Unit -> 2

Subject -> Analog ckt

Faculty -> Dr. Nidhi chouhan

Paper code -> BT-402

Lecture 3 -> class a, b, ab and c amplifier

Class A Amplifier

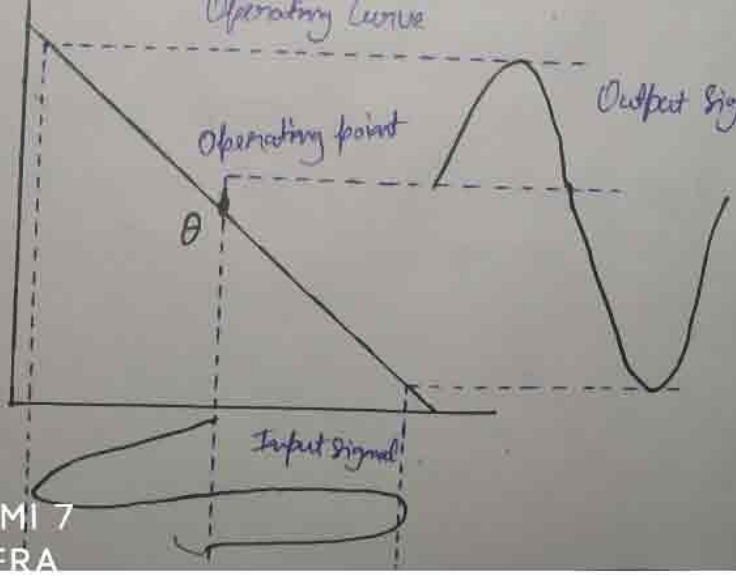
Class A Amplifier are the Most Common type of amplifier topologies as they use just One Output switching transistor (Bipolar, FET, IGBT, etc) With in their amplifier Design.

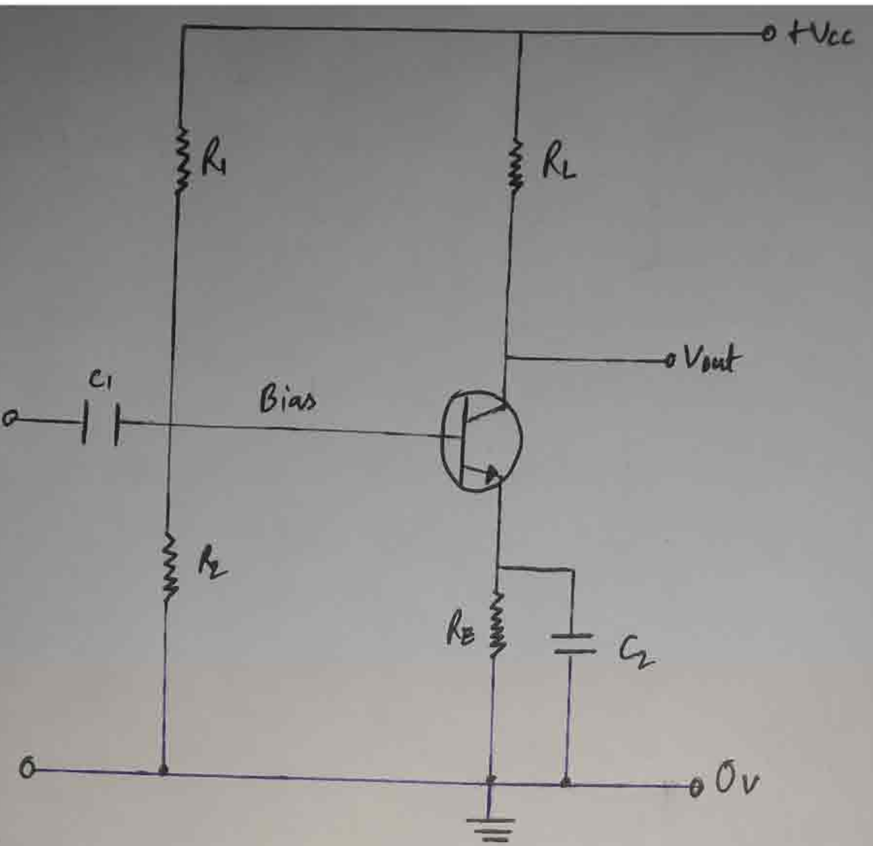
This single Output transistor is biased around the Q- Point Within the middle of Its load line and So is never driven into Its Cut-off Or Saturation regions thus allowing it to Conduct Current Over the full 360° of the Input Cycle.

* Then the Output transistor of Class-A topology Never turns 'OFF' Which is One of its main Disadvantage.

Class 'A' Amplifiers are Considered the best class of amplifier Design due to mainly excellent linearity, high gain and low Signal Distortion levels when Designed Correctly.

Class - A Amplifier are probably the best Sounding of all the amplifiers Classes mentioned here as such are Used in High - fidelity audio amplifier designs.





To achieve high linearity and gain, the Output stage of a Class A Amplifier is biased 'ON' (Conducting) all the time. Then for an Amplifier to be Classified as "class A" the zero Signal idle Current in the Output stage must be equal to greater than the Maximum load Current required to produce the largest Output Signal.

As a class A Amplifier operates in the linear portion of Its Characteristic Curves, the Single Output Device Conducts through a full 360° of the Output waveform. then the class A Amplifier is equivalent to a Current Source.

Since a class A Amplifier operates in the linear region, the transistors base (or gate) DC Biasing voltage should by chosen properly to ensure Correct operation and low Distortion.

However, as the Output Device is 'ON' at all times, it is Constantly Carrying Current, which Repeats a Continuous loss of Power in the amplifier.

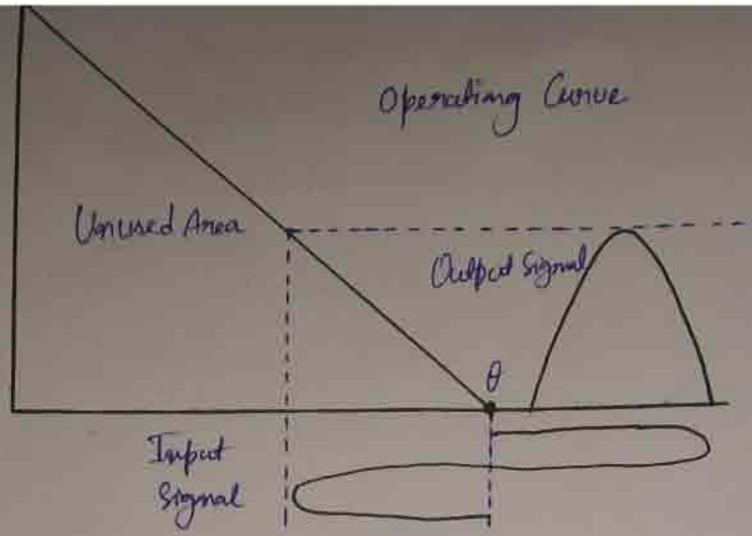
Due to Continuous loss of Power Class A Amplifiers Create tremendous amount of heat adding to their very low efficiency at around 30%, making them impractical for high-Power amplifications.

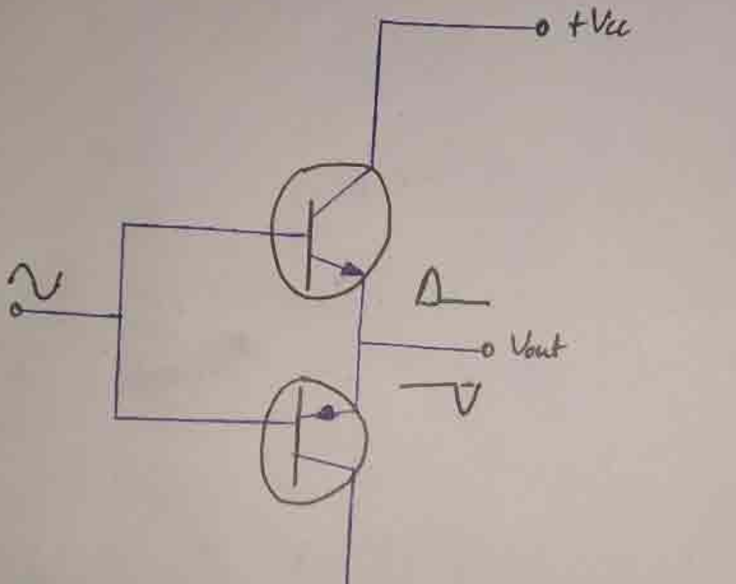
Class B Amplifier

Class B Amplifiers were Inverted as a solution to the efficiency and heating problem associated with the previous Class A Amplifier.

The Basic class B Amplifier uses two Complementary transistors either bipolar of FET for each half of the waveform with its Output Stage Configured in a "push-Pull" type arrangement, so that each transistor device amplifies Only half of the Output Waveform.

In the Class B amplifier, there is no DC base bias Current as its quiescent Current is zero, so that the DC Power is small and therefore its efficiency is much Higher than that of the Class A Amplifier. However, the Price Paid for the improvement in the efficiency is in the linearity of the switching device.





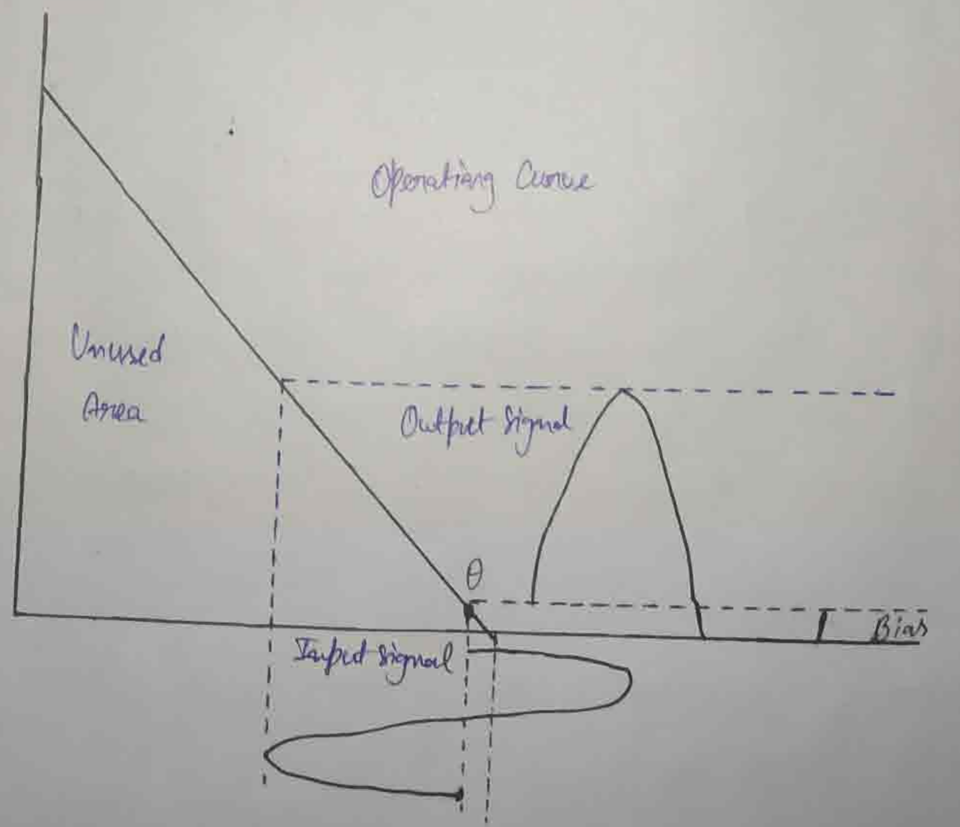
When the Input Signal goes positive, the positive biased transistor Conducts while the negative transistor is swiched 'OFF'.

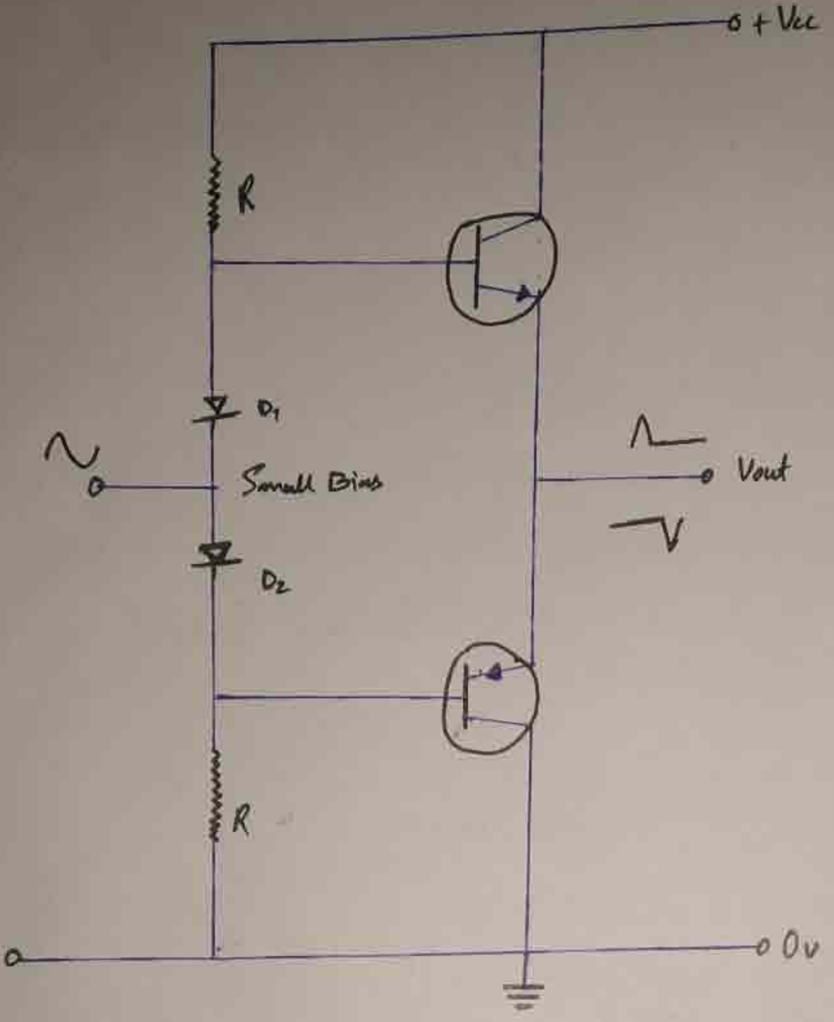
When the Input Signal goes negative, the positive transistor switches 'OFF' While the negative biased transistor turns 'ON' and Conducts the negative portion of the Signal.

This Push - Pull Design of amplifier is Obviously more efficient then class A, at about 50 %, but the problem with the Class B Amplifier Design is that it Can Create Disortion at the zero Crossing point of the waveform due to the transistors dead band of Input base Voltages from -0.7 to +0.7.

We remember from the transistor tutorial that it takes a base- emitter Voltage of about 0.7 Volts to get a bipolar transistor to start Conducting. then in a class B amplifier, the Output transistor is not 'Biased' to an 'ON' state of Operational Until this voltage is exceeded.

Class AB Amplifier





The Advantage of this small bias voltage, provided by series diodes or resistance, is that the Crossover Distortion Created by the Class B Amplifier characteristics is Overcome, With out the in efficiencies of Class A amplifier Design. so the class AB Amplifier is a good Compromise between Class A and B.

In term of efficiency and linearity, with Conversion efficiencies reaching about 50 % to 60 %.

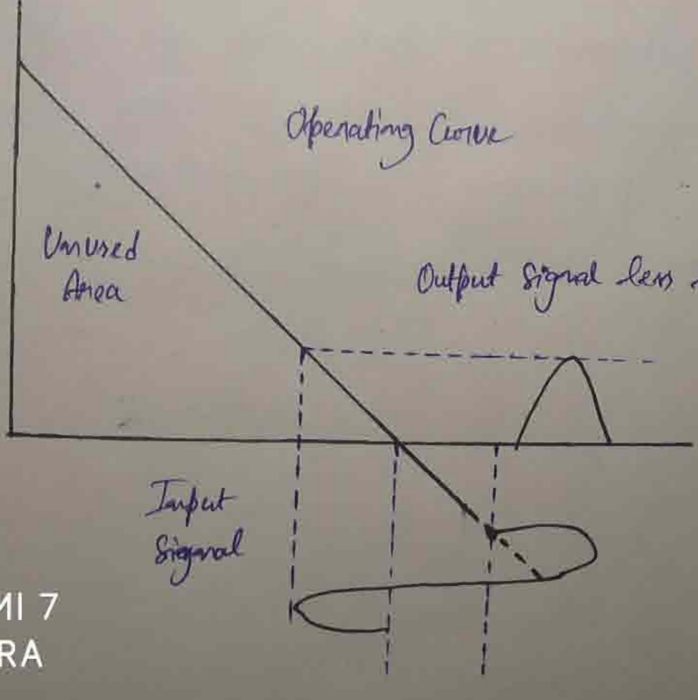
Class C Amplifier

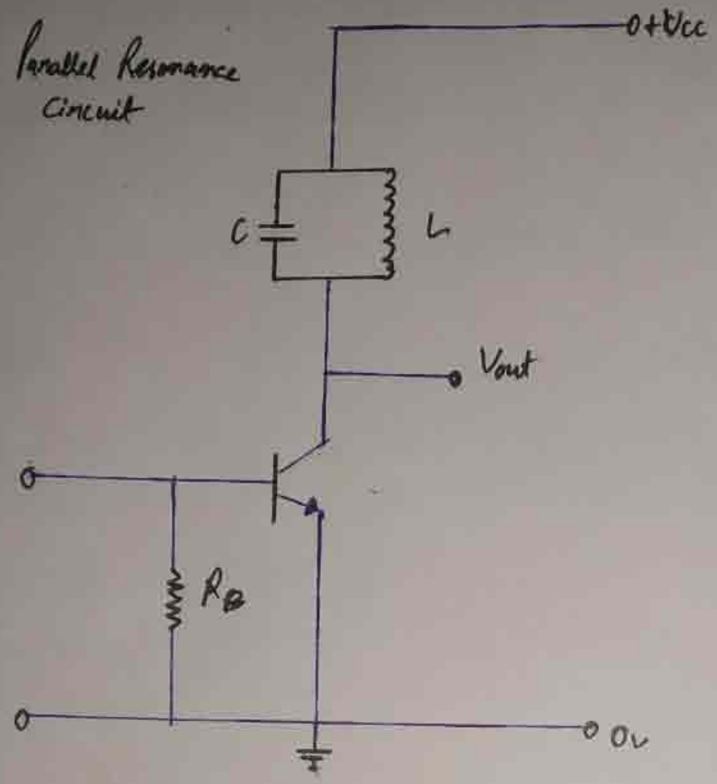
The class C Amplifier Design has the greatest efficiency but the Poorest linearity to the classes of Amplifier mentioned here.

The previous Classes A, B, and AB are Considered linear amplifier, as the Output signals amplitude and Phase are linearly Related to the Input signals amplitude and Phase.

However, the class C amplifiers is heavily biased so the Output Current is zero for more than One half of an Input sinusoidal signal cycle with the transistor Idling as its cut-off point. In Other words, the Conduction angle of the transistor is significantly less than 180° degrees, and is generally around the 90 Degrees area.

While this form of transistor biasing gives a much Improved efficiency of around 80% to the Amplifier. Therefore, class C amplifiers are not suitable for use as audio amplifiers.





Due to its heavy audio distortion, class C amplifiers are commonly used in high frequency sine wave oscillators and certain types of radio frequency amplifier. Where the pulses of current produced at the amplifiers output can be converted to complete sine wave of a particular frequency by the use of LC resonant circuits in its collector circuit.