Department of Electrical Engineering
Final-Assignment
Date: 22/06/2020

Course Details

Course Title: Advance Computer Networks **Module:** 4th
Instructor: Dr. naeem **Total Marks:** 50

Student Details

Name: Hamza mustajab **Student ID:** 15045

Q1.	(a)	The Advanced Mobile Phone System (AMPS) uses two bands. The first band, 800 to 850 MHz, is used for sending; and 860 to 910 MHz is used for receiving. Each user has a bandwidth of 60 KHz in each direction. The 3-KHz voice is modulated using FM, creating 60 KHz of modulated signal. How many people can use their cellular phones simultaneously?	Marks 6
	(b)	Express a period of 1 ms in microseconds, and express the corresponding frequency in kilohertz and A sine wave is offset one-fourth of a cycle with respect to time zero. What is its phase in degrees and radians?	Marks 4
Q2.	(a)	Explain wave division multiplexing and it's applications?	Marks 5
	(b)	Nine channels, each with a 99-KHz bandwidth, are to be multiplexed together. What is the mininum bandwidth of the link if there is a need for a guard band of 13 KHz between the channels to prevent interference?	Marks 5
Q3.	(a)	A constellation diagram consists of sixteen equally spaced points on a circle. If the bit rate is 4800 bps, what is the baud rate?	Marks 5
	(b)	Given a bandwidth of 7000 Hz for a 128-PSK signal, what are the baud rate and bit rate?	Marks 5
Q4.		Explain wireless propagation methods & wireless transmission waves? We need to send 265kbps over a noiseless channel with a bandwidth of 20KHz. How many signal levels do we need?	Marks 10
Q5.		What is the difference between Shannon & Nyquist Capacity? Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with 4 signal levels, the maximum bit rate can be ?	Marks 10

Question 1(a)

Band ⟹ $B_1 - B = 845 - 824 = 50MHz$
$B_R = 910 - 860 = 50MHz$.

Answer:-

Each band is 50MHz. if we divide 50MHz into 60KHz, we will get 833.33. in reality. the band is divided into 832 channels. But as we know that only 790 channels are valuable for cellular phones users. 42 of these are used for control.

Question 1(b)

Answer:- find equivalent of 1ms. we know that

$1ms = 1 \times 10^{-3}s = 10^{-3} \times 10^{6} = \boxed{10^3 \mu s}$

Now we use the inverse relationship to find the frequency, changing hz to KHz.

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

$f = 1/10^{-3} Hz$

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

$\boxed{F = 1KHz}$

Note:-

Solution:- we know that one Complete cycle is 360degrees.

$\therefore 1/4$ cycle is

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

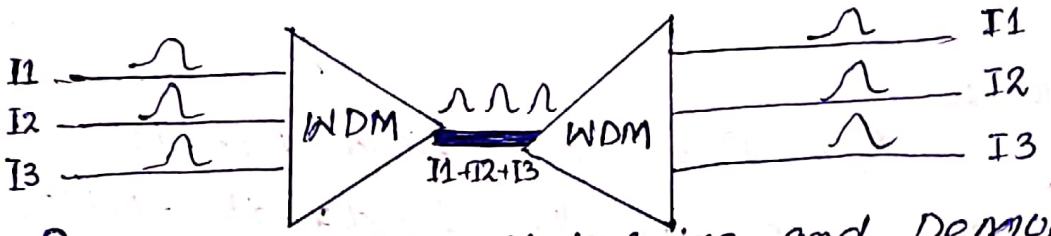
$90 \times 2\pi/360 rad = 90 \times 6.28/360$

$= \boxed{1.57}$ Ans.

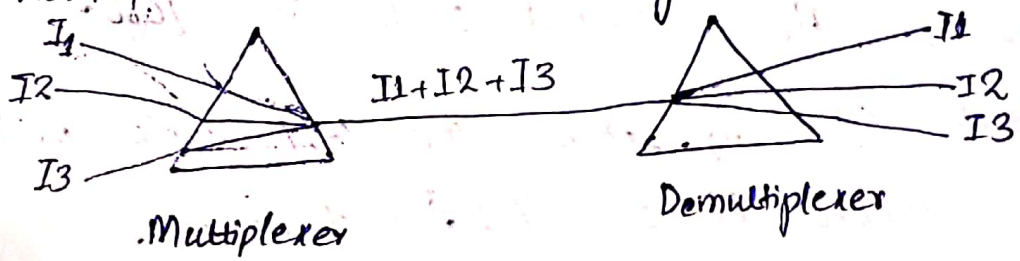
Question 2a:-

Answer:-

- Wave division Multiplexing is used to design the high rate data capability of fiber-optic cable.
- The optical fiber data rate is higher than the data rate of Metallic transmission cable but using a fiber optic for a single line wastes the available bandwidth.
- Allows us to combine several lines into one.
- it utilizes this higher bandwidth or data rate.



Prisms in WDM Multiplexing and Demux.



- WDM is a analog multiplexing to combine optical signals.
- Combines multiple light source into one light.
- optical equivalent of FDM.
- Recivers DEMUX will separates signals.

⇒ WDM Applications :-

- SONET (Synchronous Optical Network) standardized protocols that transfer multiple digital bit streams synchronously over optical fiber using laser or highly light from LED. At low transmission lines data rates can also be transfered via electrical interface.
- New Technology is Dense WDM (DWDM). Dense wave division multiplexing (DWDM) is a technology that puts data from different sources together on an optical fibre, with each signal carried at the same time on its own separate light wavelength.
- it can multiplex very large number of channels by spacing channels very close to each other.
- it achieves greater efficiency.

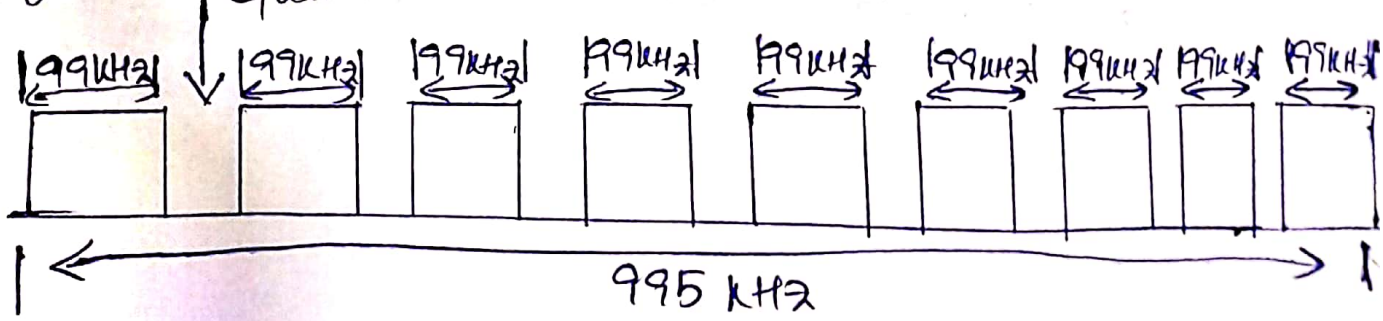
Question 2(b)

Answer: For nine (9) channels; we need at least 8 guards band.

So which means that = (9 x 99) + (8 x 13)

= 995 KHz.

Figure:



Question 3A:- The Consellation indicates

Answer:- Baud rate = ?

$16 = 2^4$

4 bits are transmitted with each signal

So. Baud rate will be

$4800/4$ = **1200 baud** Ans:-

Question 3b:-

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

But in 128-PSK the bit rate will be seven times (7) Baud rate.

So. Bit Rate = 7×7000

= **49000 bit rate**.

Question# 4

Answer:- Propagation Modes:

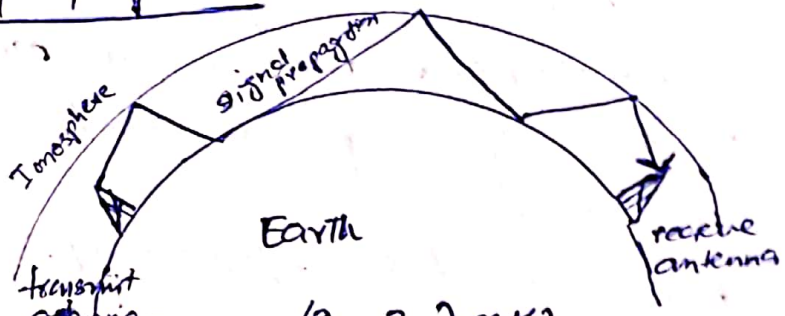
1. Ground wave propagation
2. Sky-wave propogation.
3. Line of sight propogation.

→ Ground wave propagation:-

- Follows contour of the earth.
- Can propagate considerable distances
- Frequencies upto 2 MHz.

e.g:- AM Radio

→ Sky-wave propagation:-

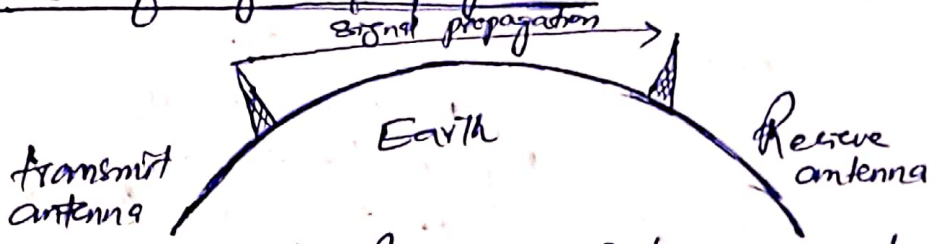


- Frequency ranges from (2-30) MHz.
- Signal reflected from ionized layer of atmosphere back down to earth.
- Signal can travel a number of hops, back and forth between imosphere and earth's surface
- Reflection effect caused by refraction.

e.g:

- Amateur Radio
- CB radio (citizen band Radio).

→ Line of-Sight propagation:-



- transmitting and Receiving antennas must be within line of sight.
  - → Satellite Communication - signal above 30MHz not Reflected by ionosphere.
  - → Ground Communication - antennas within effective line of site due to Refraction.
- Refraction - bending of microwaves by the atmosphere.
- velocity of electromagnetic wave is a function of the density of the Medium.
- wave changes medium, speed changes.
- wave bends at the boundary between mediums

WIRELESS TRANSMISSION WAVES:-

- Radio Waves:-
  - easy to generate
  - can travel long distance
  - omnidirectional
- at low frequencies, the power falls off sharply with distance from the source.
- High frequencies, radio waves tend to travel in straight line and bounce off obstacles.
- Frequency ranges 3KHz to 1GHz.

App:- AM, FM Radio, TV, Cordless phones.

Micro Waves :-

- Frequencies between 1 to 300 GHz.
- do not pass through buildings well.
- can be absorbed by water rain.
- widely used for long-distance telephone communication, cellular telephones, TV distribution.
- Can be narrowly focused (by a dish)
- the transmitting and Receiving antennas must be accurately aligned with each other.

Applications :-
- cellular phones.
- Satellite networks.
- Wireless LANs.

INFRARED WAVES :-

- widely used for short-range communication.
  - TV remote controllers.
- do not pass through solid objects.
  - Bad: limited distance
  - Good: security.
- Candidate for indoor wireless LAN.
- Cannot be used outdoors. (due to sun shines).

Application:- Wide bandwidth available for data transmission.
- Communication between keyboards, mice, PCs, and Printers.

⇒ From Nequist formula:-

$$C = 2B \log_2 2^n$$

$$265000 = 2 \times 20,000 \times \log_2 L$$

$$\log_2 L = 6.625$$

$$L = 2^{6.625}$$

$$\boxed{L = 98.7 \text{ levels}}$$

Question 5:-

Ans:- Nyquist gives the upper bound for the bit rate of a transmission system by calculating the bit rate directly from the number of bits in a symbol (or signal levels) and the bandwidth of the system (assuming 2 symbols/p cycle and first harmonic).

- Nyquist theorem states that for a noiseless channel.

$$C = 2B \log_2 2^n$$

C = Capacity in bps.

B = Bandwidth in Hz.

- Shannons gives the capacity of a system in the presence of noise.

$$C = B \log_2 (1 + SNR)$$

Note:-

- The Shannon Capacity gives us the upper limi the Nyquist formula tells us how many signals levels we need.

⇒ Bandwidth = 3000
for 4 signals level = ?

formula: Bit Rate = $2B \log_2 2^n$

$= 2 \times 3000 \times \log_2 4$

$= 12{,}000$ bps . Ans!

Hamza Mustajab
Semester # 4 (Last)
MS (EL. E)
Id :- 15045