# Exp No:1
# Diode characteristics

## ❖ Experiment Questions:

**1.Experimently find out whether the given diode is made of Germanium or Silicon.**

Conduct the experiment for obtaining the forward bias VI characteristics of the given diode.if the cut in voltage is .3V,it is Germanium diode.If it is .6,diode is made of silicon.

## ❖ Viva Questions:

**1.what are Semiconductors? Give examples?**

*The materials whose electrical property lies between those of conductors and insulators are known as Semiconductors. Ex germanium, silicon.*

**2.What are the types of Semiconductor?**

*Intrinsic semiconductor 2. Extrinsic semiconductor.*

**3.What is Intrinsic Semiconductor?**

*Pure form of semiconductors are said to be intrinsic semiconductor. Ex: germanium, silicon.*

**4.What is Extrinsic Semiconductor?**

*If certain amount of impurity atom is added to intrinsic semiconductor the resulting semiconductor is Extrinsic or impure Semiconductor.*

**5.What are the types of Extrinsic Semiconductor?**

*1. P-type Semiconductor 2. N- Type Semiconductor.*

**6.What is P-type Semiconductor?**

*The Semiconductor which are obtained by introducing trivalent impurity atom*
*(gallium, indium) are known as P-type Semiconductor.*

**7.What is N-type Semiconductor?**

*The Semiconductor which is obtained by introducing pentavalent impurity atom (phospherus,Antimony) are known as N-type Semiconductor.*

**8.What is doping?**

*Process of adding impurity to a intrinsic semiconductor atom is doping. The impurity is called dopant.*

**9.Why n - type or penta valent impurities are called as Donor impurities?**

*n- type impurities will donate the excess negative charge carriers ( Electrons) and*
*therefore they are reffered to as donor impurities.*

**10.Why P – type or trivalent impurities are called as acceptor impurity?**

*p- type impurities make available positive carriers because they create holes which can accept electron, so these impurities are said to be as acceptor impurity.*

**11.Define drift current?**

*When an electric field is applied across the semiconductor, the holes move towards the negative terminal of the battery and electron move towards the positive terminal of the battery. This drift movement of charge carriers will result in a current termed as drift current.*

**12.Define the term diffusion current?**

*A concentration gradient exists, if the number of either electrons or holes is greater in one region of a semiconductor as compared to the rest of the region. The holes and electron tend to move from region of higher concentration to the region of lower concentration. This process in called diffusion and the current produced due this movement is diffusion current.*

**13. Define mean life time of a hole or and electron.**

*The electron hole pair created due to thermal agitation woll disappear as a result of recombination. Thus an average time for which a hole or an electron exist before recombination can be said as the mean life time of a hole or electron.*

**14.Define Hall effect?**

*If a metal or semiconductor carrying current I is placed in a transverse magnetic field B , an electric field E is induced in the direction perpendicular to both I and B , This*
*phenomenon is known as Hall effect.*

**15. 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.*

**16. Give the other names of depletion region?**

*i. space charge region*
*ii. Transition region*

**17. 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.*

**18. What is meant by biasing a PN junction?**

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

**19. What are the types of biasing a PN junction?**

*1. Forward bias 2. Reverse bias.*

**20. 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.*

**21. 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.*

**22. 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.*

**23.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*

**24.Define dynamic resistance.**

*Dynamic resistance of a diode can be defined as the ratio of change in voltage across the*

*diode to the change in current through the diode.*

**25.Define the term transition capacitance?**

*When a PN junction is reverse biased, the depletion layer acts like a dielectric material while P and N –type regions on either side which has low resistance act as the plates. In this way a reverse biased PN junction may be regarded as parallel plate capacitor and thus the capacitance across this set up is called as the transition capacitance.*

## Exp No:2
## Zener Diode Characteristics

### ❖ Experiment Questions:

**Draw the reverse characteristics of zener diode and determine its break down voltage.**

### ❖ Viva Questions:

**1.What are break down diodes or zener diodes?**

*Diodes which are designed with adequate power dissipation capabilities to operate in the break down region are called as break down or zener diodes.*

**2.What is break down? What are its types?**

*When the reverse voltage across the pn junction is increased rapidly at a voltage the junction breaks down leading to a current flow across the device. This phenomenon is*

*called as break down and the voltage is break down voltage. The types of break down are*

*i) zener break down*

*ii)Avalanche breakdown*

**3.What is zener breakdown?**

*Zener break down takes place when both sides of the junction are very heavily doped and consequently the depletion layer is thin and consequently the depletion layer is thin. When a small value of reverse bias voltage is applied , a very strong electric field is set up across the thin depletion layer. This electric field is enough to break the covalent bonds. Now extremely large number of free charge carriers are produced which constitute the zener current. This process is known as zener break down.*

**4.What is avalanche break down?**

*When bias is applied , thermally generated carriers which are already present in the diode acquire sufficient energy from the applied potential to produce new carriers by removing valence electron from their bonds. These newly generated additional carriers acquire more energy from the potential and they strike the lattice and create more number of free electrons and holes. This process goes on as long as bias is increased and the number of free carriers get multiplied. This process is termed as avalanche multiplication. Thus the break down which occur in the junction resulting in heavy flow of current is termed as avalanche break down.*

**5.How does the avalanche breakdown voltage vary with temperature?**

*In lightly doped diode an increase in temperature increases the probability of collisionof electrons and thus increases the depletion width. Thus the electrons and holes needs a high voltage to cross the junction. Thus the avalanche voltage is increased with increased temperature.*

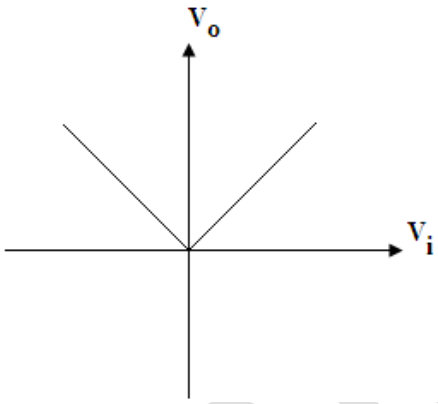
**6.How does the zener breakdown voltage vary with temperature?**

*In heavily doped diodes, an increase in temperature increases the energies of valence electrons, and hence makes it easier for these electrons to escape from covalent bonds. Thus less voltage is sufficient to knock or pull these electrons from their position in the crystal and convert them in to conduction electrons. Thus zener break down voltage decreases with temperature.*

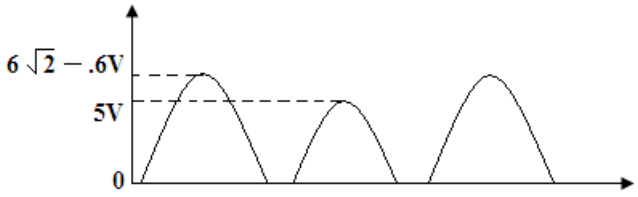
# Exp No:3
# Rectifier Circuits

## ❖ Experiment Questions:

**1.Obtain the following transfer characteristics.**

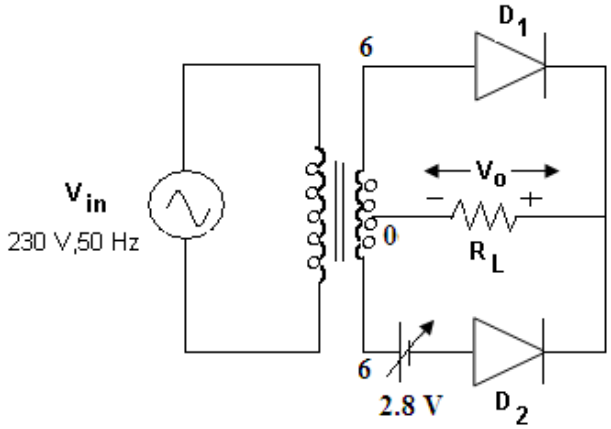



**2.Obtain the following wave shape from 230V,50 Hz supply.**

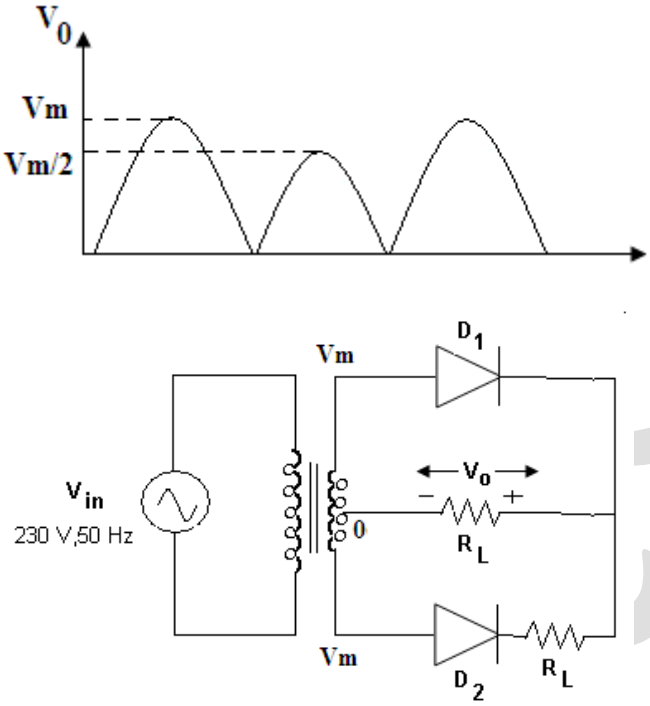



**Soln:** It is the full wave rectifier circuit with one of the diode reverse biased by 3.4v(2.8V+ Vd).all positive half cycles are passing through D1.During the negative half cycles,diode D2 will conduct only when voltage is less than -3.4V.the peak value of voltageis

$$6\sqrt{2} - 3.4 = 5V.$$



**3. Generate the following wave form**




**3. Design and set up a full wave rectifier circuit whose PIV is Vm only.**

**Soln:** Construct a Full wave bridge rectifier

## ❖ Viva Questions:

**1.what are the PIVs of three different filters?**

Vm for HWR and FW bridge rectifier.2Vm for FW center taped rectifier.

**2.What are the advantages of bridge rectfier over center-taped full wave rectifier?**

- Does not require centre tap rectifier.
- Diodes of low PIV rating can be used.

**3.Define transformer utilisation factor? What is the TUF for HWR and full wave center taped and bridge rectifier?**

TUF is the ratio of DC power delivered to the load and AC rating of te transformer secondary.

TUF for HWR =.287

Full wave center taped rectifier=.693

Bridge rectifier=.812

## Exp No:4
## Study of Capacitor Filters

### ❖ Experiment Questions:

**1.Set up a DC power supply for an output of 45V,100 mA.**

Use bridge rectifier since its PiV is Vm.Use 9-0-9 tyransformer and take input from the two ends of the secondary.

**2.Set up a FWR with capacitor filter and find ripple factor.**

### ❖ Viva Questions:

**1.What are the different types of filter circuits.**

**2.Give the expression for the ripple factor of the HWR and FWR.**

## Exp No:5
## Common Base Characteristics

### ❖ Experiment Questions:

**1. Plot the input and output characteristics of a NPN transistor in common base configuration and calculate its various parameters.**

**2. Experimently find out the value of $\alpha$.**

### ❖ Viva Questions:

**1.Define $\alpha$ and give the expression for its relation with $\beta$ .**

$$\beta = \alpha/(1-\alpha)$$

**2.Expres $I_C$ in terms $I_{CEO}$ and $I_{CBO}$.**

**$I_C = \alpha I_E + I_{CBO}$ and $I_C = \alpha I_B + I_{CEO}$**

**3.What is the arrow in the transistor symbol indicates?**

It indicates the direction of the emitter current when the E-B junction is forward biased.

**4.Why the emitter of a transistor is highly doped?**

**5.why the collector of transistors is the largest?**

**6.What is the early effect?**

Because of reverse bias at collector junction, the depletion layer is wide and it penetrates both in to the base region and collector region. But the doping of the base region is much smaller than that of collector region. Hence the penetration of the depletion layer in to the base region is much grater than the penetration in to the collector

region. There fore the effective width of the base gets reduced. As the magnitude of the reverse bias at the junction increases, the effective base width decreases. This phenomenon is known as ***early effect*** or ***Base width modulation***.

**7.What is meant by thermal run away?**

The collector current of transistor Ic given by, **IC= βIB+ICEO,**Where **ICEO** is the leakage current. The leakage current rises with temperature. An increase in **ICEO** due to temperature produces an increase in **IC** of the transistor. This causes the collector junction temperature to rise, which in turn increase in **ICEO**.This process being cumulative in nature, may cause the junction temperature of the transistor to exceed its rated value, resulting the burn out of the transistor. This phenomenon is known as ***thermal run away***.

**8.Which configuration is good as a constant current source?Why?**

CB configuration.It is observed that the output characteristics of CB configuration that the collector current remains almost constant even when collector voltage changes.

## Exp No:6

## Common Emitter Characteristics

### ❖ Experiment Questions:

**1.Plot the input and output characteristics of a PNP transistor in common emitter configuration and calculate its various parameters.**

**3. Experimently find out the value of β.**

### ❖ Viva Questions:

**1.Why the CE configuration is commonly used for tha amplifier circuits?**

Because of high current,voltage and power gains.

**2.Why the $I_B$ vs $V_{BE}$ plots move outwards for higher values of $V_{CE}$ in CE input characteristics?**

Because of early effect

**3.What is indicated by B,C and 107 in BC107?**

B stands for silicon and C stands for AF low power transistor and 107 is registered number.

**4. What are the regions operation of a transistor?**

Active region,saturation region and cut off region.

## Exp No:7
## Differentiator (High Pass Filter)

### ❖ Experiment Questions:

**1.Design a circuit to generate a pulse wave form to trigger an another circuit.**
Construct RC differentiator and using square wave as input.
**2.Generate the square wave form from the triangular wave.**
Construct RC differentiator and using triangular wave as input.

### ❖ Viva Questions:

**1.What is the response of the differentiator to a sine wave input?**
Differentiated version of sine wave is cosine.Hence output have a phase shift of 90 degree to the input.
**2.Obtain a circle on the screen of the CRO.**
It is the transfer characteristics of a differentiator or integrator for a sine wave input.
**3. Explain the responses of high pass RC circuit to sinusiodal,step,pulse and square wave inputs.**

## Exp No:8
## Integrator (Low Pass filter)

### ❖ Experiment Questions:

**1.Design a circuit to generate a triangular wave form.**
Construct RC integrator and using square wave as input.
**2.Generate the triangular wave form from the square wave form.**
Construct RC integrator and using square wave as input.
**3.Generate the triangular wave form from the sine wave.**
Construct a combinational clipper ckt and give its output as an input to integrator.
**4.How can we increase the amplitude of the integrator output?**
By increasing the frequency of the input signal we can increase the amplitude of the integrator output.

### ❖ Viva Questions:

**1.What is meant by linear wave shaping?**
**2.Explain the responses of low pass RC circuit to sinusiodal,step,pulse and square wave inputs.**

# Exp No:9
# Clipper Circuits

## *Remember:*

- *The offset knob of the input signal (function generator) must be zero.*
- *Set AC-DC switch of the CRO in DC position.*
- *If the clipped portion is not flat,increases the value of the resister.*
- *Clipping circuits will not function well if the amplitude of the input signals are not sufficiently high.*
- *If the cathode of the diode is at the upper side,the clipper is a negative clipper.*
- *If the anode of the diode is at the upper side,the clipper is a positive clipper.*
- *If the positive side of the voltage source is at the upper side,clipping occurs at the positive level.*
- *If the negative side of the voltage source is at the upper side,clipping occurs at the negative level.*

## ❖ Experiment Questions:

**1.Generate a square wave using diodes.**

Costruct a combinational clipper (double clipper)

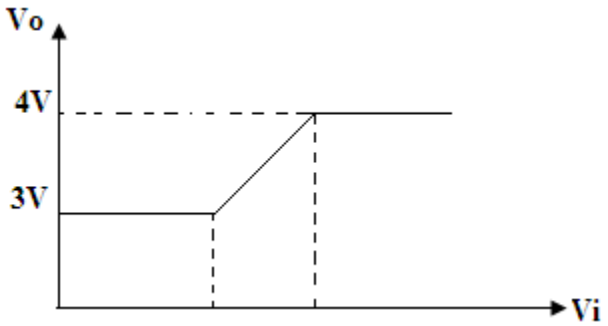
**2.Generate a spike wave form fram a given sign wave form.**

Costruct a combinational clipper (double clipper) and give its output to the differentiator.

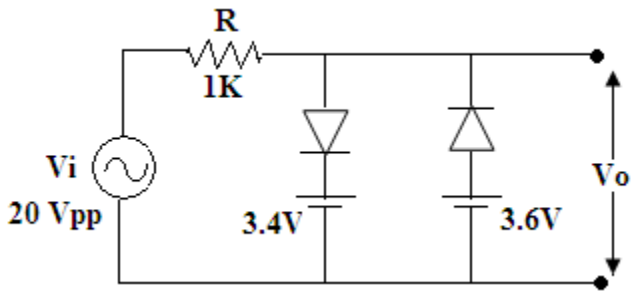
**3.Generate a triangular wave form fram a given sign wave form.**

Costruct a combinational clipper (double clipper) and give its output to the integrator.

4.Obtain the following transfer characteristics from a sine wave input.




**Soln: it is a slicer circuit which slices the input signal at 3V and 4 V.**




## ❖ Viva Questions:

**1.What is meant by nonlinear wave shaping?**

**2.What are the different types of clipping circuits?**

**3.Explain the different types of clipping circuits.**

# Exp No:10

# Clamper Circuits

***Remember:***

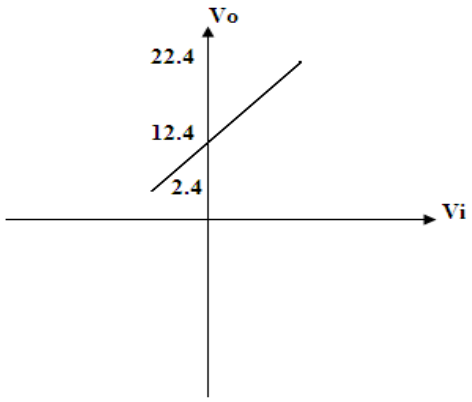
- *The offset knob of the input signal (function generator) must be zero.*
- *Set AC-DC switch of the CRO in DC position.*
- *If the cathode of the diode is downwards,the output clamps downwards.*
- *If the cathode of the diode is upwards,the output clamps upwards.*
- *If the positive side of the voltage source is at the upper side,clamping occur from that positive voltage level.*
- *If the negative side of the voltage source is at the upper side,clamping occur from that nagaitive voltage level.*

## ❖ Experiment Questions:

**1.Design a positive clamper clamping at +3 volt.**

**(***Similarlly can ask questions for design clamper circuits clamping at different voltage levels.)*

**2.Generate the wave form with following transfer characteristics.**




**Soln:**Positive clamper clamping at +3 V
**(***Similarlly can ask questions for generate different clamped wave forms with their transfer characteristics shown.)*

## ❖ Viva Questions:

**1.What is the difference between the outputs of the clipping and clamping circuits?**
**2.What are the different types of clamping circuits?**
**3.Explain the working of different clamping circuits.**

# Exp No:11

# Zener Voltage Regulator

## ❖ Experiment Questions:

**1.Set up and study the zener voltage regulator and plot its line and load regulation characteristics.**

## ❖ Viva Questions:

**1.what is meant by a voltage regulator?**

**2.Define line and load regulation,what are the ideal values.**

# Exp No:12

# Series Voltage Regulator Without Feedback

## ❖ Experiment Questions:

**1. Set up a voltage regulator with emitter follower and to plot the line and load regulation chracteristics.**

**2.Design and set up a transistorised series voltage regulator.**

## ❖ Viva Questions:

**1.Draw and explain the block diagrams of series and shunt voltage regulators.**
**2. How the transistorised series voltage regulator regulates the output voltage?**

# Exp No:13
# RC Coupled Amplifier

## ❖ Experiment Questions:

**1. Design and set up an ampli_er for the speci_cations: gain = -50, output voltage = 10 VPP ; fL = 50 Hz and calculate Zi.**

Negative sign of the gain indicates that the output of an RC coupled ampli_er is theampli_ed and inverted version of the input. fL should be considered while designing the coupling capacitor. Set up an RC coupled ampli_er for a gain of 50. To obtain an output voltage of 10 V peak to peak, take VCC 20% more than the required voltage swing. i.e., 12 V. To measure the input impedance, connect a 10 k resistor in series with the function generator and note down the potential di_erence across the resistor. Then calculate the current through the resistor. The input impedance is equal to the ratio of the voltage at the right side of the 10 k resistor with respect to the current through it.

**2. Set up an RC coupled amplifier and measure its input and output impedances.**

**Measurement of input resistance**

***Method 1:*** Connect a known resistor (say 1 k) in series between the signal generator and the input of the circuit. Calculate the current though the resistor from the potential di_erence across it. Since this current also ows into the circuit, input resistance can be measured taking the ratio of the voltage at the right side of the resistor to the current.

***Method 2:*** Connect a pot in series between the signal source and the input of the circuit. Adjust the pot until the input voltage to the circuit is 50% of the signal generator voltage. Remove the pot from the circuit and measure its resistance using a multimeter.

**Measurement of output resistance**

***Method 1:*** Measure the open circuit output voltage. This is the Thevenin voltage. Output resistance of the circuit is actually the Thevenin resistance in series with the Thevenin voltage. Connect a known value resistor, say 1 k and measure the voltage across it. A reduction in the output voltage can be observed. Calculate the current through the resistor. Since this current also ows trough the Thevenin resistance, output resistance is the ratio of the di_erence in the output voltage to the current.

***Method 2:*** Connect a pot at the output of the circuit. Adjust the pot until the voltage across it is 50% of the open circuit voltage. Remove the pot from the circuit and measure its resistance using a multimeter.

**3. Set up an RC coupled ampli_er using a PNP transistor for a gain = 20 dB and stability factor = 5.**

When a PNP transistor is used, polarity of supply voltage VCC must be reversed. Convert dB to linear scale. Take stability factor 5 = 1 + RB=RE, where RB = R1 parallel with R2.

**4. Design and set up an RC coupled ampli_er for a stability factor of 5 and fH = 30 kHz.**

Design the ampli_er as described in the previous question. Use a capacitor in parallel to the output to function as a low pass filter for a cut off frequency fH = 1=2_RCC:

**11. How is the input of the RC coupled amplifier phase shifted by 180 degree at the output?**

The collector voltage is given by the expression VC = VCC - ICRC. The increase in the input voltage causes an increase in the collector current. Increase in the collector current reduces the collector voltage. Inverse is also true. Thus the amplifier provides the phase inversion.

## ❖ Viva Questions:

1. What do you understand by Operating point?
2. What is biasing?
3. What are the requirements for biasing circuits?
4. Differentiate between ac and dc load lines? Explain their importance in amplifier analysis.
5. Why is the center point of the active region chosen for dc biasing?
6. What happens if extreme portions of the active region are chosen for dc biasing ?
7. Draw the output characteristics of the amplifier and mark the load-line on it. Also mark the three regions of operation on the output characteristics.
8. Draw hybrid and hybrid-equivalent models of a transistor in the CE configuration.
9. Give a few applications of RC-coupled amplifier.
10. What do you mean by the half power or 3 db frequencies?
11. Define stability factor &Give the expression for stability factor?
12. Why the gain is low at low and high frequencies and constant at mid frequencies in the frequency response of the RC coupled amplifier?

# Exp No:14

## Power Amplifiers

### ❖ Experiment Questions:

**1.Design and set up a complementary symmetry class-B power amplifier.**

**2. Design and set up a power amplifier operating between class-A and class-B.**

**Soln:** Design a class-AB power amplifier

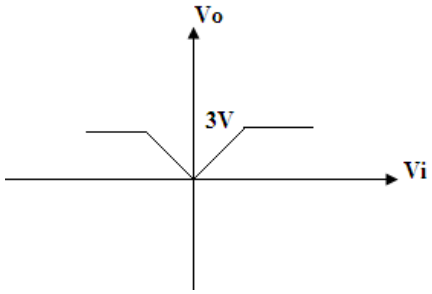
**3.Design and set up a power amplifier whose operating cycle is in etween 180 and 360 degrees.**

### ❖ Viva Questions:

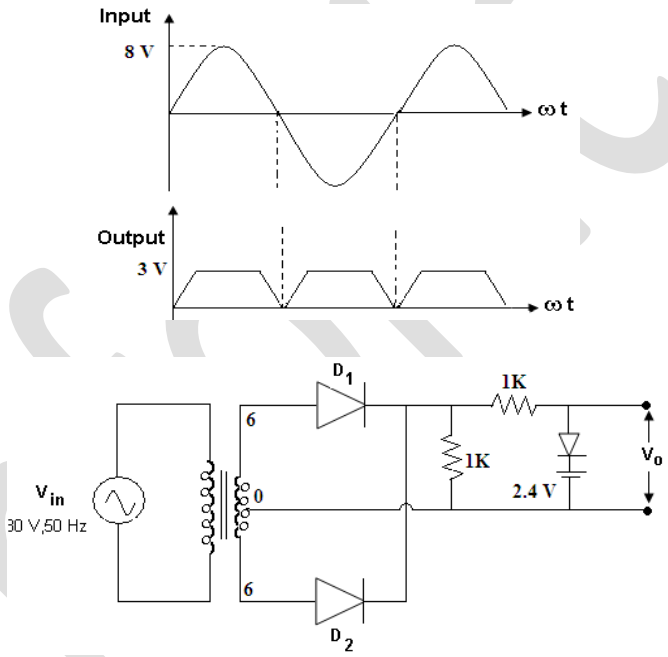
1. **Why power Amplifiers are called large signal amplifiers?**
2. **What is class AB operation?**
3. **What is crossover distortion? How it can be eliminated?**
4. **What is meant by Harmonic distortion?**
5. **What is the drawback of class B amplifier? How is this minimized?**
6. **What are the types of class B amplifier?**
7. **Draw a complimentary symmetry power amplifier?**
8. **What is the disadvantage of transformer coupled class A amplifier?**

## ❖ Solved Examination Questions:

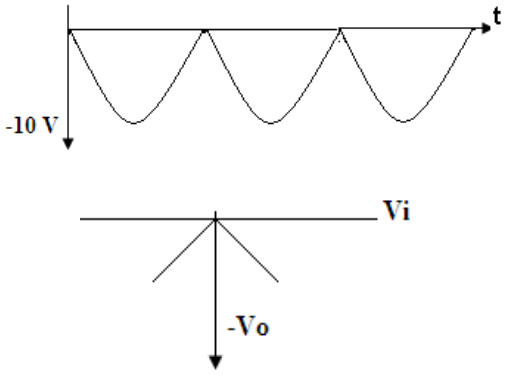
**1. Synthesis a circuit to obtain the following transfer characteristics.**




**Soln:**

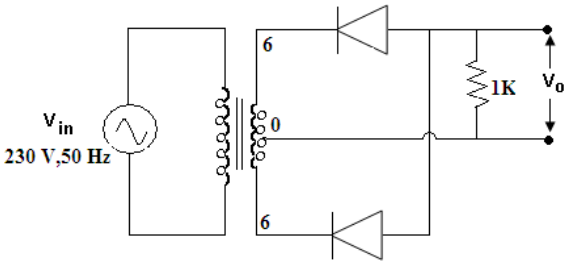



**2. Obtain the following wave form or transfer characteristics.**

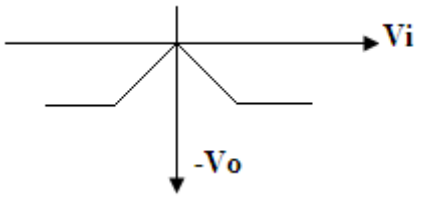


**Soln:**

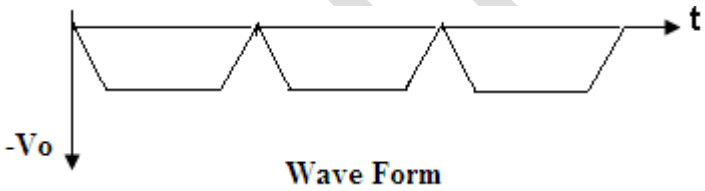
Wave form can be obtained from the full wave rectifier by reversing all diodes.




**3. Obtain the following transfer characteristics on CRO screen.**

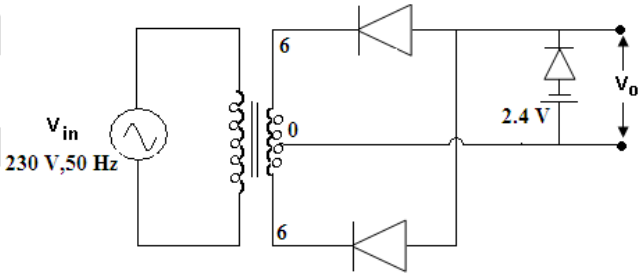



**Soln:**

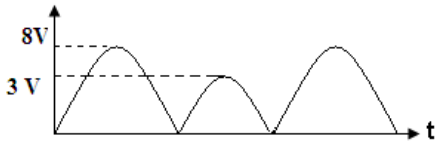



Wave Form

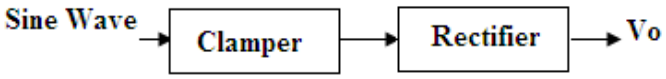
Negative full wave rectifier followed by negative clipper

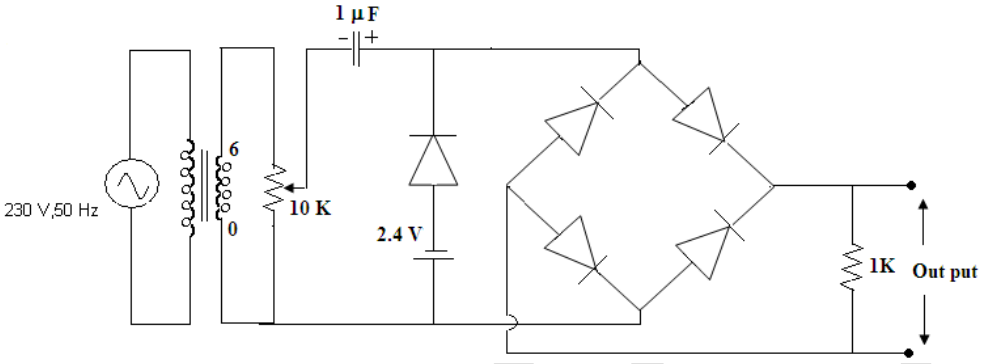



**3. Obtain the following wave form.**

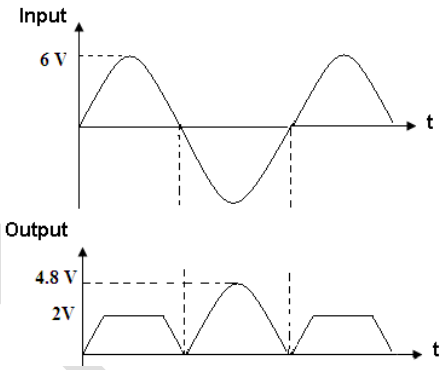


**Soln:**




**4. Obtain the following wave form.**




**Soln:**