SAAD AHMAD ID 14680

QNO 18~

a)

Given Data

First band = 800 - 850 MHz

2nd band = 860 - 910 MHz

Each user bandwidth = 60 KHz

3KHz voice is modulated creating 60KHz

Required Data

How many people can use their cellular phones simultaneously.

Calculation

Each band is 50 MHz.

If we divide 50 MHz into 60 KHz.

we get 833.33.

$$\Rightarrow \frac{50 \times 10^6 \text{ Hz}}{60 \times 10^3 \text{ Hz}} = 0.8333 \times 10^3$$

$$= \boxed{833.33}$$

In reality the band is divided into 832 channels.

This means that 832 people can use their cellular phones simultaneously.

Q.NO 1:-

B)

Given Data

A sine wave is offset one fourth of a cycle.

Required Data

i) Frequency in kilohertz.

ii) Phase in degree

iii) Phase in radians

Solution

As we know that

$1ms = 1 \times 10^{-3} s$

$= 1 \times 10^{-3} \times 10^{6} us = \boxed{10^{3} us}$

To find frequency, we use inverse relationship.

$1 ms = 1 \times 10^{-3} s = 1000 s = 10^{2} s$

$f = 1/10^{2} Hz$

Now changing Hertz to Kilohertz.

$f = 10^{-2} \times 10^{-3} KHz$

$\boxed{f = 10^{-5} KHz}$

To find its phase in degree and radians. We know that one complete cycle is 360°.

Therefore, 1/4 cycle is

$(1/4)(360) = \boxed{90 \text{ degrees}}$

$= 90 \times 2\pi/360$ radians

$= 90 \times 2(3.14)/360$ radians

$= 90 \times 6.28/360$ radians

~~$= 90 \times 2260.8$ radians~~

$= \boxed{1.57 \text{ radians}}$

↳ Answer.

☐NO 28~

A) Wave Division Multiplexing

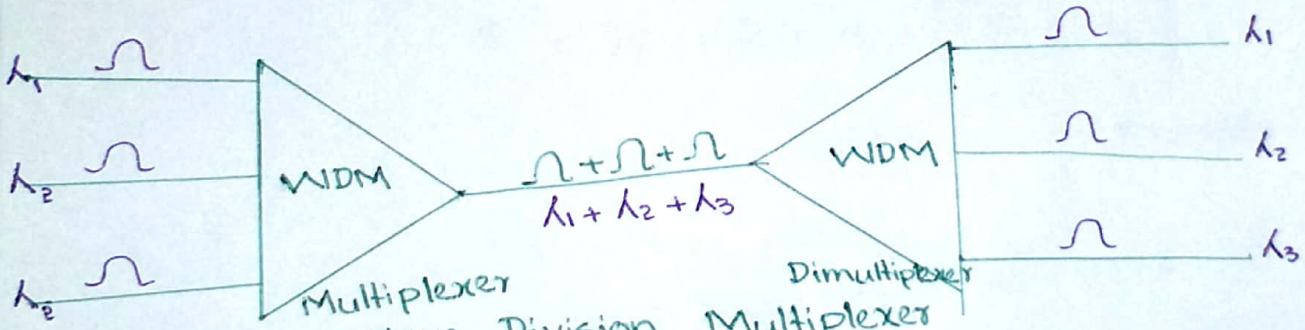
⇒ It is analog multiplexing technique to combine optical signals.

⇒ Use light signals transmitted through fiber – optic channels.

⇒ Very narrow bands of light are combined from several sources to make a wider band of light.

⇒ A prism is used to bend the light beams based on the angle of incidence and frequency.

⇒ Receive Demultiplexer separates signals.



Wave Division Multiplexer

Applications of WDM

⇒ SONET Network.
Multiple optical fiber lines are muxed / demuxed.

⇒ Dense WDM allows muxing of large number of channels by spacing channels closer to one another to achieve greater efficiency.

☐NO 2:-

B)

Given Data

No of channels = 9

Each channel band width = 99 KHz

Guard band width = 13 KHz

Required Data

Minimum band width of the link = ?

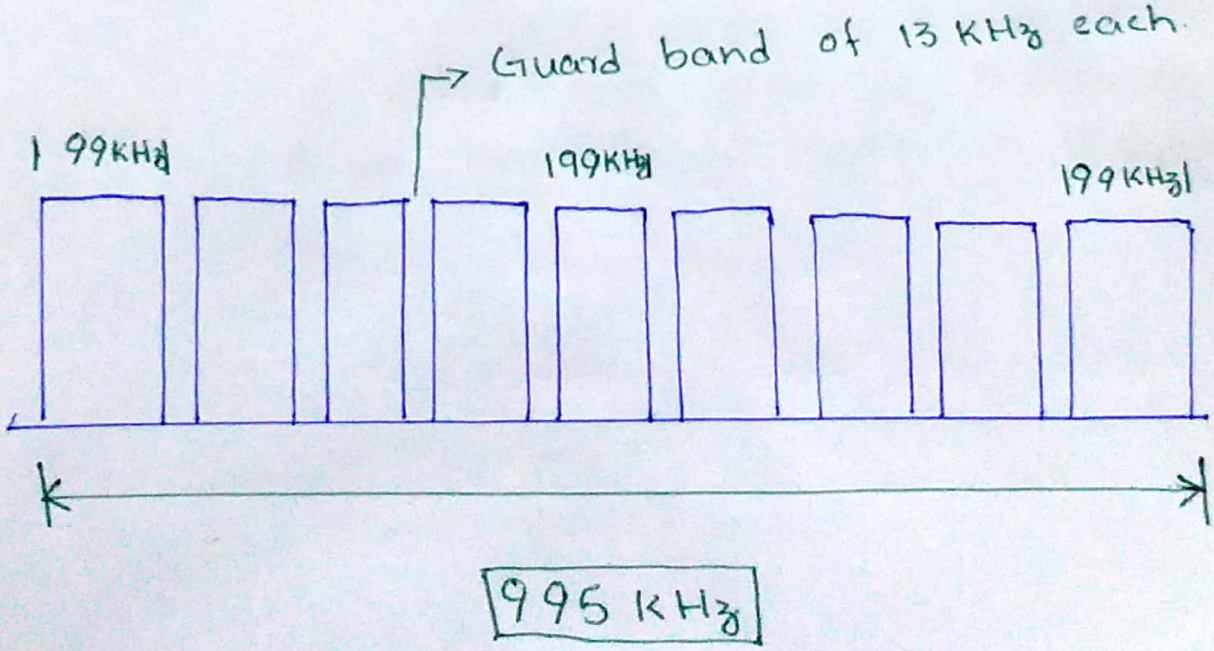
Solution

For nine channels, we need at least eight guard bands.

This means that the required band width is at least

$9 \times 99 + 8 \times 13 =$ **995 KHz.**

↳ Answer



QNO35-

A)

Given Data

Diagram consist of equally spaced points = 16

Bit rate = 4800 bps.

Required Data

Baud rate = ?

Solution

Since

$2^4 = 16$

Hence 4 bits are transmitted with each signal unit.

$$\text{Baud rate} = \frac{4800}{4}$$

Baud rate = 1200 baud

If the bit rate is 4800 bps, then the baud rate is 1200.

QNO 3

B)

Given Data

Band width = 7000 Hz

Signal PSK = 128 PSK.

Required Data

i) Baud rate = ?

ii) Bit rate = ?

Solution

i) Baud rate

For PSK the baud rate is the same as the bandwidth, which means that the baud rate is 7000.

But in the 128-PSK the bit rate is 7 times the baud rate.

Bit rate = 7 x 7000

Bit rate = 49000 bps

↳ Answer

☐NO 48:-

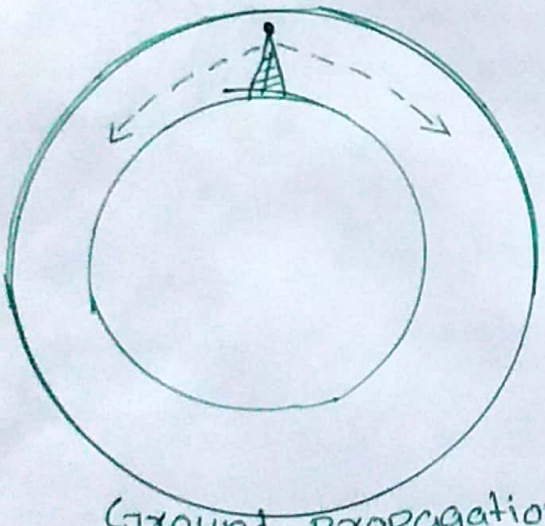
Wireless Propagation Methods

=> Ground-radio waves travels through lowest portion of atmosphere, hugging the Earth.

=> sky-higher frequency radio waves radiate upword into ionosphere and then reflect back to earth.

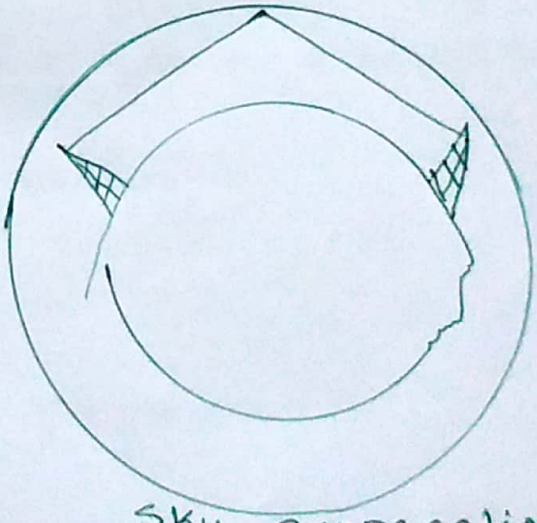
=> Line-of-sight-high frequency signals transmitted in straight lines directly from antenna to antenna.

Ionosphere

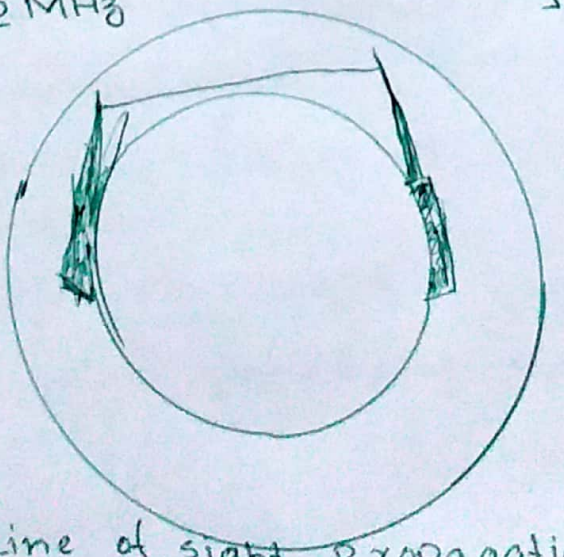


Ground propagation below 2 MHz

Ionosphere



sky propagation 2-30 MHz



→ Ionosphere

Line of sight propagation (above 30 MHz)

Wireless Transmission Waves

Three types of wireless transmission waves.

i) Radio Waves
ii) Microwave
iii) Infrared

i) Radio Waves

=> Frequency range 3KHz to 1GHz
=> Omnidirectional
=> Ideal for long-distance broadcasting.
=> May penetrate walls.
=> Susceptible to interface by other antennas using same frequency.
=> Applications
  => AM, FM radios
  => TV
  => Paging
  => Cordless phones.

ii) Microwave

=> Frequency between 1 and 300 GHz
=> Unidirectional.
=> Narrow focus required
  Issues
=> Line-of-sight
=> Cannot penetrate wall.

3) Infrared

⇒Frequency between 300 GHz and 400 THz.

⇒Short - range communication.

⇒High frequency cannot penetrate walls.

⇒Require line-of-sight propagation

Advantages

⇒Prevent interfaces between systems in adjacent rooms.

Disadvantages

⇒Cannot used for long range communication.

Applications

⇒Wide band width available for data transmittion.

⇒Communication between data keyboards, mice, PCs, printers.

Q NO 4:-

Given Data

Band width = 20KHz

Bit rate = 256 Kbps

Required Data

Signal level = ?

Calculation

To find signal level we use Nyquist formula

$265{,}000 = 2 \times 20{,}000 \times \log_2 L$

$\text{Log } 2L = 6.625 \quad L = 26.625$

$= \boxed{98.7 \text{ Levels}}$

Q NO 5 Qn

Nyquist Capacity theorem

According to Nyquist theorem the sampling rate must be atleast 2 times the highest frequency.

Accuracy of digital reproduction of a signal depends on the number of samples.

Number of sample needed to adequately represent an analog signal is equal to twice the highest frequency of the original signal.

Shannon Capacity Theorem

Relates the system capacity of the ~~chann~~ channel with the average received signal power, the average noise power and the bandwidth.

It is to be noted that doubling the bandwidth will not double the available capacity.

This capacity relationship can be started as

$$C = W \log_2 \left(1 + \frac{S}{N}\right)$$

where 'C' is the capacity of channel.
W is bandwidth in Hertz.
N is the average noise power.
S is average received signal power.

Q NO 5:

Given Data

Band width = 3000 Hz

Signal level = 4 level

Required Data

Maximum bit rate = ?

Solution

We know that

Bit rate = 2 x B.W x $\log_2(4)$

Bit rate = 2 x 3000 x $\log_2(4)$

Bit rate = 12,000 bps

↳ Answer.