PNS SCHOOL OF ENGG.& TECH.

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SUB-Wave propagation & broadband communication system(Th.-4)

1STInternal question & answer

DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION

Semester -5th

Full mark -20

1. a) What is refraction ?

Ans-Refraction of light is defined as the change in direction or the bending of a wave passing from one medium to another due to the change in speed of the wave.

b) What is interference?

Ans-Interference is the phenomenon in which two waves superpose to form the resultant wave of the lower, higher or same amplitude. The most commonly seen interference is the optical interference or light interference.

c) What is attenuation?

Ans-Attenuation is the loss of signal strength in networking cables or connections. This typically is measured in decibels (dB) or voltage and can occur due to a variety of factors. It may cause signals to become distorted or indiscernible.

d) Define sky wave propagation?

ANS-Sky Wave propagation, commonly known as the skip, is a kind of radio wave propagation.

It is either the reflected or refracted back waves to the earth from the ionosphere, which is an electrically charged layer of the upper atmosphere.

Medium and shortwave frequencies can be refracted back to earth which is beyond the horizon, which makes them useful in the transcontinental transmission of the waves.

e) Define critical frequency?

Radio frequency waves propagate between transmitter and receiver using antennas. The radio frequency at or below, the wave gets reflected from ionosphere and above this frequency waves penetrate through ionospheric layer. This is frequency is known as critical frequency. It is denoted by fc.

F) Define antenna gain?

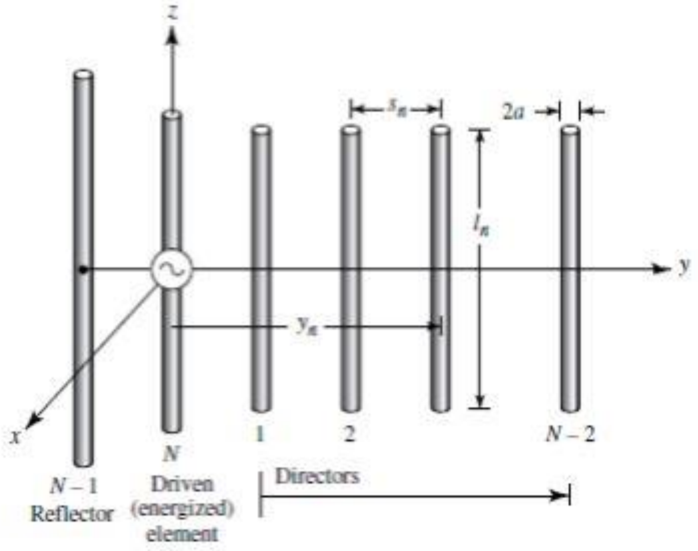
Antenna gain is the ability of the antenna to radiate more or less in any direction compared to a theoretical antenna. If an antenna could be made as a perfect sphere, it would radiate equally in all directions.

NO.2 a) Draw and explain the yagi uda antenna ?

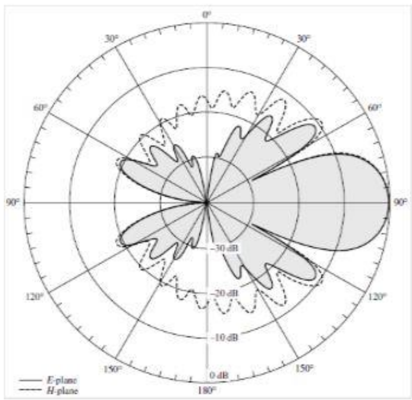
Yagi Uda antenna is also termed as Yagi antenna which is a directional antenna that has either two or more parallel resonant antenna components acting as half-wave dipoles. This antenna is majorly formed by three components which are reflector, driven element, and directors, where the single driven component has a connection either with the transmitter/receiver via a transmission line or other parasitic components. In general, the parasitic elements are the reflector and a number of **directors**(longer element)**.**

These parasitic elements (shorter elements) are not electrically connected to the transmitter or receiver but instead act as passive resonators, working in conjunction with the driven element.

Yagi antennas are generally constructed to function in HF and UHF ranges and they provide the functional frequency between 30 MegaHertz to 3 GigaHertz, even when the bandwidth is very minimal. These antennas are uniquely designed to have good gain values which are more than 10dB.



Yagi-Uda antenna configuration.



E-plane H-Plane Amplitude Pattern of 15 Element Yagi Antenna

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Components

There are mainly three basic components of Yagi antenna which are:

1. DRIVEN ELEMENT

2. REFLECTOR

Driven element –

The driven element provides the necessary current required for radiating electromagnetic energy into space and is usually the same length as a half wavelength at the intended operating frequency. All other elements are electrical multiples of half a wavelength long so that they resonate at the same frequency as the driven element..

Reflector –

The length of the reflector is generally 5% more than the driven element. Mostly, each Yagi Uda antenna consists of one reflector element which is at the back of the driven element which means at the sideways from where the maximum sensitivity happens .Tthis design pattern reduces the range of interference .In general, a reflector adds approximately 4 – 5dB of gain in the forward path.

Director –Even when there is a single director or more directors, the length of directors is shorter than the driven component. The positioning of directors will be in front of the driven component which means in a direction that has a high level of sensitivity.

Mostly, there will be a gain of 1 dB across each director element in the forward path even though this level gets decreased when there are more directors.

b) Explain the concept of smart antenna and its benefits?

A smart antenna is an adaptive antenna array consisting of multiple antennas. It uses intelligent algorithms to calculate the optimal antenna combination so that the signals transmitted by the antennas are superimposed and enhanced at the receive end.

Doing so increases the signal coverage distance and improves the transmission rate. Smart antennas make optimal use of beam forming and antenna array technologies, thereby reaping better benefits.

The main benefit of smart antenna systems is its ability to simultaneously increase the useful receiving signal and lower the interference level, increasing the signal-to-interference ratio (SIR) in more densely populated areas.

WiFi, also known as Wi-Fi, is a trademark owned by the Wi-Fi Alliance (WFA). It is a WLAN technology based on the IEEE 802.11 family of standards.

Since the release of the first-generation IEEE 802.11 standard in 1997, it has been evolved to the latest 6th-generation 802.11ax standard (Wi-Fi 6). Before the release of Wi-Fi 6, Wi-Fi standards were identified by versions from 802.11b to 802.11ac.

i) Increased number of users

ii) Increased Range

iii) Security

v) Reduced Interference

iv)Increased bandwidth

c) Explain the radiation mechanism of antenna Write the MAXWELL'S equation .

An Antenna is a transducer, which converts electrical power into electromagnetic waves and vice versa. An Antenna can be used either as a transmitting antenna or a receiving antenna. A transmitting antenna is one, which converts electrical signals into electromagnetic waves and radiates them.

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A transmitting antenna is one, which converts electrical signals into electromagnetic waves and radiates them.

A receiving antenna is one, which converts electromagnetic waves from the received beam into electrical signals.

In two-way communication, the same antenna can be used for both transmission and reception.

MAXWELL'S EQUATIONS

(1) div D = ρ,

(2) div B = 0,

(3) curl E = -dB/dt, and

(4) curl H = dD/dt + J.

Maxwell's Equations are a set of four vector-differential equations that govern all of electromagnetics (except at the quantum level, in which case we as antenna people don't care so much). They were first presented in a complete form by James Clerk Maxwell back in the 1800s. He didn't come up with them all on his own, but did add the displacement current term to Ampere's law which made them complete.

The four equations (written only in terms of E and H, the electric field and the magnetic field), are given below.

The good news about this is that all of electromagnetics is summed up in these 4 equations. The bad news is that no matter how good at math you are, these can only be solved with an analytical solution in extremely simple cases. Antennas don't present a very simple case, so these equations aren't used a whole lot in antenna theory (except for numerical methods, which numerically solve these approximately using a whole lot of computer power).

The last two equations (Faraday's law and Ampere's law) are responsible for electromagnetic radiation. The curl operator represents the spatial variation of the fields, which are coupled to the time variation. When the E-field travels, it is altered in space, which gives rise to a time-varying magnetic field. A time-varying magnetic field then varies as a function of location (space), which gives rise to a time varying electric field. These equations wrap around each other in a sense, and give rise to a wave equation. These equations predict electromagnetic radiation as we understand it.