Bhartiya Vidya Bhavan's Shri Ishvarlal L. P. Arts-Science and J. Shah Commerce College, Dakor
Dakor - 388225, Dist. – Kheda, Gujarat

B.Sc. (semester -3)

Subject : Physics

Course : USO3CPHY22

BASIC SOLID STATE ELECTRONICS

UNIT 3: OSCILLATORS

Lecture 1

Prof.Sandip V. Dholakia
Physics Department
Bhavan's College, Dakor

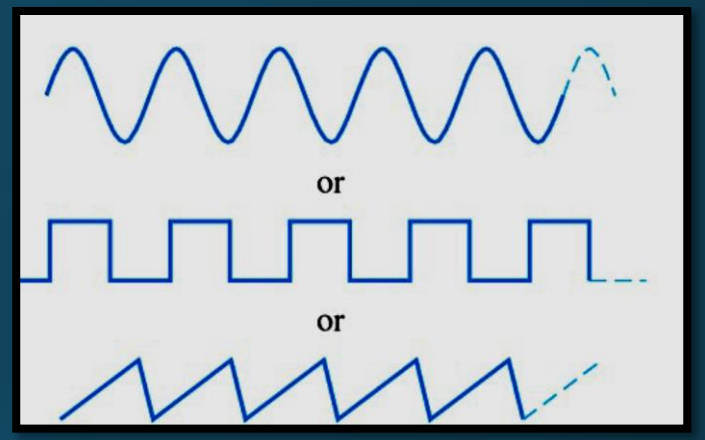
❖ SYLLABUS for Oscillators:

- Need of an oscillator,
- Classification of oscillators,
- Tuned circuit for generation of sine waves,
- Frequency of oscillation in LC circuit,
- Sustained oscillations,
- Positive feedback amplifier as an oscillator,
- The starting voltage,
- Hartley oscillator,
- Colpitts oscillator,
- Basic principles of RC oscillators,
- Phase shift oscillator,
- Wien bridge oscillator

- Introduction
- Concept of Oscillators
- Classification of Oscillators
- Positive Feedback Amplifier as an Oscillator
- Hartley Oscillator

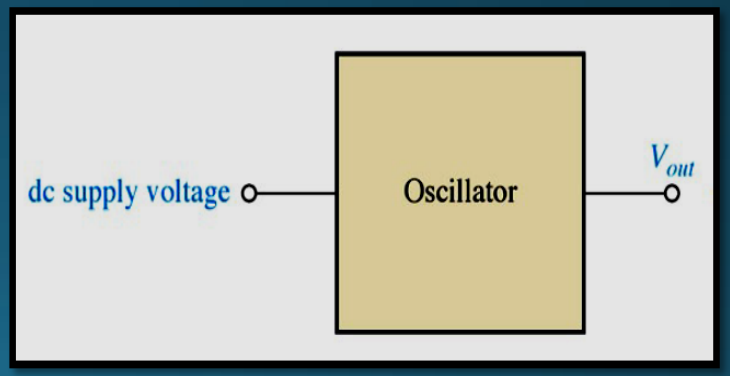
❖INTRODUCTION

- An electronic oscillator is an electronic circuit that produces a repetitive electronic signal, often a sine wave or a square wave.



- Any circuit that generates an alternating voltage is called an oscillator

- The energy supplied in the form of dc is used to generate ac voltages.

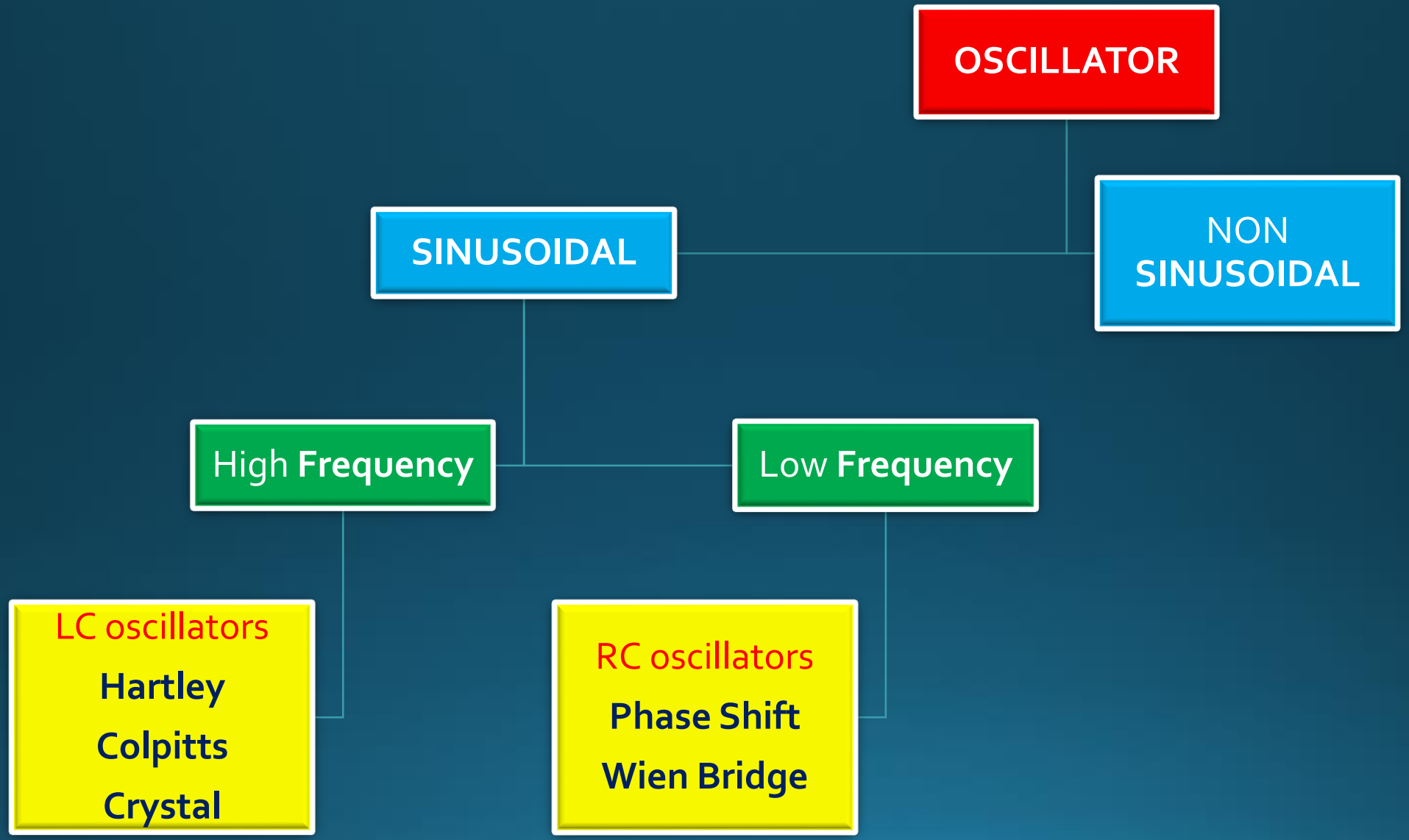


- It basically converts the dc signal to a required ac signal.

❖ Concept of Oscillators

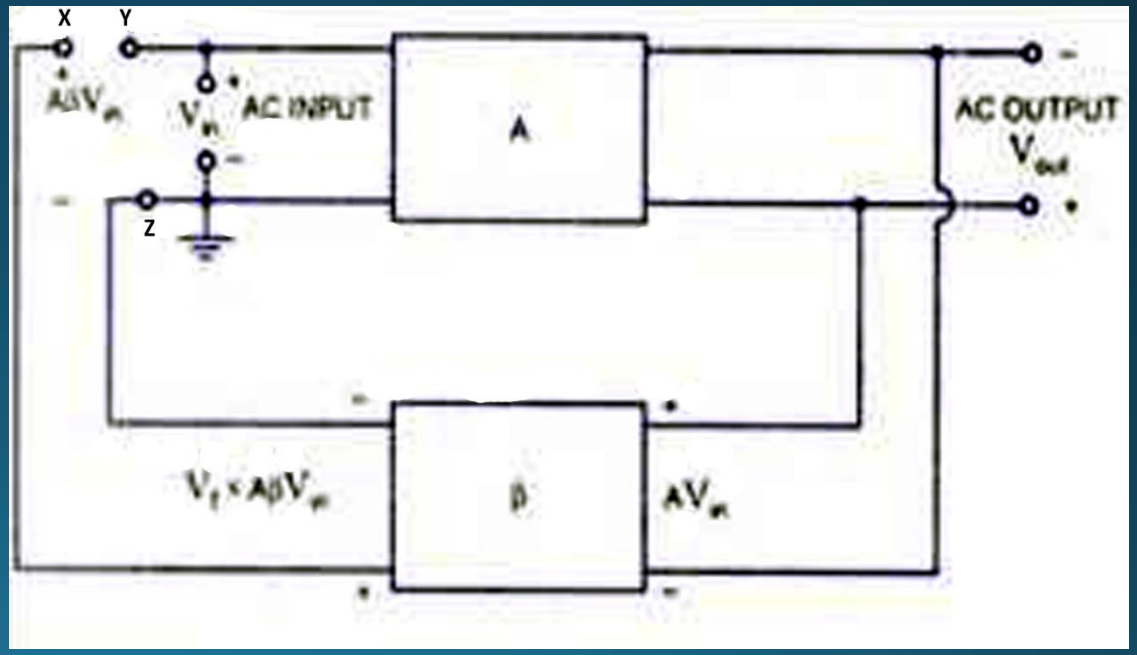
- An oscillator is basically a waveform generator which generates an output waveform, which oscillates with constant amplitude & constant desired frequency.
- It is basic element of all the ac signal sources and generates sinusoidal signal of required frequency and for electrical and electronic measurement.
- Oscillators are generally required to generate carrier frequency signal needed in modulation of audio and video waves broadcasting.
- An oscillator is an amplifier, which uses a positive feedback and without any external input signal, generates an output waveform of a desired frequency

❖ Classification of Oscillators

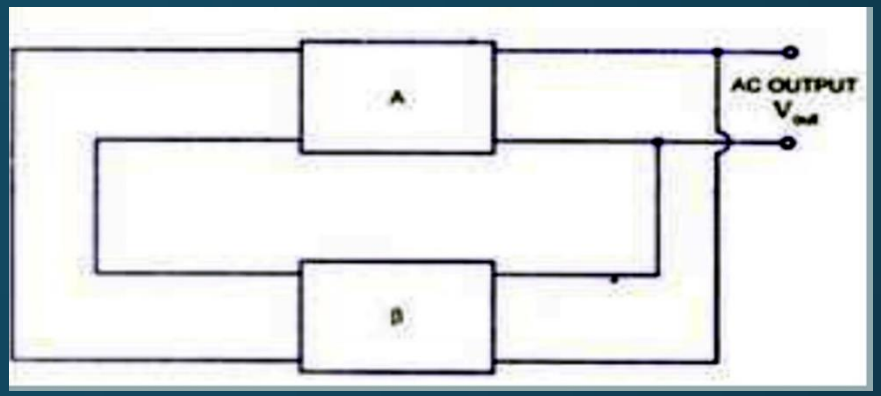


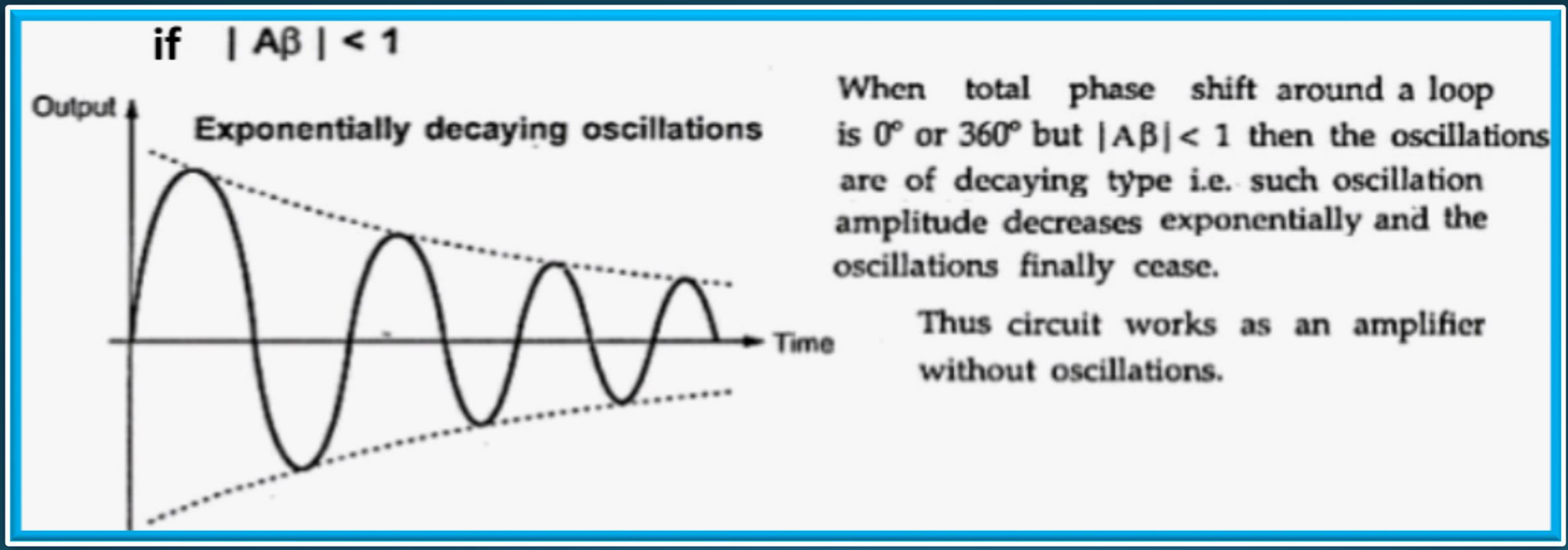
❖ Positive Feedback Amplifier as an Oscillator

- An oscillator generates ac output signal without any input ac signal. This is achieved by feeding a portion of output back into the input.
- This feedback serves as an input to the internal amplifier.
- Let's consider an amplifier circuit with series voltage feedback network as shown in Fig.
- The input voltage v supplied to the internal amplifier across the terminals YZ appears as an amplified signal Av at the output.
- This amplified signal Av drives the feedback network to produce a feedback voltage Aßv
- This feedback voltage Aßv is in phase with the input signal at YZ



- Now if we connect terminals X and Y as shown in figure, the feedback signal becomes the input at YZ.
- If Aß < 1, then Aßv <v and the output signal will go on reducing and ultimately die out as shown in figure

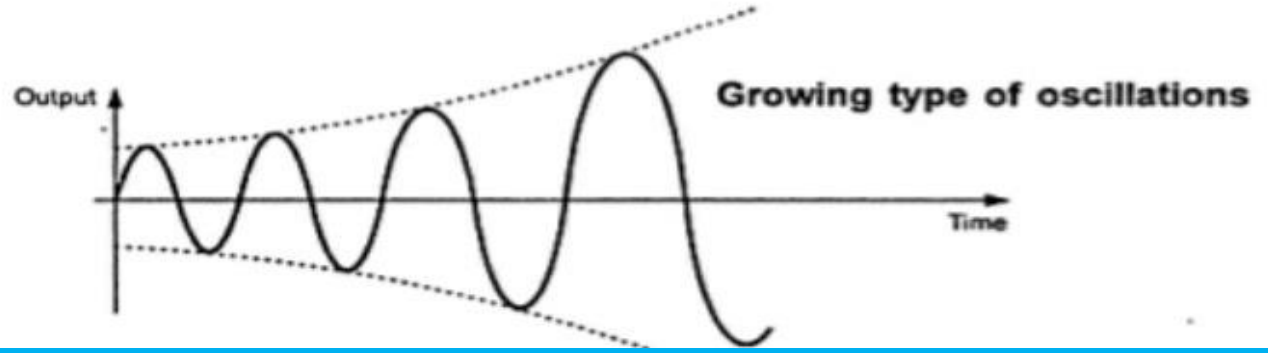




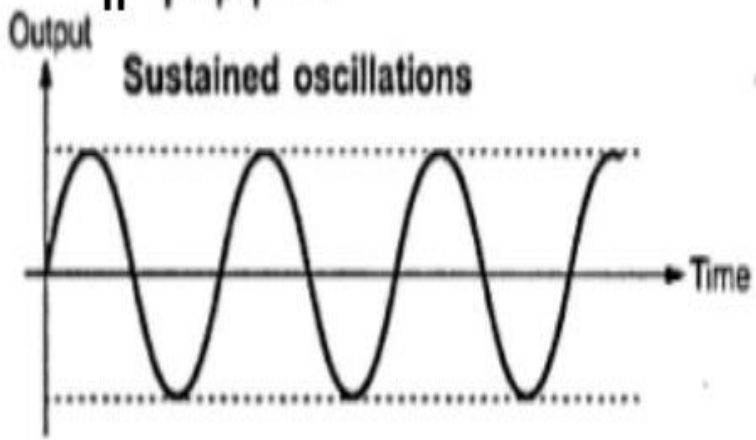
- if Aß > 1, then Aßv > v and the output signal will build up as shown in fig.
- Such oscillations are called *growing oscillations*.

if | Aβ | > 1

When the total phase shift around a loop is 0° or 360° and |Aβ| > 1, then the output oscillates but the oscillations are of growing type. The amplitude of oscillations goes on increasing



if | Aβ | = 1



As stated by Barkhausen criterion, when total phase shift around a loop is 0° or 360° ensuring positive feedback and |Aβ| = 1 then the oscillations are with constant frequency and amplitude called sustained oscillations.

- if Aß = 1, no change occurs in the output signal. The output will have constant amplitude as shown in fig.
- Such oscillations are called sustained oscillations.

- The overall voltage gain of a positive feedback amplifier is given as

$$A_f = \frac{A}{1 - A\beta}$$

- In this equation, if $A\beta = 1$, then A_f = A.
- This means that the amplifier becomes an oscillator under this condition.
- The condition $A\beta = 1$ is called Barkhausen Criterion of oscillation

IN NEXT LECTURE WE TALK MORE ABOUT

OSCILLATORS IN DETAIL

THANK YOU.....