UNIVERSITY PART-A ANSWERS

Unit-1

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. What are transistors?

Transistors Three terminal devices that can function as electronic switches or as signal amplifiers. They are current operated devices with high input impedance and low output impedance. Since it transfers current from a high to a low resistance region, it was named bipolar.

3. What is Biasing? And need for biasing.[NOV/DEC-08,11],[MAY/JUN-09,13]

Biasing In order to operate transistor in the desired region we have to apply external dc voltages of correct polarity and magnitude at the two junctions of the transistor.

Need for Biasing BJT

From the above discussion, it is clear that we have to supply external d.c. voltages (d.c. biasing) of correct polarity and magnitude to the two junctions of the transistor, to operate it in the desired region.

In transistor circuits, output signal power is always greater than input signal power. Now the question is how this amplification of power is achieved. The d.c. sources(d.c. biasing) supplies the power to the transistor circuit to get the output signal power greater than input signal power.

4. What are the requirements for biasing circuits?

a. The q point must be taken at the Centre of the active region of the output characteristics.
b .Stabilize the collector current against the temperature variations.
c. Make the q point independent of the transistor parameters.
d. When the transistor is replaced, it must be of same type.
e. Emitter diode should be forward bias and collector diode should be reverse biased.
f. There should be a zero signal collector current.

5. Explain about the characteristics of a transistor?

Input characteristics: it is drawn between input voltage & input current while keeping output voltage as constant.

Output characteristics: It is drawn between the output voltage &output current while keeping input current as constant.

6. What is operating point?

For the proper operation of the transistor a fixed level of current and voltages are required. This values of currents and voltages defined at a point at which the transistor operate is called operating point.

7. What is d.c load line? [NOV/DEC-06][MAY/JUN-12]

The d.c load line is defined as a line on the output characteristics of the transistor which gives the value of Ic & Vce corresponding to zero signal condition

8. 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.

9. Name the two techniques used in the stability of the q point .explain.

Stabilization technique: This refers to the use of resistive biasing circuit which allows IB to vary so as to keep IC relatively constant with variations in Ico,β,&V_{BE}.
Compensation techniques: This refers to the use of temperature sensitive devices such as thermostats diodes. They provide compensating voltages &currents to maintain operating point constant.

10. Define stability factor?[MAY/JUNE-09,10][NOV/DEC-09,12]

Stability factor is defined as the rate of change of collector current with respect to the rate of change of reverse saturation current.

11. What are the basic relation ships of BJT transistor?

$$V_{BE} = 0.7\ \text{V}$$

$$I_E = (\beta + 1)I_B \cong I_C$$

$$I_C = \beta I_B$$

12. 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.

13. What are the methods for biasing? [MAY/JUNE-09,10][NOV/DEC-09,12]

The transistor needs two bias voltages V_{BB} and V_{CC}. The V_{BB} supply is used for biasing of the emitter junction and V_{CC} supply for biasing the collector base junction. Also it is possible to bias both the junctions using a single supply.

Common Methods :

1. Fixed Bias or Base Bias.
2. Collector feedback bias
3. Voltage divider bias or Emitter bias or self bias

14. What are the disadvantages of collector to base bias?

a. The collector current is high.
b. If AC signal voltage gain feedback into the resistor R_e , it will reduce the gain of the amplifier.

15. Why is the operating point selected at the Centre of the active region? [NOV/DEC 07]

The operating point is selected at the Centre of the active region to get to perfect amplification. Moreover there is no distortion.

16. Give the expression for stability factor.[MAY-07,08]

$S= (1+\beta)/[(1-\beta)(\delta IB/\delta IC)]$

17. Define the stability factors S' and S''. [MAY-07,08]

The stability factor S' is defined as the rate of change of I_C with V_{BE}, keeping β & I_{C0} constant.

$$S' \frac{I_C}{V_{BE}} \frac{I_C}{V_{BE}}$$

The stability factor S" is defined as the rate of change of I_C w

$$S'' \frac{I_C}{} \quad \frac{I_C}{}$$

ith β, keeping V_{BE}

& I_{C0} constant.

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18. What are the advantages of fixed bias circuit?

This is simple circuit which uses a few components. The operating point can be fixed anywhere on the Centre of the active region.

The β value is high, stability factor is very large. so the operating point does not maintain by properly.

19. What are the advantages of self bias circuit?

The stability factor value is very very small compare than other biasing circuit .This biasing should maintain an operating point

20. Give the stability factor S for the fixed bias circuit.

The stability factor for the fixed bias circuits is

$$S \quad 1$$

β = current gain of the transistor

21. What do you meant by thermal runway?[NOV/DEC-06]

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.

22. What t is heat sink?

A heat sink is an environment or object that absorbs and dissipates heat from another object using thermal contact (either direct or radiant). Heat sinks are used in a wide range of applications wherever efficient heat dissipation is required; major examples include refrigeration, heat engines and cooling electronic devices.

23. What is biasing of FET ?

Like BJT, the parameters of FET are also temperature dependent. In FET, as temperature increases drain resistance also increases, reducing the drain current. Thus reducing the possibility of thermal runway.

24. How FET is known as voltage variable resistor?[DEC-06]

In the region before pinch off, where V_{DS} is small the drain to source resistance r_d can be controlled by the bias voltage V_{GS}. Therefore FET is useful as a voltage variable (VVR) or voltage dependent resistor (VDR).

25. Why the input impedance of FET is more than that of a BJT?

The input impedance of FET as more than that of BJT because the input circuit of FET is reversed biased where as the input circuit BJT is forward biased.

26. What are the methods of bias compensation technique?

1. Diode compensation due to Ico,β,&V_{BE}
2. Thermistor compensation
3. Sensistor compensation

27. What is meant by compensation techniques? [NOV/DEC-11]

Compensation techniques use temperature sensitive devices such as diodes, transitors, thermistors, etc. to maintain operating point constant.

UNIT-II

1) What are the advantages of Darlington circuit [NOV/DEC-11]

Very high current gain

Very high input impedance

Convenient and easy circuit configuration to use

Darlington pairs are widely available in a single package or they can be made from two separate transistors

2) Define miller's theorem [APR/MAY-10][APR/MAY-11]

Miller's theorem states that the effect of resistance Z on input circuit is a ratio of input voltage V_i to the current I which flows from input to output.

$$Z_1 = \frac{V_i}{I}$$

Miller's theorem states that the effect of resistance Z on Output circuit is a ratio of output voltage V_o to the current I which flows from output to input.

$$Z_2 = \frac{V_o}{I}$$

3) What is the coupling schemes used in multistage amplifiers [APR/MAY-10]

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

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

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

commonly used coupling schemes are,

Resistance capacitance(RC) coupling

Transformer coupling

Direct coupling\

4) Define CMRR[NOV/DEC-09][NOV/DEC-11]

The ability of differential amplifier to reject a common mode signal is expressed by a ratio called as common mode rejection ratio[CMRR]. It is defined as the ratio of differential voltage gain A_d to common mode voltage gain A_c

$$CMRR = \rho = \left|\frac{A_d}{A_c}\right|$$

5) Define transconductance[NOV/DEC-08]

Transconductance, also known as **mutual conductance** is the ratio of the current change at the output port to the voltage change at the input port. It is written as g_m. For direct current, transconductance is defined as follows:

$$g_m = \frac{\Delta I_{\text{out}}}{\Delta V_{\text{in}}}$$

For small signal alternating current, the definition is simpler:

$$g_m = \frac{i_{\text{out}}}{v_{\text{in}}}$$

6) Why hybrid parameters are called so? Define them. [OR] Define the various h-parameters? [May-2007, May-2006, Dec-2008]

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

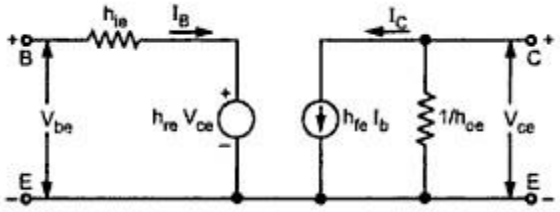
h_{11}= Input impedance with output port short circuited. = $\left.\frac{V_1}{i_1}\right|_{V_2=0}$

h_{12}= Reverse voltage transfer ratio with input port open circuited. = $\left.\frac{V_1}{V_2}\right|_{i_1=0}$

h_{21}= Forward current gain with output port short circuited. = $\left.\frac{i_2}{i_1}\right|_{V_2=0}$

h_{22}= Output admittance with input port open circuited. = $\left.\frac{i_2}{V_2}\right|_{i_1=0}$

7) Draw a CE amplifier and its hybrid equivalent circuit. [May-2008]



8) Define Miller effect input capacitance.[Dec-2006, Dec2007, May-2008]

For any inverting amplifier, the input capacitance will be increased by a miller effect capacitance, sensitive to the gain of the amplifier and the inter electrode capacitance connected between the input and output terminals of the active device.

$C_{Mi} = (1- A_V) C_f$ $C_{M0} = C_f$

C_f = Inter electrode capacitance between input and output.

9) What is meant by bootstrapping?[Dec-2003] [APR/MAY-11]

In Darlington transistor pair circuits, the input impedance is reduced because of the biasing resistors in the circuit. To overcome this, decrease in the input resistance due to the biasing network, a small capacitor and resistance R_3 are added in the circuit. This improves the input impedance of the Darlington pair circuit. C is added at the input side and R_3 is connected between output and input circuits.

R_{eff} - Effective input resistance.

$$R_{eff} \quad \frac{R_3}{1 \; A_V} ; \qquad R_{eff} \text{ – Large value.}$$

$A_V - 1$

10) What is the need of differential amplifier?[Nov/Dec-2009] [APR/MAY-11]

The need for differential amplifier arises in many physical measurements, in medical electronics and in direct coupled amplifier applications. In this amplifier, there will be no output voltage resulting from thermal drifts or any other changes provided, change in both halves of the circuits are equal.

11) Why R_E is replaced by a constant current bias in a differential amplifier?[Dec-2008]

The emitter supply V_{EE} used for biasing purpose must become larger as R_E is increased in order to maintain the quiescent current at its proper value. If the operating currents of the transistors are allowed to decrease, this will lead to higher h_{ie} values and will tend to decrease CMRR. To overcome this practical limitation R_E is replaced by a constant current bias.

12) State the various methods of improving CMRR. [Dec-2007]

Constant current bias method.

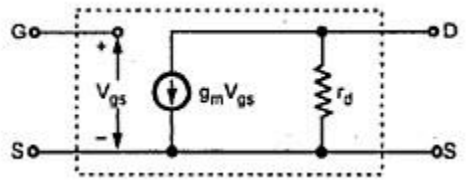
Use of current mirror circuit.

Use of active load.

13) Why emitter bypass capacitor C_E is used in CE amplifier circuit. [APR/MAY 2004]

An emitter bypass capacitor C_E is connected in parallel with the emitter resistance R_E to provide a low reactance path to the amplified ac signal. If it is not inserted, the amplified ac signal passing through R_E will cause a voltage drop across it. This will reduce the output voltage, reducing the gain of the amplifier

14) Draw the low frequency equivalent circuit of FET.[NOV/DEC-09,08]



OTHER QUESTIONS

15) What is an amplifier?

An amplifier is a circuit that increases the amplitude of the given input signal by means of energy drawn from an external source.

16) Based on the transistor configurations how amplifiers are classified.

Based on the transistor configurations, the amplifiers are classified

Common emitter amplifier.

Common base amplifier.

Common collector amplifier

17)What are the salient features of hybrid parameters?

The salient features of hybrid parameters are,

h – Parameters are real numbers.

They are easy to measure.

They are convenient to use in circuit analysis and design.

Easily convertible from one configuration to other.

Readily supplied by manufacturers.

18) Write the relationship between the three transistor current gains, , ?

$$\frac{}{1} \qquad \frac{}{1} \qquad \frac{1}{1} \qquad 1$$

19) Write the current amplification factors of the three transistor amplifier configurations.

In a transistor amplifier with AC input signal, the ratio of change in output current

to the change in input current is known as the current amplification factor.

In the CB configuration, the current amplification factor $\frac{I_C}{I_E}$

In the CE configuration, the current amplification factor $\frac{I_C}{I_B}$

In the CC configuration, the current amplification factor $\frac{I_E}{I_B}$

20) What are the advantages of differential amplifier?

Very stable.

Low noise, low drift.

Variations in supply voltage, temperature etc will not change the gain of the amplitude.

Does not require any coupling capacitor.

Frequency response is better.

21) What are the applications of a differential amplifier?

1. To measure many physical quantities.
2. Can be used as a direct coupled amplifier.
3. Used in operational amplifier.

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22. What are the limitations of h parameter?

The accurate calculation of h parameter is difficult.

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

23. What is a differential amplifier?

An amplifier that has two inputs and produces an output signal that is a function of the difference between the two given inputs is called a differential amplifier.

24. Write the need for constant source for difference amplifier.

The necessary for constant source for differential amplifier is to increase the common mode rejection ratio without changing the quiescent current and without lowering the forward current gain.

25. What is an emitter follower?

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

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

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

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

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

28. What is differential mode signal?

The difference between the two input signals is generally called as differential signal or difference signal.

Differential voltage $Vd \; V_{i2} \; V_{i1}$

Differential gain $Ad \quad \frac{V_0}{V_d} \quad \frac{V_0}{V_{i1} \; V_{i2}}$

The differential gain is expressed in decibel (dB) value as

$A_d = 20 \log_{10} (Ad)$ in Db

29. What is common mode signal?

The average of two input signals or voltages is called a common-mode signal.

$$\text{Common mode voltage} \quad + Vc \quad \frac{V_{i2} \; V_{i1}}{2}$$

The gain with which it amplifies the common mode signal to produce the output is called common mode gain of the differential amplifier denoted as A_c.

$$\text{Common mode gain} \qquad A_c \qquad = \qquad V_0 / V_C$$

The total output voltage of a differential amplifier is thus given by

$$V_0 \qquad = \qquad A_d V_d \; + AcVc$$

30. **Explain the types of Differential amplifiers?**

There are four differential amplifier configurations,

Dual-input, balanced output differential amplifier

Dual-input, unbalanced output differential amplifier

Single-input, balanced output differential amplifier

Single-input, unbalanced output differential amplifier

If two inputs are used, it is 'dual input' otherwise it is single input.If the output voltage is measured between two collector terminals, it is balanced output because both collectors are at the same dc potential with respect to ground. If the output is measured at one of the collector terminal with respect to ground, it is unbalanced output.

UNIT-III

1) What do you mean by amplifier rise time [APR/MAY-10]

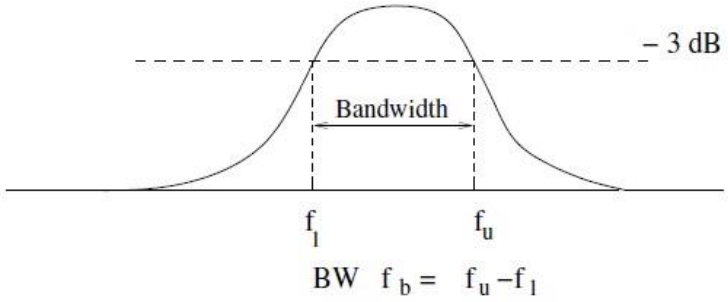
The rise time, t_r, of an amplifier is the time taken for the output to change from 10% to 90% of its final level when driven by a step input. The rise time is approximated by:

$$\mathbf{t_r * BW = 0.35}$$

where t_r is rise time in seconds and BW is bandwidth in Hz.

2) Define Bandwidth [NOV/DEC-09,11]

Bandwidth is defined as a band containing all frequencies between upper cut-off and lower cut-off frequencies



BW $f_b = f_u - f_l$

Upper and lower cut-off (or 3dB) frequencies corresponds to the frequencies where the magnitude of signal's Fourier Transform is reduced to half (3dB less than) its maximum value.

3) Define the frequency response of an amplifier.[Dec-2006]

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

4) Define lower and upper cut-off frequencies of an amplifier.[Dec-2005]

Lower cut – off frequency:-

The frequency (on lower side) at which the voltage gain of the amplifier is exactly 70.7% of the maximum gain is known as lower cut – off frequency.

Upper cut – off frequency:-

The frequency (on higher side) at which the voltage gain of the amplifier is exactly 70.7% of the maximum gain is known as upper cut – off frequency.

5) What is cascade amplifier?[May-2003]

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

6) What are the high frequency effects? [May-2004]

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

7) Write the overall lower cut-off frequency of multistage amplifier. [May-2008]

$$f_L n \frac{f_L}{\sqrt{2^{1/n}1}}$$

Where $f_L n$ = Lower 3 dB frequency of identical cascaded stages. n = Number of stages.

8) Write the overall higher cut-off frequency of multistage amplifier.[May-2008]

$$f_H nf_H \sqrt{2^{1/n}1}$$

Where $f_H n$ = Higher 3 dB frequency of identical cascaded stages.

n = Number of stages.

f_H = Higher 3db frequency of single stage.

9) Write the relation between the rise time and upper cut – off frequency.[Dec-2006]

$$2.2 \quad 0.35$$

$$f_H \frac{}{2t_r} \quad \frac{}{t_r}$$

10) Write the relation between the sag time and lower cut – off frequency.

$$_1f \frac{pf}{100}$$

P – y of tilt.

f – Input signal frequency.

11) Give the relationship between Bandwidth and rise time. [Dec-2006] [APR/MAY-11]

$$BWf_Hf_L$$
$$BWf_H \ldots\ldots \square \ldots f_L f_H$$
$$BWf_H \frac{2.}{2} \quad \frac{0.35}{}$$

$$\frac{2t_r}{t_r}$$

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12) If the rise time of a BJT is 35 nano seconds, what is the bandwidth that can be obtained using this BJT? [May-2005, Dec-2007]

$$t_r \frac{0.350.35}{f_2 \quad BW}$$

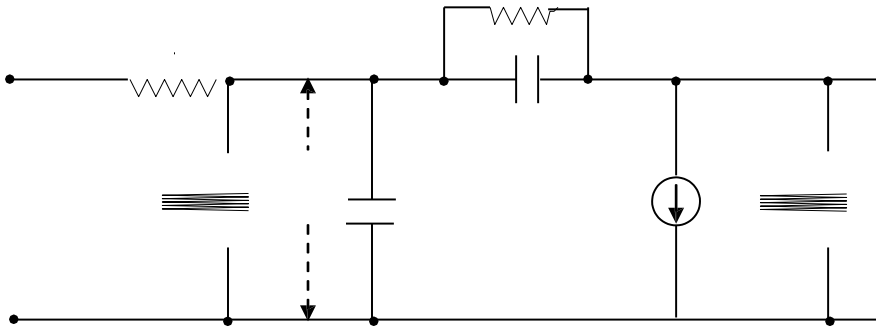
$$0.35$$

$$B \quad \underline{0.35} \; 1MO \; Hz$$
$$W \quad 9$$

$$t_r \quad 3*510$$

BW = 10 MHz

13) Draw a hybrid – π model for a BJT. [DEC – 2002] [DEC-2004]



14) What is significance of gain bandwidth product? [May-2008]

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

OTHER QUESTIONS

15) Write a note on effects of coupling capacitor.

The coupling capacitor C_0 transmits AC signal. But blocks DC. This prevents DC interference between various stages and the shifting of operating point.

It prevents the loading effect between adjacent stages.

16) Why an NPN transistor has a better high frequency response than the PNP transistor?

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

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17) Write an expression for the bandwidth of multistage amplifier.

The bandwidth of multistage amplifier is $f_2 f_1 f_0 \sqrt{2^{1/n} - 1}$

19)Write the relation between the sag time and lower cut – off frequency.

$$f = \frac{pf}{100}$$

P – y of tilt.

f – Input signal frequency

20) What are the advantages of representation of gain in decibels?

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

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

21) What are the coupling methods used for coupling in multistage amplifiers?

The coupling methods used are

1. RC coupling.
2. Transformer coupling.
3. Direct coupling.

22) State the reason for fall in gain at low frequencies.

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

23) State the reason for fall in gain at high frequencies.

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

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UNIT-IV

1. What is crossover distortion? [APR/MAY-10,11]

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

2) Mention the applications of class C amplifiers [APR/MAY-11]

It is commonly used in RF circuits where a resonant circuit must be placed at the output in order to keep the sine wave going during the non-conducting portion of the input cycle.

It is also used in collector amplitude modulation, radio frequency receivers.

They are also used as , Troposcatter Amplifiers(transmitting and receiving microwave radio signals over considerable distances) , FM Amplifiers , Booster Amplifiers

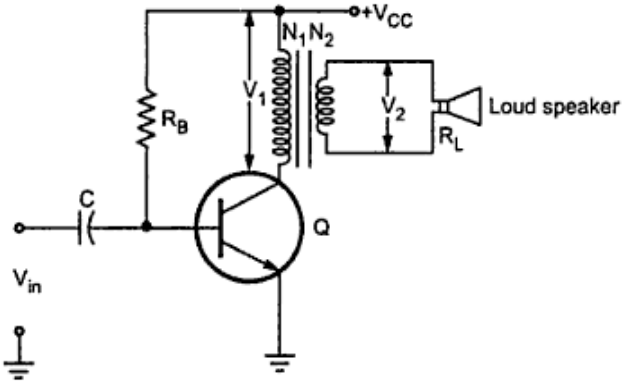
They are also used in Radar Systems.

3) what is the theoretical maximum conversion efficiency of class A power amplifier

[APR/MAY-12][NOV/DEC-09]

The efficiency of an amplifier represents the amount of a.c power delivered to load from d.c source. It is given as,

4) Draw the circuit diagram of transformer coupled class A amplifier [NOV/DEC-06]



5) Why class 'A' amplifier must not be operated under no signal conditions. [DEC-2005]

The amount of power that must be dissipated by the transistor is the difference between the d.c power input P_{dc} and the a.c power delivered to the load $P_{ac.}$

$$P_d = Pdc - P_{ac}$$

The maximum power dissipation occurs when there is zero a.c input signal. When a.c input is zero, the a.c power output is also zero. But transistor operates at quiescent condition, drawing d.c input power from the supply to V_{CC} I_{CQ}. This entire power gets dissipated in the form of heat. Thus d.c power input without a.c input signal is the maximum power dissipation.

$$P_d) \text{ Max} = V_{CC}\ I_{CQ}.$$

6) Define thermal resistance. [MAY-2006] [DEC-2004]

The resistance offered by the bipolar junction transistor to the flow of heat is called thermal resistance.

The thermal resistance $Q = Q_{jA} = Q_{jC} + Q_{CS} + Q_{SA}\ ^0C/W$

Where,

Q_{jA} = total junction to ambient thermal resistance

Q_{jC} = junction to case thermal resistance

Q_{CS} = case to heat sink resistance

7) How crossover distortion is eliminated?[MAY -2003, MAY-2006, MAY-2007]

To avoid crossover distortion, a slight forward bias (0.3 V for germanium, 0.6V for silicon) voltage is applied to the base emitter junction of both the transistors. It causes transistor to conduct immediately when the input signal is applied. So Q point is fixed above cut-off.

8) What is class D amplifier? [APR/MAY-13]

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

9) What are advantages and disadvantages of class B amplifier? [DEC-2004]

Advantages of class B power amplifier

Efficiency is increased from 25% to 78.5%.

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

Due to the centre tapped transformer at input and output the core saturation loss is reduced.

Disadvantages of class B power amplifier

Transistor is biased above the cut-off point.

Due to the centre-tapped transformer at both input and output, the circuit becomes complex.

10) How do you bias the class A operation? [DEC-2005]

In class A mode, the output current flows throughout the entire period of input cycle and the 'Q' point is chosen at the midpoint of AC load line and biased. The output signal varies for a full 360° of the cycle.

11) What is meant by Power amplifier? [DEC-2005]

The stage which develops and feeds sufficient power to the load handling the large signals is called **large signal amplifier** or **Power amplifier.** It is also called **audio amplifier** or **audio frequency (A.F power amplifiers)**.

12) List the features of Power amplifier.

The outputs of the power amplifier are the large current and voltage.

The output of the power amplifier is carried out by DC equivalent and graphical method.

The output of the power amplifier is feed to the load.

The load must have the low output resistance. The output resistance is important.

The analysis of signal distortion in the power amplifier is important.

13) List the application of large signal amplifiers.

The position of the quiescent point on the load line decides the class of operation of the power amplifier. The various classes of the power amplifiers are,

Class A.

Class B

Class C

Class AB.

14) Define class B amplifier.

A class B circuit provides an output signal varying over one-half the input signal cycle, or for 180° of signal.

15) Define the following modes of operation (a) class AB (b) class C.

Class AB:-In this mode of operation, the output current flows or more than one half cycle but less than full cycle.

Class C:-In this mode, the level current flow for less than one half cycles, i.e., $1/4^{th}$ of the input Cycle.

16) Give the applications of class C power amplifier.

The applications of class C amplifier are,

Used in radio and TV transmitters.

Used to amplify the high frequency signals.

Tuned amplifiers.

17) Give two drawbacks of class C amplifier.

The drawbacks of class C amplifier are,

Distortion is high

Figure of merit is low

18) State the merits of using push pull configuration.

The merits of push pull configuration are:

Efficiency is high (78.5%)

Figure of merit is high.

Distortion is less

Ripple present in the output due to power supply is nullified

19) What are the advantages of using complementary symmetry configuration?

The advantages of using complementary symmetry are:-

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

It uses one PNP transistor and one NPN transistor; hence it provides proper impedance matching. Hence its voltage gain is unity. (i.e. it acts as voltage follower).

20) What are the drawbacks of the transformer coupled amplifier? [APR/MAY-11]

The disadvantages of transformer coupled amplifiers are,

Transformers are bulky

Loss is more

Centre tapping of transformer is difficult.

21) Why RC coupling is popular?

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

22) List the advantages of transformer coupled amplifier. [APR/MAY-11]

The advantages of transformer coupled amplifier are,

It is more efficient because the low C resistance of the primary is connected to the collector circuit.

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

23) What is the use of transformer coupling in the output stage of multistage amplifier?

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

24) State the reason for fall in gain at low frequencies in the RC coupled.

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

The bypass capacitor cannot bypass or shunt the emitter resistor effectively.

As a result of these factors, the voltage gain rolls off at low frequency.

25) State the reason for fall in gain at high frequencies.

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

26) Define figure of merit.

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

27) What is the use of heat sink? [APR/MAY-13]

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

28) Write the advantages of heat sink.

The advantages of heat sink are,

The temperature of the case gets lowered.

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

29) State the applications of large signal amplifiers.

Public address systems.

Radio receivers.

Cathode ray tubes.

TV receiver

Tape players.

30) Comparison of amplifier classes.

Class	A	B	C	AB
Operating Cycle	360°	180°	Less than 180°	180° to 360°
Position of Q point	Centre of load line	On X axis	Below X axis	Above X-axis but below the centre of load line
Efficiency	Poor, 25% to 50%	Better, 78.5%	High	Higher than A but less than B 50% to 78.5%
Distrotion	Absent No distortion	Present More than class A	Highest	Present

31) Write short notes on Tuned amplifiers.

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

32) Define the Frequency distortion.

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

33) What is a harmonic component or harmonics?

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

34) What are the examples of harmonic component?

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

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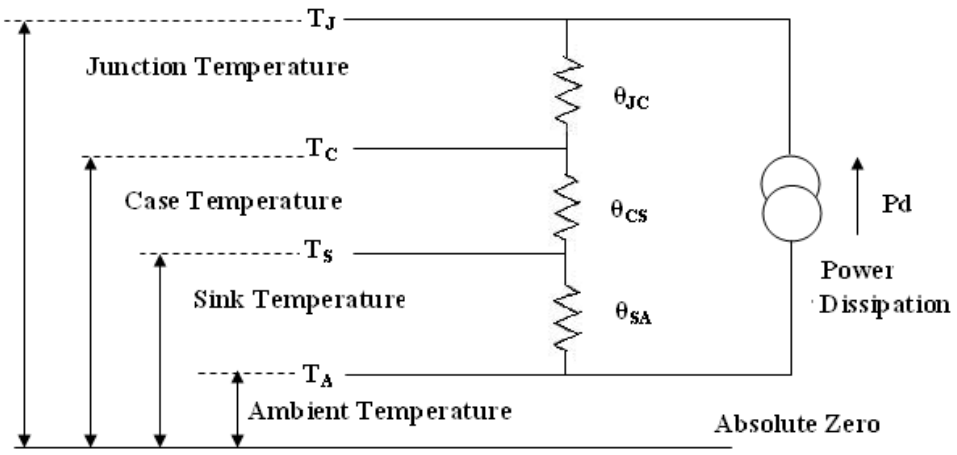
35) Define harmonic distortion. [NOV/DEC-11,12]

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

$$\% \; n\text{th harmonic distortion} = \% \; D_n = \frac{|A_n|}{|A_1|} \times 100\%$$

36) Draw the diagram of the electrical analogue circuit.



37) What is total harmonic Distortion?

When an output signal has a number of individual harmonic distortion components, the signal can be seen to have a total harmonic distortion based on the individual elements as

combined by the relationship of the following equation:

$$\% \text{ THD} = \sqrt{D_2^2 + D_3^2 + D_4^2 + \cdots} \times 100\%$$

where THD is total harmonic distortion.

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UNIT-V

1) Define voltage regulation [NOV/DEC-11]

The voltage regulation is the factor that indicates the change in d.c output voltage as load changes from no load to full load condition. The secondary voltage should not change with respect to load current.

If $(V_{dc})_{NL}$ =D.C voltage on no load

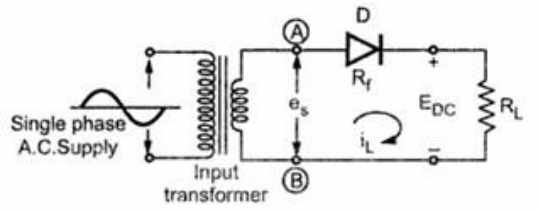
$(V_{dc})_{FL}$ = D.C voltage on full load

The voltage regulation is defined as,

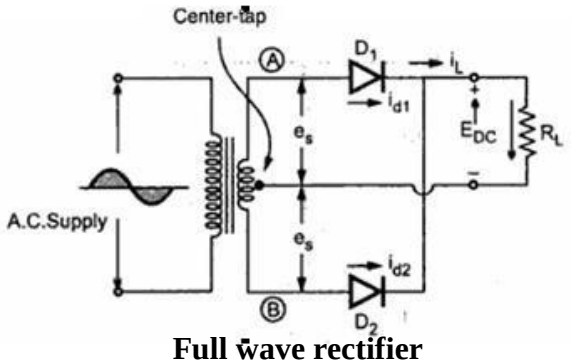
$$\text{voltage regulation} \quad \frac{(V_{dc})_{NL} (V_{dc})_{FL}}{(V_{dc})_{FL}}$$

2) Compare half wave and full wave rectifiers [NOV/DEC-12][APR/MAY-10]

Half wave rectifier	**Full wave rectifier**
The rectifying element conducts only during positive half cycle of input a.c signal. The negative half cycle is eliminated from the output.	This conducts during both positive and negative half cycle of input a.c supply. In order to rectify both the half cycles of a.c input two diodes are used in the circuit.
As it rectifies AC partially , its efficiency is also less. (40.6%)	Its efficiency is almost double of half wave rectifier. (81.2%) d.c load current of full wave circuit is twice of half wave circuit
It requires only single diode for rectification	It consists of more than one diode , positive half cycle is converted by one diode and negative half cycle by other.

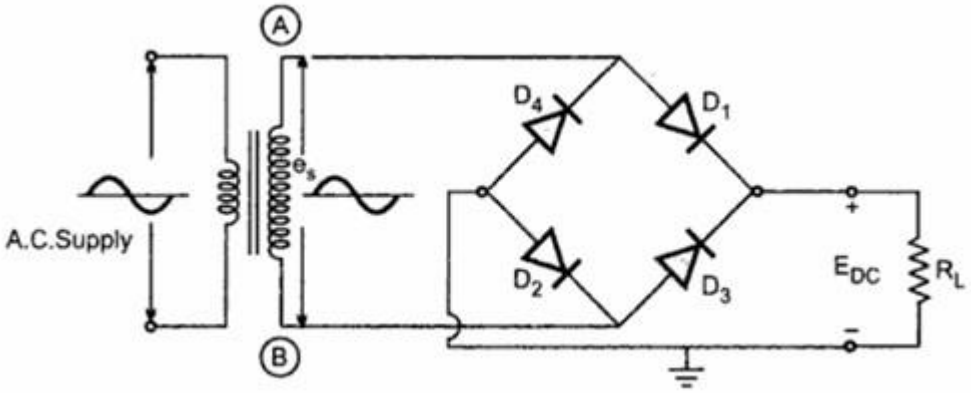


Half wave rectifier



Full wave rectifier

3) Draw the full wave bridge rectifier circuit [NOV/DEC-09]



4) **What is meant by ripple factor [APR/MAY-13]**

The amount of a.c content in the output is mathematically expressed by a factor called as ripple factor. It is given as,

$$RF = \frac{\text{RMS value of dc component}}{\text{Dc value of component}}$$

5) What are the advantages of SMPS [APR/MAY-10,NOV/DEC-09]

Light weight since the transformer is too small and it operates at high frequency of 50Hz-1MHz.

Output voltage is well regulated and controlled by duty cycle and there is little resistive loss since the transistor fully on or off during switching.

Greater efficiency since the switching transistor dissipates very little heat outside of its active region (i.e., when the transistor acts like a switch and either has a negligible voltage drop across it or a negligible current through it).

High efficiency over a wide range of loads and output voltage is achieved via SMPS.

6) Where is SMPS used [DEC-2009]

It is used where perfect dc voltage is required for the proper functioning of the circuit .it is used in computers, printers, inverters etc

7) What is the basic concept of SMPS [APR/MAY-11]

The Pulse Width Modulation is the basic concept. When the transistors are operated in the cut-off region there is no current and no power dissipated. While then in saturated region a negligible voltage drop appears across it and hence dissipates very small power, providing max current to load. It is used where very high efficiency is needed.

8) What is a voltage multiplier [APR/MAY-11]

It is a two or more rectifiers circuit that produces a greater dc output voltage than ac input voltage.

They are used to step up the output voltage level to the two or three or more times the peak voltage of the input

These circuits are used for higher voltage/ lower current devices

voltage doubler, voltage tripler ,voltage quadruple

9) What are the limitations of Zener diode regulator [DEC-2005]

The output voltage is equal to Vz.this is a constant voltage. so they cant produce adjustable output

Large power gets dissipated in the series resistor R

Large changes in Zener current results in larger power wastage

The output voltage remains constant between Iz(min) and Iz(max)

As temperature changes Vo also changes

10) What is a bleeder resistor **[DEC 2002, DEC 2005]**

In case of choke filter, when Rl is increased, Idc decreases, but I2m and for a certain period the net current in the circuit may become zero

If the current through L is not continuous then a back emf will be developed

This voltage may exceed the PIV rating of the rectifier diodes and damage them. As well to capacitors.

11) What is a rectifier?

A rectifier is a device which converts ac voltage to pulsating dc voltage using one or more p-n junction diodes.

12) What are the important characteristics of a rectifier circuit?

The important characteristics of a rectifier circuits are:

Waveform of the load current: As rectifier converts ac to pulsating dc, it is important to analyze the nature of the current through load which ultimately determines the waveform of the load voltage.

Regulation of the output voltage: As the load current changes, load voltage changes. Practically load voltage should remain constant. So load regulation studies the effect of change in load current on the load voltage.

Rectifier Efficiency: It signifies how efficiently the rectifier circuit converts ac power to dc power.

Peak value of current in the rectifier circuit: The peak value is the maximum value of an alternating current in the rectifier circuit. This decides the rating of the rectifier circuit element which is diode.

Peak value of voltage across the rectifier element in the reverse direction (PIV): When the diode is not conducting, the reverse voltage gets applied across the diode. The peak value of such voltage decides the peak inverse voltage i.e. PIV rating of a diode.

Ripple factor: The output of the rectifier is of pulsating dc type. The amount of ac content in the output can be mathematically expressed by a factor called ripple factor. Less is the ripple factor, better is the performance of the circuit.

13) What is a filter?

A filter is an electronic circuit composed of inductors, capacitors or combination of both and connected between the rectifier and the load so as to convert pulsating dc to pure dc.

14) What are the types of filters available and explain their importance of usage? [NOV/DEC-11]

The output of the half wave and full wave rectifier is not pure dc but a pulsating dc which denotes the presence of ac ripples. In order to separate dc from ripple, the filter circuit should use components which have widely different impedance for ac and dc. Two such components are inductance and capacitance.

Ideally, the inductance acts as a short circuit for dc but it has a large impedance for ac. Similarly, the capacitance acts as open circuit for dc and almost short for ac if the value of capacitance is sufficiently large enough.

Since ideally, inductance acts as a short circuit for dc, it cannot be placed in shunt arm across the load; otherwise the dc will be shorted. Similarly, the capacitance is open for dc and hence cannot be connected in series with the load.

The different types of filters are:

1) Capacitor filter
2) Inductor filter
3) LC filter or Choke input filter
4) CLC filter (or) pi filter

15) What is PIV?

When the diode is not conducting, the reverse voltage gets applied across the diode. The peak value of such voltage decides the peak inverse voltage.

16) What are the disadvantages of bridge rectifier?

The only disadvantage of bridge rectifier is the use of four diodes as compared to two diodes in normal full wave rectifier. This causes an additional voltage drop as indicated by the term 2Rf present in the expression of Im instead of Rf. This reduces the output voltage.

17) What is the need of Bridge rectifier?

Bulky center tapping is not required

Current flowing in the transformer secondary is alternating, TUF to 0.812

PIV is equal to peak voltage of secondary transformer

18) Define TUF and ripple factor in half wave rectifier. [APR/MAY-11]

Transformer Utilization Factor is defined as the ratio of dc power delivered to the load to the ac power rating of transformer secondary

$$TUF = \frac{\text{DC power delivered to the load}}{\text{Ac power rating}} = 28.6\ \%$$

Ripple factor is defined as ,

$$RF = \frac{\text{RMS value of dc component}}{\text{Dc value of component}} = 121\ \%$$

19) What is a half wave rectifier?

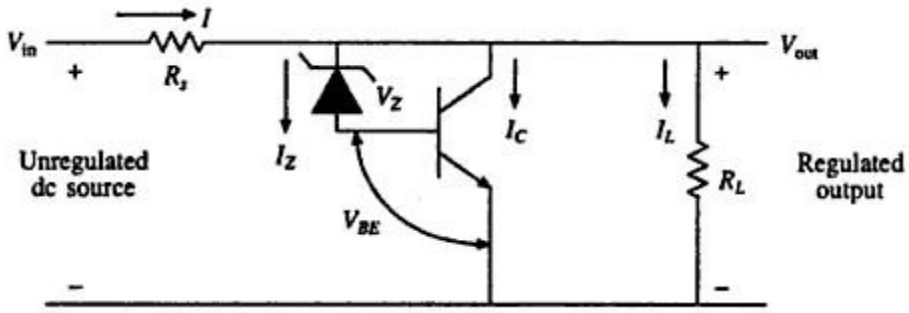
This converts an ac voltage into a pulsating dc voltage using only one half of the applied ac voltage. The rectifying diode conducts during one half of the cycle only

20) What is a full wave rectifier?

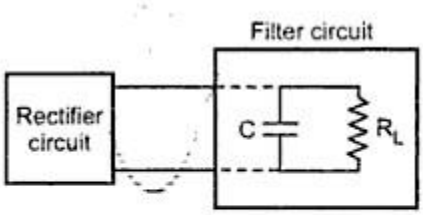
This converts an ac voltage into a pulsating dc voltage using both half cycles of the applied voltage. It uses two diodes of which one conducts during one half cycle while the other during the next of the applied ac voltage

As temperature changes Vo also changes

21) Draw the circuit diagram of shunt voltage regulator.



22) What is the need for capacitor filter?



The block schematic of capacitor input filter is shown in the Fig.

The filter uses a single capacitor connected in parallel with the load, represented by the resistance R_L. In order to minimize the ripple in the ouput, the capacitor C used in the filter circuit is quite large, of the order of tens of microfarads.

23) Define conversion efficiency.

The conversion efficiency η of a rectifier circuit is generally defined as

$$\eta = \frac{\text{dc power delivered to the load}}{\text{ac power input to the rectifier circuit}}$$

or

$$\eta = \frac{P_{dc}}{P_{ac}}$$

24) What are the two advantages of full wave rectifier?

The efficiency is more

Ripple factor is low