Contents

[1. Kirchhoff’s Law: 1](#_Toc125535900)

[1.1 Kirchhoff’s Point Law or Current Law (KCL): 1](#_Toc125535901)

[1.2 Kirchhoff’s Mesh Law or Voltage Law (KVL): 1](#_Toc125535902)

[2 The Ray Theory: 2](#_Toc125535903)

[2.1 Acceptance Angle: 2](#_Toc125535904)

[2.2 Numerical Aperture: 2](#_Toc125535905)

[3 Fibre – Optic communication system: 3](#_Toc125535906)

[3.1 Transmitter: 3](#_Toc125535907)

[3.2 Repeater: 3](#_Toc125535908)

[3.3 Receiver: 3](#_Toc125535909)

[4 Sinusoidal Oscillator: 4](#_Toc125535910)

[4.1 Damped oscillations: 4](#_Toc125535911)

[4.2 Undamped oscillations: 4](#_Toc125535912)

[5 Sound Reflection: 5](#_Toc125535913)

[5.1 Echoes: 5](#_Toc125535914)

[5.2 Reverberation: 5](#_Toc125535915)

# Kirchhoff’s Law:

* These **law**s are more comprehensive than Ohm’s *law* and are used for solving electrical networks which may not be readily solved by the latter.
* Kirchhoff’s laws, two in number, are particularly useful (a) in determining the equivalent resistance of a complicated network of conductors and (b) for calculating the **currents** flowing in the various conductors.

## Kirchhoff’s Point Law or Current Law (KCL):

* “In any electrical network, the algebraic sum of the CURRENTS meeting at a point (or junction) is zero.”
* it simply means that the total current leaving a junction is equal to the total current entering that junction.

## Kirchhoff’s Mesh Law or Voltage Law (KVL):

* “The algebraic sum of the ~~products~~ of currents and resistances in each of the conductors in any closed path (or mesh) in a network plus the algebraic sum of the e.m.fs. in that path is zero.”
* In other words, Σ IR + Σ e. m. f. = 0

# The Ray Theory:

* Propagation of light through the core of an optical Fibre is subject to the materials that compose both the core and the cladding and their refractive index difference.

## Acceptance Angle:

* The refraction inside the cladding is considered to be loss of energy in the fibre. However, when the angle is decreased to ϕc known as the critical angle of incidence, the ray just graces the boundary inside the fibre. For any angle of incidence within the angle ϕc′ the ray of light will be totally internally reflected.
* Hence, the angle ϕc′ known as the maximum acceptance angle (ϕmax) is the maximum limiting angle of a fibre that allows light to travel through the fibre.

## Numerical Aperture:

* To measure the amount of light gathered by the fibre, a quantity known as numerical aperture is used.
* Numerical aperture (NA) is defined as a measure of the light-gathering ability of an optical fibre; also it is defined as a quantity that is numerically equal to sine of the acceptance angle (sin ϕmax).

# Fibre – Optic communication system:

* Communication is an exchange of information between source and user that is located away from the source.
* A typical exchange is where the information generated at one end (source) is transported to the other end (user). The information is transported or transmitted by means of a transmission medium.

## Transmitter:

* The transmitter consists of the source, coder and modulator. The input analog signal (data, voice, music, etc.) is converted to a digital signal by means of a coder or an encoder.
* The converted digital signal is then modulated into an optical carrier and transmitted.

## Repeater:

* A repeater is required when the signal while propagating can fall below a minimum detectable level due to transmission losses and fibre losses like dispersion. In that case, the signal has to be boosted back (amplified) to its original level.
* This works on the principle of creation of electron–hole pairs at the junction of a PN diode by successive collisions of the impinging photons.

## Receiver:

* The receiver unit consists of a photodetector, demodulator, decoder and amplifier. As was the case with the repeater, in the first stage of the receiver, the incoming optical signals are detected using a photodiode.
* These are then amplified and demodulated to obtain the required digital signal. The signals are then decoded and the transmitted signal is outputted.

# Sinusoidal Oscillator:

* An electronic device that generates sinusoidal oscillations of desired frequency is known as a sinusoidal oscillator.
* It receives d.c. energy and changes it into a.c. energy of desired frequency. The frequency of oscillations depends upon the constants of the device.

## Damped oscillations:

* The electrical oscillations whose amplitude goes on decreasing with time are called damped oscillations.
* Obviously, the electrical system in which these oscillations are generated has losses and some energy is lost during each oscillation

## Undamped oscillations:

* The electrical oscillations whose amplitude remains constant with time are called undamped oscillations.
* Although the electrical system in which these oscillations are being generated has also losses, but now right amount of energy is being supplied to overcome the losses.

# Sound Reflection:

* Sound waves are longitudinal waves and requires elastic medium for their propagation.
* They exhibit all the wave properties such as reflection, diffraction, interference etc. When sound encounters an obstacle, it undergoes reflection as well as diffraction.
* The reflection of sound in an enclosed space leads to two important effects, namely echo and reverberation.

## Echoes:

* An echo is produced when the sound reflected from an obstacle reaches the ear after the sound from the source has already been heard. Thus, there is a repetition of the sound in this case.
* The sensation of sound persists for about 100ms after the source stopped giving sound.

## Reverberation:

* When attending an assembly inside the auditorium, it must have observed how different the voice of the orator appears from the original.
* Reverberation is the phenomena of persistence of sound even after source of sound has been stopped.