EEC 603
MICROWAVE ENGINEERING

UNIT-1

Syllabus

- Introduction
- Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE10 mode,
- Field Distribution, Power, Attenuation.
- Circular Waveguides: TE, TM modes.
- Wave Velocities, Micro strip Transmission line (TL),
- Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities.

Introduction

- Microwaves propagates through various microwave circuits ,components and devices that act as section of microwave transmission lines that are broadly called waveguides.

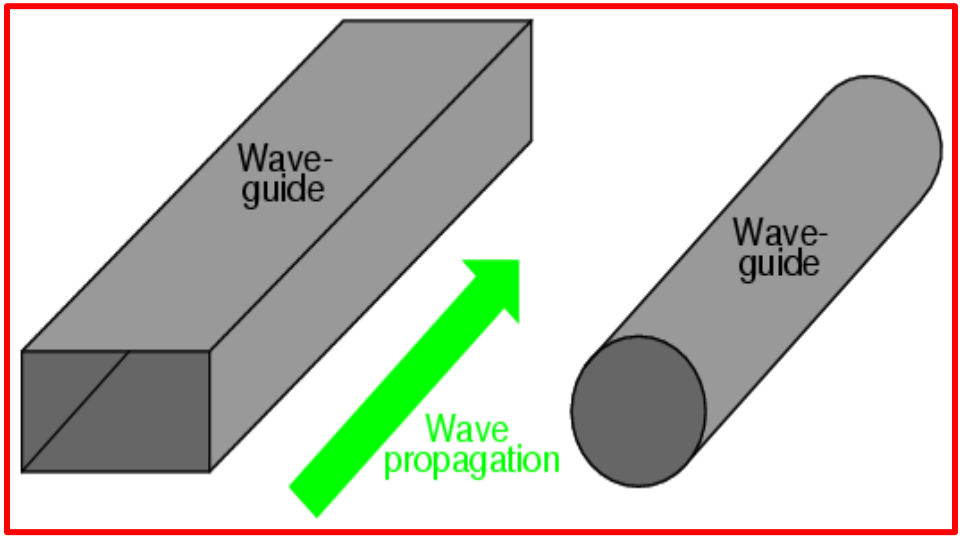
Waveguides

Introduction

- At frequencies higher than 3 GHz, transmission of electromagnetic energy along the transmission lines and cables becomes difficult.
- This is due to the losses that occur both in the solid dielectric needed to support the conductor and in the conductors themselves.
- A metallic tube can be used to transmit electromagnetic wave at the above frequencies

Definition

➢A Hollow metallic tube of uniform cross section for transmitting electromagnetic waves by successive reflections from the inner walls of the tube is called ***waveguide*.**



Basic features

- Waveguides may be used to carry energy between pieces of equipment or over longer distances to carry transmitter power to an antenna or microwave signals from an antenna to a receiver

- Waveguides are made from copper, aluminum or brass. These metals are extruded into long rectangular or circular pipes.

- An electromagnetic energy to be carried by a waveguide is injected into one end of the waveguide.

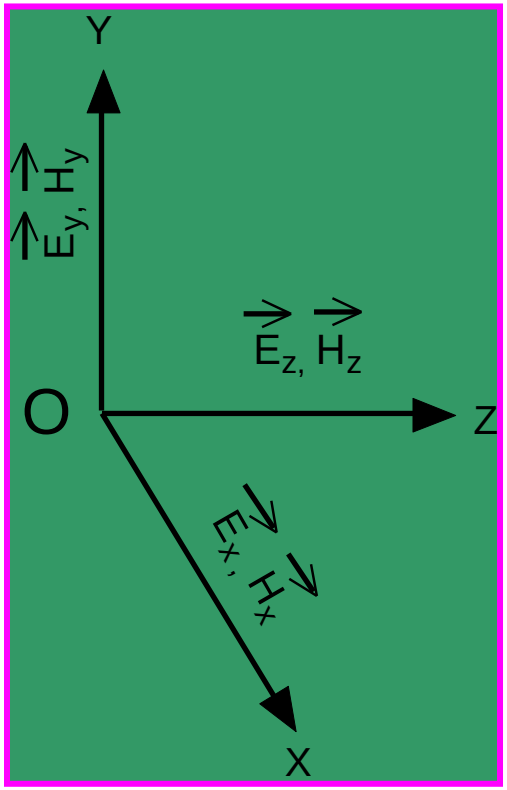
- The electric and magnetic fields associated with the signal bounce off the inside walls back and forth as it progresses down the waveguide.

EM field configuration within the waveguide

- In order to determine the EM field configuration within the waveguide, Maxwell's equations should be solved subject to appropriate boundary conditions at the walls of the guide.

- Such solutions give rise to a number of field configurations. Each configuration is known as a *mode*. The following are the different modes possible in a waveguide system

Components of Electric and Magnetic Field Intensities in an EM wave



Possible Types of modes

- 1. Transverse Electro Magnetic (TEM) wave: Here both electric and magnetic fields are directed components. (i.e.) $E_z = 0$ and $H_z = 0$.

- 2. Transverse Electric (TE) wave: Here only the electric field is purely transverse to the direction of propagation and the magnetic field is not purely transverse. (i.e.) $E_z = 0$, $H_z \neq 0$

Possible Types of modes

3. Transverse Magnetic (TM) wave: Here only magnetic field is transverse to the direction of propagation and the electric field is not purely transverse. (i.e.) $E_z \neq 0, H_z = 0.$

4. Hybrid (HE) wave: **Here neither electric nor magnetic fields are purely transverse to the direction of propagation. (i.e.)** $E_z \neq 0, H_z \neq 0.$