1. a) Explain in detail application of wireless networks and small history of wireless networks.

Ans:- Applications:- Although many applications can benefit from wireless networks and mobile communications, particular application environments seem to be predestined for their use. The following sections will enumerate some of them - it is left to you to imagine more.

Vehicles:-

Today's cars already comprise some, but tomorrow's cars will comprise many wireless communication systems and mobility aware applications. Music, news, road conditions, weather reports and other broadcast information are received via digital audio broad casting (DAB) with 1.5 Mbits/s. For personal communication a universal mobile telecommunications system (UMTS) phone might be available offering voice and data connectivity with 384 kbit/s. For remote areas, satellite communication, a universal can be used, while the current position of the car is determined via the global positioning system (GPS). Cars driving in the same area build

Scanned by CamScanner

a local ad-hoc network for the fast exchange of information in emergency situations or to help each other keep a safe distance. In case of an accident, not only will be the airbag be trigged, but the police and ambulance service will be informed via an emergency call to a service provider. Cars with this technology are already available.

Emergencies:-

Just imagine the possibilities of an ambulance with a high-quality wireless connection to a hospital. Vital information about injured persons can be sent to the hospital from the scene ~~for~~ of the accident. All the necessary steps for this particular type of accident can be prepared and specialists can be consulted for an early diagnosis. Wireless networks are the only means of communication in the case of natural disasters such as hurricanes or earthquakes. In the worst cases, only decentralized, wireless ad-hoc networks survive. The breakdown of all cabling not only implies the failure

Scanned by CamScanner

Business:- A travelling salesman today needs instant access to the company's database: to ensure that files on his or her laptop reflect the current situation to enable the company to keep track of all activities of their travelling employees, to keep data bases consistent etc. With wireless access, the laptop can be turned into a true mobile office, but efficient and powerful synchronization mechanisms are needed to ensure data consistency. At home the laptop connects via a WLAN or LAN and DSL to the Internet. Leaving home requires a handover to another technology to an enhanced version of GSM, as soon as the WLAN coverage ends.

Replacement of wired Networks:-

Wireless networks can be used to replace wired networks, remote sensors for tradeshows, or in historic buildings. Due to economic reasons, it is often impossible to wire remote sensors for weather forecasts, earthquake detection, or to provide environmental information. Wireless connections, via satellite can be help in this situation. Tradeshows need a highly dynamic infrastructure, but cabling takes a long

Scanned by CamScanner

Infotainment and more:-

Internet Imagine a travel guide for a city. Static information might be loaded via CD-ROM, DVD, or even at home via the Internet. But wireless networks can provide up-to-date information at any appropriate location. The travel guide might tell you something about the history of a building downloading information about a concert in the building at the same evening via a local wireless network. You may choose a seat, pay via electronic cash, and send this information to a service provider. Another growing field of wireless network applications lies in entertainment and games to enable, ad-hoc gaming networks as soon as people meet to play together.

Location dependent services:-

Many research efforts in mobile computing and wireless networks try to hide the fact that the network access has been changed WLAN or between different access or that a wireless link is more error prone than a wired one. Many ~~chapp~~ chapters in this book give examples.

Scanned by CamScanner

fact of changing access points by redirecting Packets but keeping the same IP address and many protocols try to improve link quanity using encoding mechanisms (or) retransmission so that applications made for fixed networks still work. In many cases, however, it is important for an application to 'know' some-thing about the location or the user might need location information for further activities: Serveral services that might depend on the actual location can be distinguished.

Follow-on services:- The function of forwarding calls to the current user location is well known from the good old telephone system. Wherever you are, just transmit your temporary phone number to your phone and it redirects incoming calls. Using mobile Computers, a follow-on service could offer, for instance, the same desktop environment wherever you are in the world. All e-mail would automatically be forwarded and all changes to your desktop and documents would be stored at a central location at your company.

Location aware services:- Imagine you wanted to print a document sitting in the lobby of a hotel using your laptop.

Scanned by CamScanner

If you drop the document sitting in the lobby of a hotel using your laptop. If you drop the document over the printer icon, where would you except the document to be printed.

Privacy:- The two services classes listed above immediately raise the question of privacy. You might not want video calls following you to dinner, but maybe you would want important e-mails to be forwarded. There might be locations and/or times when you want to exclude certain service from reaching you and you do not want to be distributed.

Information services:- While walking around in a city you could always use your wireless travel guide to 'pull' information from a service. However a service could also actively push information on your travel guide the Mexican restaurant just around the corner has a special taco offer.

Support services:- Many small additional mechanisms can be integrated to support a mobile device. Intermediate results of

Scanned by CamScanner

Calculations, state information (or) class
Cache contents could 'follow' the mobile node through the fixed network. As soon as the mobile node reconnects, all information is available again. This help to reduce access delay and traffic within the fixed network

Mobile and wireless devices:-
Even though many mobile and wireless devices are available, there will be many more in the future. There is no precise classification of such devices, by size, shape, weight or computing power. Currently laptops are considered the upper end of the mobile device range.

Sensor:- A very simple wireless device is represented by a sensor transmitting state information. One example could be a switch sensing the office door. If the door is closed, the switch transmits this to the mobile phone inside the office which will not accept incoming calls.

Embedded controllers:- Many appliances already contain a simple (or) some times more complex controller. Keyboards, mice, headers, washing machines, coffee machines, hair dryers and TV sets.

Scanned by CamScanner

Pager:- As a very simple receiver, a page can only display short text messages, has a tiny display, and cannot send any messages. Pagers can even be integrated into watches. The tremendous success of mobile phones, has made the pager virtually redundant in many countries. Short message have replaced paging.

Mobile phones:- The traditional mobile phone only had a simple black and white text display and could send/receive voice or short messages. Today, mobile phones migrate more and more toward PDAs. Mobile phones with full color graphic display, touch screen, and Internet browser are easily available.

Personal digital assistant:- PDA's typically, accompany a user and offer simple versions of office software. The typically input device is a pen, with built-in character recognition translating hand-writing into characters. Web browser and many other software packages are available for these devices.

Scanned by CamScanner

Pocket Computer:- The next steps toward full computers are pocket computers offering tiny keyboards, color displays and simple versions of programs found on desktop computers.

Notebook/laptop:- Finally, laptops offer more (or) less the same performance as standard desktop computers; they use the same software - the only technical difference being size, weight and the ability to run on a battery. If operated mainly via a sensitive display the devices are also known as notepads (or) tablet PCs.

1b) Discuss in detail about simplified reference model for w

A short history of wireless communication:-

Wired Communication started with the first Commercial telegraph line between Washington and Baltimore in 1843, and Alexander Graham Bell's invention and marketting of the telephone in 1876. In Berlin, a public telephone service was available in 1881, the first regular public voice and video service was already available in 1936 between Berlin and Leipzig.

Scanned by CamScanner

All optical transmission systems suffer from the high frequency of the carrier light. As every little obstacle shadows the signal, rain and fog make communication almost impossible. At that time it was not possible to focus light as efficiently as can be done today by means of a laser, wireless communication did not really take off until the discovery of electromagnetic waves and the development of the equipment to modulate them. It all started with Michael Faraday demonstrating electromagnetic foundations for electromagnetic fields with his famous equations. Today the unit Hz reminds us of this discovery. Nikola Tesla soon increased the distance of electromagnetic transmission. The name which is most closely connected with the success of wireless communication is certainly that of Guglielmo Marconi. He gave the first demonstration of wireless telegraphy in 1895 using long wave transmission with very high transmission.

Scanned by CamScanner

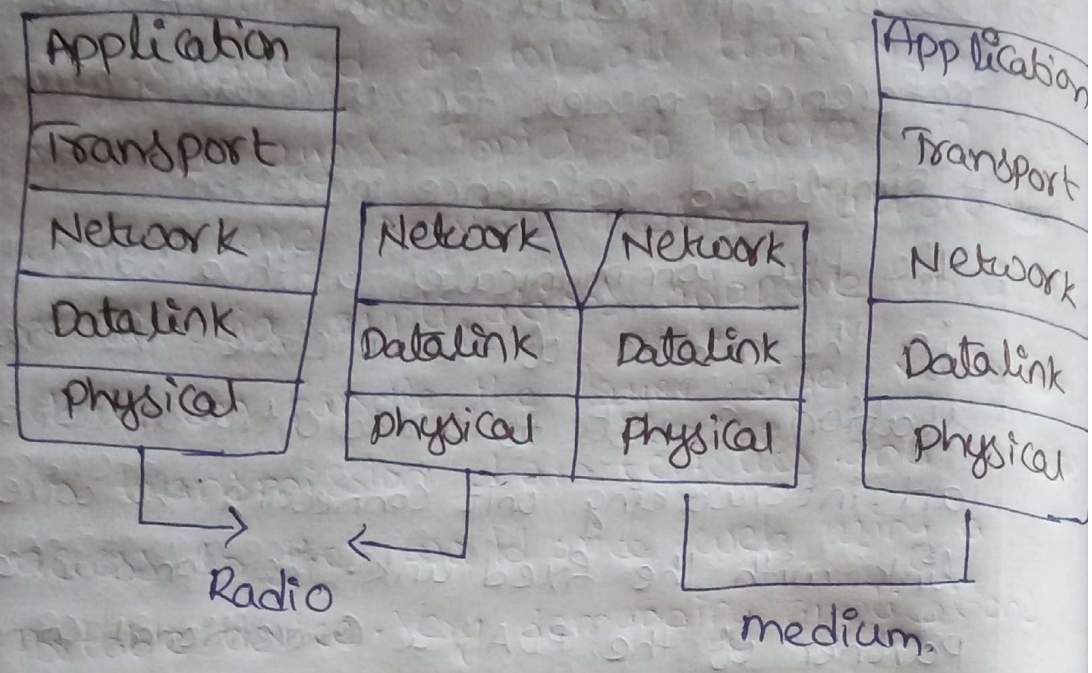
1b) Discuss in detail about simplified reference model for wireless network.

Ans. A simplified reference model:-

The PDA Communicates with a base station in the middle of the picture. The base station Consists of a radio transceiver and an interworking unit Connecting the wireless link with the fixed link. The Communication partner of the PDA, a Conventional Computer is shown on the right-hand side.

Underneath each network element, the figure shows the protocol stack implemented in the system according to the reference model. End-Systems, such as the PDA and Computer in the example, need a full protocol stack comprising the application layer, transport layer, network layer, data link layer, and physical layer. Applications on the end-systems communication with each other using the lower layer services. Intermediate Systems, such as the interworking unit, do not necessarily need all of the layers. The network, data link and physical layers. As only entities at the same level the end-system application do not notice the intermediate system directly in this scenario

Scanned by CamScanner



Physical layer:- This is the lowest layer in a communication system and is responsible for the conversion of a stream of bits into signals that can be transmitted on the sender side. The physical layer of the receiver then transforms the signals back into a bit stream. For wireless communication, the physical layer is responsible for frequency selection, generation of the carrier frequency, signal detection.

Data link layer:- The main tasks of this layer include accessing the medium, multiplexing of different data streams, correction of transmission errors, and synchronization. Discuss different medium access schemes.

Scanned by CamScanner

A small section about the specified data link layer used in the presented system is combined in each respective. Altogether the data link layer is responsible for a reliable point-to-point connection between two devices (or) a point-to-multiplication point connection between one sender and several receivers.

Network layer:- This third layer is responsible for routing packets through a network (or) establishing a connection between two entities over many other intermediate systems. Important topics are addressing, routing, device location and handover between different networks. The other chapters also contain sections about the network layer, as routing is necessary in most cases.

Transport layer:- This layer is used in the reference model to establish an end-to-end connection. Topics like quality of service, flow and congestion control are relevant, especially if the transport protocols known from the Internet, TCP and UDP, are to be used over a wireless link.

Scanned by CamScanner

Application layer:- Finally, the applications are situated on top of all transmission-oriented layers. Topics of interest in this context are service location, support for multimedia applications, adaptive applications that can handle the ~~layer~~ larger variations in transmission characteristics, and wireless access to the world wide web using a portable device. Very demanding applications are video and interactive gaming.

2 a) Define signal and Explain about different representations of signals.

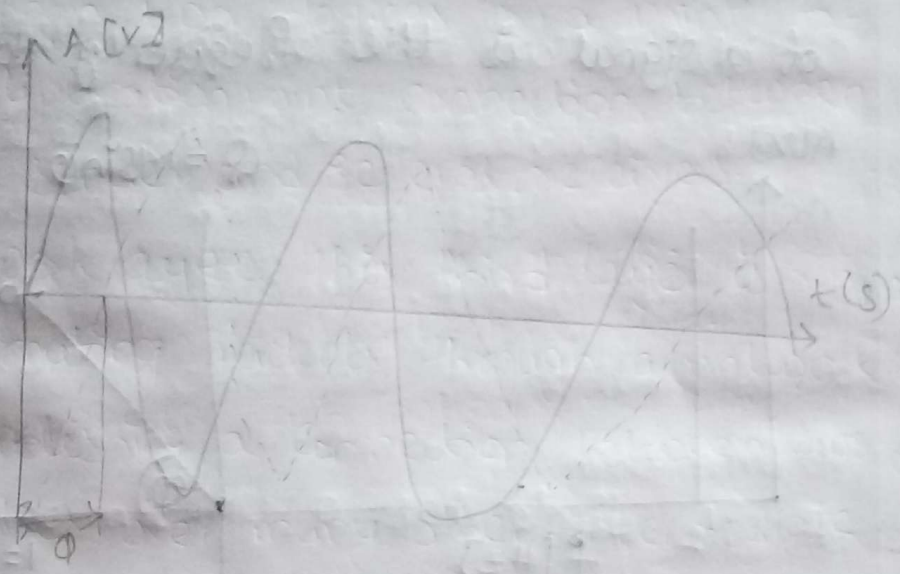
Ans:- Signals are the physical representation of data. Users of communication system can only exchange data through the transmission of signals. Layer 1 of the ISO/OSI basic reference model is responsible for the conversion of data.

Signals are functions of time and location. Signal parameters represent the data value. The most interesting types of signals for radio transmission are periodic signals, especially sine waves as carriers. The general function of a sine wave is: $g(t) = A_t \sin(2\pi f_t t + \phi_t)$.

Signal Parameters are the Amplitude A, the frequency f, and the phase shift ϕ. The

Scanned by CamScanner

amplitude as a factor of the function g may also change over time, thus A_t, The frequency f expresses the periodicity of the signal with the period $T = 1/f$. The frequency f may also change over time, thus f_t:



Fundamental Equation of Fourier:-

$$g(t) = \frac{1}{2}c + \sum_{n=1}^{\infty} a_n \sin(2\pi n f t) + \sum_{n=1}^{\infty} b_n \cos(2\pi n f t)$$

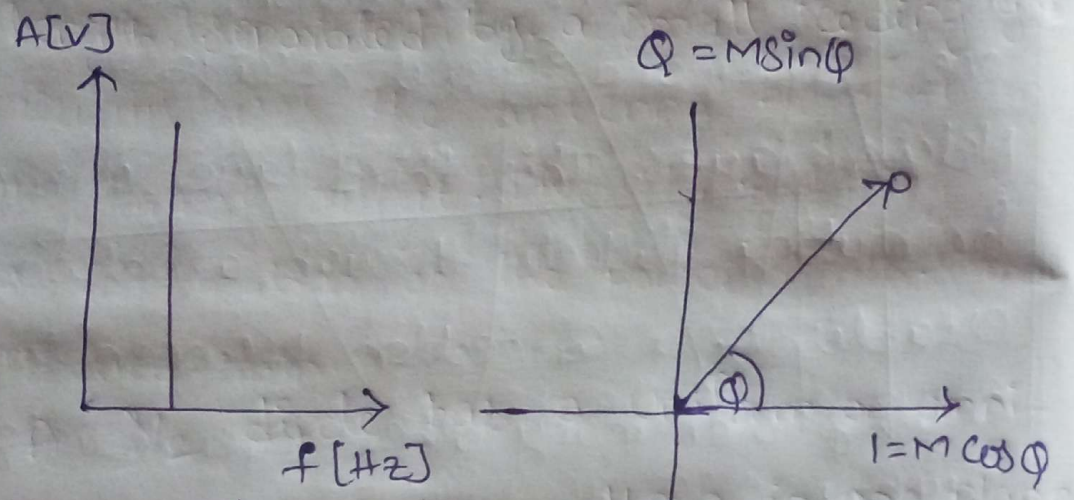
In this Equation the parameter c determines the Direct Current (DC) Component of the signal, the coefficient a_n and b_n are the amplitude of the nth sine and cosine function. The frequencies of these functions increase with a growing Parameter n and are a multiple of the fundamental frequency f.

A typical way of represent signals is the time domain. Here the amplitude A of a Signal is shown versus time. This is also the typical representation known from an

Scanned by CamScanner

oscilloscope. A phase shift can also be shown in the representation.

Representation in the time domain are problematic if a signal consists of many different frequencies. In this case, a better representation of a signal is the frequency domain.



Frequency domain representation of a signal.

Phase domain representation of a signal

A third way to represent signals is the Phase domain shown in figure. This representation also called phase state (or) signal Constellation diagram, shows the amplitude M of a signal and its phase φ in polar co-ordinates. The x-axis represents a phase of 0 and is also called In-Phase (I). A Phase shift of 90° (or) π/2 would be a Point on the y-axis called Quadrature (Q).

Scanned by CamScanner

2b) Explain in detail about different kinds of Anthena with radiation patterns?

Ans:- Anthenas:- As the name wireless already indicates, this communication mode involves getting rid of wires and transmitting signals through space without guidance. We donot need any medium for the transport of electromagnetic waves, some how we have to couple the energy from the transmitter to the outside world and in reverse, from the outside world to the receiver. This is exactly what antennas do. Antennas couple electromagnetic energy to and from space to and from a wire or Coaxial cable.

A theoretical reference antenna is the isotropic radiator, a point in space radiating equal power in all directions, all points with equal power are located on a sphere with the antenna as its center. The radiation pattern is symmetric in all directions.

Scanned by CamScanner

Real antennas all exhibit directives effects the intensity of radiation is not the same in all directions from the antenna. The simplest real antenna is a thin, center-fed dipole also called Hertzian dipole. The dipole consists of two collinear conductors of equal length, separated by a small feeding gap.

A $\lambda/2$ dipole has a uniform or omni-directional radiation pattern in one plane and a figure eight pattern in the other two planes. This type of antenna can only overcome environmental challenges by boosting the power level of the signal.

Scanned by CamScanner

If an antenna is positioned in a valley or between buildings, an omni-directional radiation pattern is not very useful. In this case directional antennas with certain fixed preferential transmission and reception directions can be used. A simple special example of directional antennas is constitutes by satellite dishes.

Directed antennas are typically applied in cellular system as presented. Several directed antennas can be combined on a sign single pole to construct a sectorized antenna. A cell can be sectorized into three or six sectors.

Scanned by CamScanner

Two (or) more antennas can also be combine to improve reception by counteracting the negative effects of multi-path propagation. These antennas also called multi-element antenna arrays, allow different diversity scheme. One such scheme is switched diversit (or) selection diversity, where the receiver always uses the antenna element with the largest output. Diversity combining constitut a combination of the power of all signals to produce gain.

Scanned by CamScanner

3a) Discuss in detail about signal propagation?

Ans:- Signal propagation:-

Like wired networks, wireless Communication networks also have senders and receivers of signals. In connection with signal propagation these two networks exhibit considerable differences. In wireless networks, the signal has no wire to determine the direction of propagation, One can precisely determine the behaviour of a signal travelling along this wire received power depending on the length For wireless transmission, this predictable behaviour is only valid in a vacuum with out matter between the sender and the receiver.

Transmission range:- With in a certain radius of the sender transmission is Possible receiver receives the signals with an error rate low enough to be able to communicate and can also act as

Scanned by CamScanner

Detection range:- Within a second radius detection of the transmission is Possible the transmitted power is larger enough to different from background noise. The error rate is too high to establish communication.

Interference range:- Within a third even larger radius, the sender may interfere with other transmission by adding to the background noise. A receiver will not be able to detect the signals, but the signals may disturb other signals.

This simple and ideal scheme led to the notion of cells around a transmitter. Real life does not happen in a vaccum, radio transmission has to contend with our atmosphere, mountains, buildings, moving senders and receivers etc.

Scanned by CamScanner

3b) What are the different fundamental propagation behaviours depending on their frequency.

Ans:- Radio waves can exhibit three fundamental propagation behaviors depending on their frequency:-

1) Ground wave
2) Sky wave
3) Line-of-sight.

1) Ground wave:- (<2MHz): Waves with low frequencies follow the earth's surface and can propagate long distances. These ways waves are used for eg, submarine communication (or) AM radio.

2) Sky wave:- (2-30 MHz):- Many international broadcasts and amateur radio use these short waves that are reflected at the ionosphere. This way the waves can about bounce back and forth between the ionosphere and the earth's surface, travelling around the world.

Scanned by CamScanner

3) Line-of-sight :- (>30 MHz) : Mobile phone systems, satellite systems, cordless telephones etc. use even higher frequencies. The emitted waves follow straight line of sight. This enable direct communication with satellites (or) microwaves links on the ground. However, an additional consideration for ground-based communication is that the waves are bent by the atmosphere due to refraction.

→ Almost all communication systems presented in this book work with frequencies above 100 MHz so, we are almost exclusively concerned with LOS communication.

Scanned by CamScanner

4a) Explain in detail about Multiplexing mechanism with diagramatic representation.

Ans:- Multiplexing:- Multiplexing is not only a fundamental mechanism in communication systems but also in everyday life. Multiplexing describes how several users can share a medium with minimum or no interference. One example is highways with several lanes. Many users use the same medium with hopefully no interference. This is possible due to the provision of several lanes separating the same traffic.

1) Space division multiplexing:-

For wireless communication, multiplexing can be carried out in four dimensions:- space, time, frequency and code. In this field, the task of multiplexing is to assign space, time, frequency and code to each communication channel with a minimum of interference and a maximum of medium utilization. The term communication channel here only refers to an association of sender(s) and receiver(s).

Scanned by CamScanner

For this first type of multiplexing space division multiplexing (SDM), the (three dimensional) space S_i is also shown. Here space is represented via circles indicating the interference range as introduced. The channels K_1 to K_3 can be mapped out onto the three space S_1 to S_3 which clearly separate the channels and prevent the interference ranges from overlapping. The space between the interference ranges is sometimes called guard space. Such a guard space is needed in all four multiplexing schemes presented. For the remaining channels (K_4 to K_6) three additional spaces would be needed.

Scanned by CamScanner

2) Frequency division multiplexing:-

Frequency division multiplexing (FDM) describes schemes to subdivide the frequency dimension into several non-overlapping frequency bands. Sender using a certain frequency band can use this band continuously Again, guard spaces are needed to avoid frequency band overlapping also called adjace-nt channel interference. Assigning a separate frequency for each possible communication scenario would be a tremendous waste of frequency resources. Additionally the fixed assignment of a frequency to a sender makes the scheme very inflexible and limits the number of senders.

Scanned by CamScanner

3) Time division multiplexing :-

A more flexible multiplexing scheme for typical mobile communications is time division multiplexing (TDM). Here a channel k_i is given the whole bandwidth for a certain amount of time. Again guard spaces, which now represent time gaps, have to separate the different periods when the senders use the medium. If two transmissions overlap in time, this is called co-channel interference. This scheme is more robust against frequency selective interference, in a certain small frequency band. A channel may use this band only for a short period of time.

Scanned by CamScanner

4) Code division multiplexing:-

While SDM and FDM are well known for from the early days of radio transmission and TDM is used in connection with many applications, code division multiplexing (CDM) is a relatively new scheme in commerical communication systems. First used in military applications due to its inherent security features. Separation is now achieved by assigned each channel its own code, guard space are realized by using codes with the necessary 'distance' in code space orthogonal codes. The main advantage of CDM for wireless transmission is that it gives good protection against interference and tapping.

Scanned by CamScanner

4b) Describe modulation techniques.

Ans:- Modulation:-

Modulation is the addition of information to an electronic (or) optical carrier signal (or) modulation is the process of varying one (or) more properties of a period wave form called carrier signal, with a modulating signal that typically contains information to be transmitted. The introduced the basic function of a sine wave which already indicates the three basic modulation schemes $g(t) = A_t \cos(2\pi f_t t + \varphi_t)$

→ This function has three parameters: amplitude A_t, frequency f_t and phase φ_t which may be varied in accordance with data (or) another modulating signal. For digital modulation which is the main topic in this section, digital data is translated into an analog signal. The three basic methods for this translation are amplitude shift keying (ASK), frequency shift keying (FSK), phase shift keying (PSK).

→ Apart from the translation of digital data into Analog signals, wireless transmission

Scanned by CamScanner

requires an additional modulation, an analog modulation that shifts the center frequency of the baseband signal generated by the digital modulation up to the radio carrier.

There are several reasons why this base band signal cannot be directly transmitted in a wireless system:

- Antennas:- An antenna must be the order of magnitude of the signal's wavelength in size to be effective. With 1GHz, antennas a few centimeters in length can be used.
- Frequency division multiplexing:- Using only baseband transmission, FDM could not be applied. Analog modulation shifts the base band signals to different carrier frequencies. The higher the carrier frequency, the more bandwidth that is available for many baseband signals.

Medium Characteristics:- Path-loss, Penetration of obstacles, reflection, scattering and diffraction all the effects discussed depend heavily on the wavelength of the signal. Depending on the application, that right carrier frequency with the desired characteristics has to be chosen: long waves for submarines, short way waves for handheld devices, very short waves for directed microwave transmission etc.

Scanned by CamScanner

→As for digital modulation three different basic schemes are known for analog modulation: amplitude modulation (AM) frequency modulation (FM) and phase modulation (PM).

→The first step is the digital modulation of data into the analog base-band signal according to one of the schemes presented in the following sections. The analog modulat then shifts the center frequency of the analog signal up to the radio carrier. This signal is then transmitted via the antenna.

The receiver receives the analog radio signal via its antenna and demodulates the signal into the analog signal with the help of the known carrier. This would be all that is needed for a analog radio tuned into a radio station. Bits (or) frames have to be detected the receiver must synchronize with the sender. After synchronization the

Scanned by CamScanner

receiver has to decide if the signal represents a digital 1 (or) 0, reconstructing the original data.

The digital modulation schemes presented in the following section differ in many issues, such as ~~spectrum~~ Spectral efficien-cy, Power efficiency.

Amplitude shift keying:-

Amplitude shift keying (ASK) the most simple digital modulation scheme. The two binary values 1 and 0 are represented by two different amplitudes. This simple scheme only requires low bandwidth, but is very suscept-ible to interference. Effects like multipath propagation, noise or path loss heavily influence the amplitude. In wireless environment a constant amplitude cannot be guaranteed, so ASK is typically not used for wireless radio transmission. Here a light pulse may represent a 1, while the absence of light represents a 0. The carrier frequency in optical systems is some hundred THz.

Scanned by CamScanner

Frequency shift keying:- A modulation scheme often used for wireless transmission is frequency shift keying (FSK). The simplest form of FSK also called binary FSK (BFSK) assigns one frequency f_1 to the binary 1 and another frequency f_2 to the binary 0.

Phase shift keying:-(PSK):

Phase shift keying (PSK) uses shifts in the phase of a signal to represent data. Shows a phase shift of 180° (or) π as the 0 follows the 1. This simple scheme, shifting the phase by 180° each time the value of data changes is also called binary PSK (BPSK).

Scanned by CamScanner

Advanced frequency shift keying:-

A famous FSK scheme used in many wireless systems is minimum shift keying (MSK). MSK basically BFSK without abrupt phase changes belongs to CPM schemes.

→ A high frequency is always chose if even and odd bits are equal.

→ The signal is inverted if the odd bit equals 0.

→ Bandwidth needed to FSK depends on the distance b/w the carrier frequencies.

Scanned by CamScanner

Advanced phase shift keying:-

The simple PSK scheme can be improved in many ways. The basic BPSK scheme only uses one possible phase shift of 180°.

→ It bit value 0 :sine wave, it 1 inverted sine wave. It is very simple PSK.

→ It has low ~~frequency~~ special efficiency.

→ It is robust

→ One way to avoid the problem is QPSK differential QPSK

→ Quadrature amplitude modulation (QAM) for standard 9,600 bits modems.

Scanned by CamScanner

5a) Explain in detail about Spread Spectrum techniques.

Ans:- Spread Spectrum:-

As the name implies spread spectrum techniques involve spreading the band width needed to transmit data. Spreading the bandwidth has several advantages. The main advantage is the resistance to narrowband interference.

1) Shows an idealized narrowband signal ~~into~~ from sender of user data.

2) Converts the narrowband signal into a broadband signal. The narrow band signal into a broad band signal. The energy needed to transmit the signal is the same, but it is now spread over a large frequency range. The power level of the spread signal can be moved much lower than that of the original narrowband signal without losing data.

3) The sum of interference and user signal is received. The receiver new knows how to de-spread the signal, converting the signal into a narrow band signal again

Scanned by CamScanner

4) The receiver applies a band-pass filter to cut off frequencies left & right of the narrowband signal.

→ Six different channels are use FDM for multiplexing, which means that each channel has its own narrow frequency band for the transmission.

→ Depending on receiver characteristics. Channels 1, 2, 5, 6 could be received while the quality of channels 3 & 4 is too bad to reconstruct transmitted data.

→ This application shows that tight coupling of CDM & spread spectrum. Features that make spread spectrum & CDM are very attractive for military applications are the coexistence of several signals without coordination. This is used in mobile systems.

Scanned by CamScanner

The disadvantage is the increased complexi-
-ty of receivers that have to ~~spread~~ despread a signal.

→ Although spread signals appear more like noise, they still raise the background noise level and may interfere with other transmissions if no special precautions are taken.

→ Spreading the spectrum can be achieved in two different ways. ~~as~~ shown in

Scanned by CamScanner

i) Direct Sequence Spread Spectrum: (DSSS)

Direct Sequence Spread Spectrum (DSSS) systems take a user bit stream and perform an (XOR) with a so-called chipping sequence.

→ While each user bit has a duration t_b, the chipping sequence consists the smaller pluses called chips.

→ If the chipping sequence is generated properly it appears as random noise. this sequence is also sometimes called Pseudo noise sequence.

Scanned by CamScanner

Advantages:-

→ Reduces frequency selective fading

→ In cellular networks, base stations can use the same frequency range. Several base stations can detect & recover the signal.

Disadvantages:-

→ Precise power control necessary.

Scanned by CamScanner

Frequency Hopping Spread Spectrum:-

→ The total available bandwidth is spl
into many channels of smaller bandwi
plus guard spaces between the channel
→ Discrete changes of carrier frequency
sequency of frequency changes determin
via pseudo random number sequence
→ This system implements FDM and TDM
→ The pattern of channel usage is called
the hopping sequence, the time spend on a
channel with a certain frequency is
called the dwell time
→ In slow hopping the transmitter uses one
frequency for several bit periods.
→ ~~Re~~ For fast hopping systems, the transmitt
changes the frequency several times during
the transmission of a single bit.

Advantages:-

→ frequency selective fading & interference
limited to short period, simple implemena-ti

Disadvantages:-

→ Not as robust as DSSS & simpler to
detect

→

Scanned by CamScanner

5b) Explain in detail about SDMA and FDMA

Ans:- Space Division Multiple Access (SDMA).

→ It is used for allocating a separated space to users in wireless networks.

→ A typical application involves assigning an optimal base station to a mobile phone user.

→ The mobile phone may receive several base stations with different quality

→ A MAC algorithm could now decide which base station is best, taking into account which frequencies (FDM), time slots (TDM) (or) code (CDM) are still available.

→ Typically SDMA is never used isolation but always in combination with one (or) more other schemes.

→ The basic for the SDMA algorithm is formed by cells and the sectorized antennas which constitute the infrasture implementing Space Division Multiplexing (SDM).

→ Single users are separated in space by individual beams.

→ This can improve the overall capacity of a cell.

Scanned by CamScanner

→ Frequency Division Multiple access (FDMA)
Comprises all algorithms allocating frequen
to transmission channels according to the
frequency division multiplexing (FDM).
→ It describes schemes to subdivide the
frequency dimension into several non-
corresponding, non-overlapping frequency bands.
→ FDMA is a method employee to permit
several uses to transmit simultaneously
on one satellite transponder by assigning
a specific frequency channel to each user.
→ Each conversion gets, its own, unique
radio channel.
→ The channels are relatively narrow,
usually 30 kHz (or) less and are defined as
either transmit or receive channels.
→ A full duplex conversation requires
a transmit & receive channel pair.
→ FDM is often used for simultaneous
access to the medium by base station
and mobile station in cellular networks.
→ A establish a duplex channel.
→ A scheme called frequency division
duplexing (FDD) in which the two directio

Scanned by CamScanner

mobile station to base station and vice versa are now separate using different frequencies.

→ The two frequencies are also known as uplink from mobile station to be station (or) from ground control to satellite and as downlink from base station to mobile station or from statellite to ground control.

Scanned by CamScanner

6a) Discuss in detail about all TDMA mechanisms.

Ans:- Time Division Multiple Access (TDMA)

→ Compared to FDMA, time division multiple access (TDMA) offers a much more flexible scheme, which comprises all technologies that allocate certain time slots for communication controlling TDM.

→ The following sections present several examples for fixed and dynamic schemes and used for wireless transmission.

→ Typically, those schemes can be combine with FDMA to achieve even greater flexibility and transmission capacity.

1) Fixed TDM:-

→ The simplest algorithm for using TDM is allocating time slots for channels in a fixed pattern. This results in a fixed bandwidth and is the typical solution for wireless phone systems.

→ The following figure shows how these fixed TDM patterns are used to

Scanned by CamScanner

implement multiple access and a duplex channel b/w a base station & mobile station. This is time division duplex (TDD).

2) Classical Aloha:-

→ ~~The first~~ This scheme was used in ALOHANET for wireless connection of several stations.

→ Aloha neither coordinates medium access nor does it resolve contention on the MAC layer.

→ Instead each station can access ~~any~~ medium at any time.

→ This is a random access scheme.

Scanned by CamScanner

3) Slotted Aloha:-

→ The first refinement of the classical Aloha scheme is provided by the introduction of time slots (slotted Aloha).

→ All senders have synchronized, transmission can only start at the beginning of a time slot.

4) Carrier sense multiple access.-

→ One improvement to the basic Aloha is sensing the carrier before accessing the medium.

→ Carrier is idle decreases the probability of a collision

→ If a non-persistant CSMA, stations sense the carrier & start sending immediately if the medium is idle.

Scanned by CamScanner

→ In P-Persistant CSMA, System nodes also sense the medium but only transmit with a probability of P.

→ In 1-Persistant CSMA system, all stations wishing to transmit access the medium at the some time, & it becomes idle.

→ The other two are CSMA/CA & ETNMPA.

5) Demand Assigned Multiple Access:-

→ DAMA also called reservation aloha, a scheme for satellite systems. During a Contention phase, all stations try to reserve access time for satellite transm-ission.

→ To maintain a fixed TDM pattern of reservation and transmission, the stations have to be synchronized from time to time. It is Explicit reservation.

6) PRMA Packet reservation multiple access:-

→ PRMA is a implicity reservation scheme. Here slots can be reserved implicity.

→ A certain no. of slots forms a frame. The frame is repeated in time

Scanned by CamScanner

a fixed TDM pattern is applied.

7) Reservation TDMA:-

→ An even more fixed pattern that still allows some random access is exhibited by reservation TDMA.

→ Each station is allocated its own mini-slot and can use it to reserve up to k data slots.

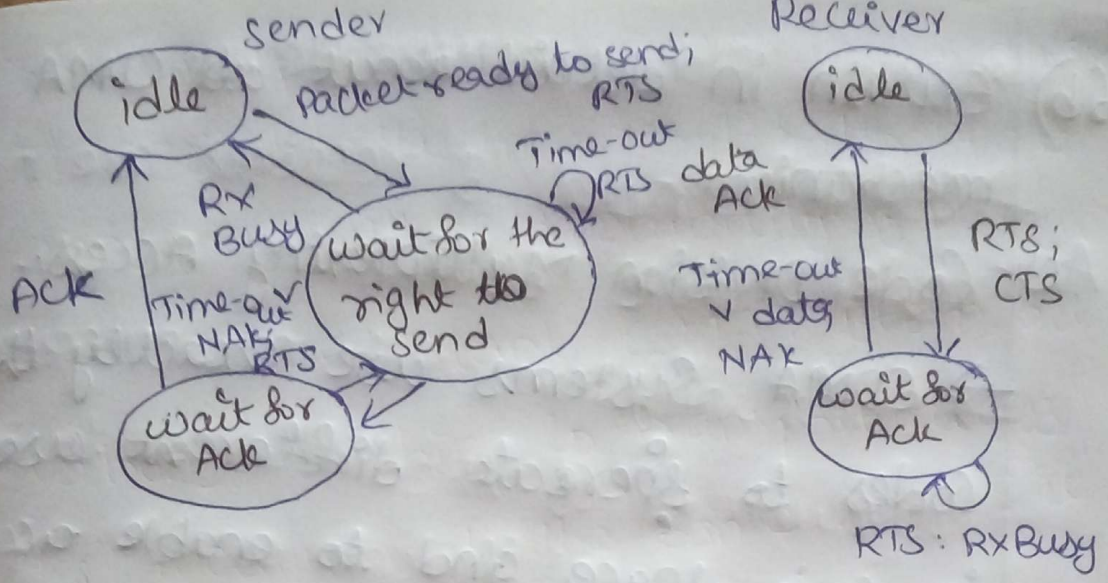
→ This guarantees each station a certain bandwidth and a fixed delay.

→ Isochronous traffic with ~~flex~~ fixed bit rates and best-effort traffic without any guarantees.

8) Multiple access with collision avoidence

→ MACA presents a simple scheme that solves the hidden terminal problem does not need a base station & is still a random access aloha scheme but with dynamic reservation.

Scanned by CamScanner



9) Polling:

→ Where one station is to be heard by all others, polling scheme can be applied

→ Polling is a strictly centralized scheme with one master station and several slave stations.

→ The master can poll the slaves according to many schemes. round robin, randomly according to reservations etc

10) Inhibit Sense Multiple Access:-

→ ISMA is used for the packet data transmission service cellular Digital Packet Data (CDPD) in the AMDS mobile Phone system is also known as digital SMA (DSMA).

→ Here, the base station only signals a busy medium via a busy tone on the downlink.

Scanned by CamScanner

6b) Explain in detail about all CDMA mechanism :-

Ans- Code Division Multiplexing Access:-

→ CDMA Systems use exactly these codes to seperate different users in code space and to enable access to shared medium without interfere

→ Codes with certain characteristics can be applied to the transmission to enable the use of CDM.

→ A code for a certain user should have a good auto-correlation and shou be orthogonal to other codes.

→ Two vectors are called orthogonal if their inner product is 0, as is the case for two vector (2, 5, 0) & (0, 0, 17)

$$(2, 5, 0) * (0, 0, 17) = 0 + 0 + 0 = 0$$

→ Two senders, A & B want to send dat Both senders spread their signal using their key as chipping sequence.

→ Sender A then sends the signal, Sender B does the same with its

Scanned by CamScanner

data to spread the signal with the code

→ Both the signals are then transmitted at the same time using the same frequency, so, the signals superimpose in space.

Scanned by CamScanner

*Spread Aloha Multiple Access:-

→ CDMA Senders & receivers are not really simple devices.

→ Communication with n devices requi Programming of the receiver to be ab to decode n different codes.

→ For mobile phone systems, a lot of the Complexity needed for CDMA is integrat in the base stations.

→ The resulting scheme is called Spread Aloha multiple access (SAMA) is a Combination of CDMA & TDMA.

Working:-

→ Each sender uses the same spreading code. The standard case for Aloha cross is shown in the upper part of figure.

→ Sender A and sender B access the medium at the same time in their narrow band spectrum, so that all three bits shown cause a collision.

→ The same data could also be sent

Scanned by CamScanner

with higher power for a shorter period as shown in the middle, but now spread spectrum is used to spread the shorter signals i.e to increase band width.

→ Both signals are spread, but the chipping phase differs slightly.

→ Separation of the two signals is still possible if the one receiver is synchronized to sender A & another one to sender B.

→ The signal of an unsynchronized sender appears as noise.

→ Advantages of spread spectrum techniques:
robustness against narrowband interference.

Scanned by CamScanner