedback**
- **Current series feedback**
- **Current shunt feedback**
- **Voltage shunt feedback**

21. What is the condition of oscillation?

- **The loop gain of the circuit must be = 1i.e.,**
- **The phase shift around the circuit must be zero.**

22. What is open loop gain?

The amplifier gain is A i.e., it amplifies its input Vi, A times to produce Vo. and This is called open loop gain of the amplifier.

23. Mention two reasons. Why LC oscillator is prepared over RC at radio frequency?

- **It operates in high frequency range from 200 kHz upto few GHz.**
- **We can vary the frequency range easily using tank circuit.**

24. What is the basic principle of operating of a RC oscillator?

For producing oscillations in an oscillator circuit we need positive feedback which means that the voltage signal feedback should be in phase with the input signal. For providing a positive feedback at one particular frequency, an inverting amplifier may be used with a feed back network that causes a phase shift of 180° at the desired frequency of oscillation. The 180° phase shift in the feedback signal can be obtained by a suitable network consisting of three R-C sections

25. How oscillation occurs in crystal oscillator?

Certain materials such as quartz exhibit a unique property called "piezo electric" property. It states that if mechanical force is applied to a quartz crystal then it generates electric potential. Also if electric field is applied to a crystal it vibrates mechanically.

If we apply mechanical vibrations to a quartz crystal then under proper operating conditions we can obtain electrical oscillations from it.

26. Mention any two audio frequency oscillators:

- **RC phase shift oscillator**
- **Wein bridge oscillator**

27. Compare the oscillator and amplifier.

SL.No Oscillators & Amplifiers

1. Oscillator produces the waveform of desired frequency.

Amplifier amplifies the input signal magnitude to desired level.

2. In oscillators positive feedback is applied In amplifiers negative feedback is applied

3. Only we can vary the out put frequency not signal amplitude

Only we can vary the output signal amplitude not frequency

4. Used as signal generators and RF sources Used as audio amplifier

28. Define Differential amplifier.

An op-amp with no feedback is already a differential amplifier, amplifying the voltage difference between the two inputs. However, its gain cannot be controlled, and it is generally too high to be of any practical use. So far, our application of negative feedback to op-amps has resulting in the practical loss of one of the inputs, the resulting amplifier only good for amplifying a single voltage signal input. With a little ingenuity, however, we can construct an op-amp circuit maintaining both voltage inputs, yet with a controlled gain set by external resistors.

29. Compare the oscillator and amplifier.

SL.No	Oscillators & Amplifiers
1.	Oscillator produces the waveform of desired frequency. Amplifier amplifies the input signal magnitude to desired level.
2.	In oscillators positive feedback is applied. In amplifiers negative feedback is applied
3.	Only we can vary the out put frequency not signal amplitude. Only we can vary the output signal amplitude not frequency
4.	Used as signal generators and RF sources Used as audio amplifier

30. Give the expression for the frequency of oscillations in an op-amp sine wave oscillator?

The expression for the frequency of oscillations in an op-amp sine wave oscillator is, f = 1 / (2ðRC)

31. What are the conditions for sustained oscillator or what is Barkhausen criterion?

Condition for sustained oscillation,

a. Magnitude condition |Avâ| = 1

b. Phase condition LAvâ = 0°

These conditions are called as Barkhausen criterion.

32. What is Oscillator circuit?

A circuit with an active device is used to produce an alternating current is called an oscillator circuit.

33. What are the classifications of Oscillators?

Based on wave generated:

i. Sinusoidal Oscillator,

ii. Non-sinusoidal Oscillator or Relaxation Oscillator

According to frequency generated:

i. Audio frequency oscillator
20 Hz – 20 kHz
ii. Radio frequency Oscillator
30 kHz – 30 MHz
iii. Ultrahigh frequency Oscillator
30 MHz – 3 GHz
iv. Microwave Oscillator
3 GHz – above.
*** Crystal Oscillators.**

34. What are the types of feedback oscillators?

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

35. What are the conditions for oscillation? (May2004)

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

36. Define Piezoelectric effect.

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

37. What is the advantage of negative feed back?

- **increased stability**
- **Increased bandwidth**
- **Decreased noise**
- **Less frequency distortion**

13 MARK QUESTIONS:

1. Draw the circuit diagram of a differential amplifier. Explain the operation in difference & common mode. (10) T_1 P.No.376 (Dec2007)
2. Write the voltage gains & impedance for a differential amplifier circuit. (6) T_1 P.No.380 (Dec2007)
3. Draw the circuit of differential amplifier & explain. (4) T_1 P.No.376 (May2004)
4. Explain the operation of voltage feedback amplifier with a circuit. (12) T_1 P.No.406 (May2004)
5. What type of feedback is used in oscillators? Why? (4) T_1 P.No.436 (May2004)
6. Draw the Crystal oscillator circuit & explain. (12) T_1 P.No.438
7. Discuss the different voltage/current – series/shunt feedback connections with expressions for gain, input resistance & output resistance. (16) T_1P.No.404(Dec2007)
8. Conduct an Ac analysis on the differential amplifier & derive expressions for differential gain, common-mode gain & hence CMMR. (16) T_1P.No.404(Dec2007)
9. Draw the LC oscillator circuit & explain.
10. Draw the RC oscillator circuit & explain.
11. Explain the working of voltage-shunt feedback.
12. Explain the working of current-series feedback.
13. Explain the negative feedback with the help of emitter follower. Why is the emitter follower so called.
14. Explain the stability of feedback amplifiers.