- Wi-Fi is Wireless Local Area Network (WLAN)
- Wi-Max wireless network has a range of 40 to 50 Km. It provides wireless alternative to Cable TV and DSL.
- Bluetooth provides a short-range wireless connection to exchange information between devices such as mobile phones, laptops, printers and digital cameras.
- Infra-red waves are extremely high frequency waves used by remote controls for television, VCR and other similar devices.
- Cellular communication divides a geographical region into sections called cells and has a Base Station (BS) at the center. The BS contains a transceiver and controller that provides radio communication to mobile phones.
- Global Positioning System (GPS) is a radio navigation system that allows people on land, in sea or in the air to determine their exact position.
- Geostationary Earth Orbit is an orbit directly above the earth's equator with a period equal to the earth's rotational period.
- Medium Earth Orbit is located above low earth orbit and below geostationary earth orbit, is generally used for navigation.
- Low Earth Orbit is located up to an altitude of 2,000 Km from the earth's surface. Less energy is required to place a satellite into a low earth orbit and it requires low power amplifiers for communication.
- Wireless Markup Language (WML) is a markup language used to deliver Internet contents to small wireless devices such as mobile phones and other hand-held devices.

 EXERCISE

Q1.   Select the best answer for the following MCQs

i. Which of the following has a range of 40 to 50 Km?
A. Wi-Fi   B. Wi-Max   C. Bluetooth   D. Infra-red

ii. Which of these uses extremely high frequency waves for short range communications?
A. Wi-Fi   B. Wi-Max   C. Bluetooth   D. Infra-red

iii. Which of these is used for communication between mobile phones, laptop computers and digital cameras?
A. Wi-Fi   B. Wi-Max   C. Bluetooth   D. Radio Signal

iv. Which of these is positioned from 160 to 2,000 Km above the earth surface?
A. Geostationary Earth Orbit   B. Medium Earth Orbit
C. Low Earth Orbit   D. GALILEO

v. Which orbit is located directly above the earth's equator?
A. Geostationary Earth Orbit   B. Medium Earth Orbit
C. Low Earth Orbit   D. GALILEO

vi. What is a fixed station in a cellular wireless network called that provides local coverage for mobile communication?
A. Base station   B. Satellite
C. Mobile Terminal   D. Global Positioning System

vii. What is used to create web pages?
A. HTML   B. HTTP   C. WAP   D. TCP

viii. What is HTTP?
A. Markup language   B. Protocol for mobile phones
C. Application layer protocol   D. Transport layer protocol

ix. Which of these provides wireless alternative to cable TV and DSL?
   A. Bluetooth   B. Infra-red
   C. Wi-Max   D. Wireless Access Point

x. In which earth orbit satellite is placed for navigation?
   A. Geostationary earth orbit   B. Medium earth orbit
   C. Low earth orbit   D. High earth orbit

Answers

i.	B	ii.	D	iii.	C	iv.	C	v.	A
vi.	A	vii.	A	viii.	C	ix.	C	x.	B

Q2. Give short answers of the following questions.

i. Define radio signal and transceiver.

Answer

Radio Signal

A radio signal or radio wave is an electromagnetic wave propagated by an antenna. Radio waves have different frequencies and tuning a radio receiver to a specific frequency you can pick up a specific radio signal.

Transceiver

A transceiver is a device, which can transmit and receive a radio signal and have a common circuitry in a single housing. In case of radio, the transmitter and the receiver are separated.

ii. What is Wireless Access Point?

Answer

Wireless Access Point

A Wireless Access Point (WAP) is a device that allows wireless devices to connect to a wired network using Wi-Fi. The access point connects to the wired network and then broadcasts signals wirelessly to all the other wireless devices such as laptop computers.

iii. What is meant by line of sight communication?

Answer

Line of Sight Communication

In Line of Sight (LOS) communication, the transmitter and receiver antennas are in line of sight. Line of sight communication is used in high frequency communication where the signals cannot pass through structures and hills. For long distance communication, transmitters are installed on high buildings, mountaintops or high towers. Relay stations (boosters) are used to amplify the signals and retransmit from station to station.

iv. Differentiate between short distance and long distance wireless communication.

Answer

Difference between short distance and long distance wireless communication:

Short Distance Wireless Communication	Long Distance Wireless Communication
Short distance wireless communication consists of very short distance of few meters to a distance of up to 50 Km. Wi-Fi, Wi-Max, Bluetooth and Infra-red are the types of short distance wireless communications.	Long distance wireless communication comprises of distance above 50 Km using either cellular communication or global positioning system.

v. What is base station?

Answer

Base station

Base station communicates with many mobile phones at the same time. It is equipped with a transceiver and antenna for transmitting and receiving signals from mobile phones. It is responsible for handling traffic and signaling between mobile phones.

vi. Define Global Positioning System (GPS)?

Answer

Global Positioning System

Global Positioning System (GPS) is a radio navigation system that allows people on land, in sea or in the air to determine their exact position, 24 hours a day anywhere in the world in all weather conditions.

vii. What is Wireless Markup Language?

Answer

Wireless Markup Language (WML)

Wireless Markup Language is based on HTML and XML and it delivers Internet contents to small wireless devices, such as browser-equipped mobile phones and other handheld devices. These devices have very small displays, slow CPUs, limited memory capacity, low bandwidth and restricted user-input capabilities. WML demands less memory and processing power from browsers than HTML. WML also includes features that support relatively small display sizes of today's wireless devices.

viii. What is Wireless Application Protocol?

Answer

Wireless Application Protocol (WAP)

WAP consists of multiple protocols that provide Internet access to mobile users of wireless phones and other wireless devices such as pagers and personal digital assistants (PDAs). Today, it has become the standard for providing data and voice services to wireless hand-held devices.

ix. What is web protocol stack?

Answer

Web Protocol Stack

Web Protocol Stack consists of TCP/IP and HTTP. Its purpose is to allow two computers to communicate with each other over the Internet. When a message is sent over Internet, it is translated from text form to electronic signals at the source computer and then translated back to text form at the destination computer. Every computer needs protocol stack to communicate over the Internet and it is usually built in the operating system such as Windows. The protocol stack used for the Internet is known as TCP/IP protocol stack.

x. What is HTTP?

Answer

HTTP

The Hypertext Transfer Protocol (HTTP) is an application protocol for distributed, collaborative, and hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web. Hypertext is structured text that uses logical links (hyperlinks) between nodes containing text.

Q3. Write long answers of the following questions.

i. Define wireless communication and mention its advantages and disadvantages.

Answer

Wireless Communication

Wireless communication is a term used to describe communications between two or more devices without any physical connection. The wide spread use of mobile telephone, various satellite services, and now the wireless Internet and wireless LANs are generating incredible changes in telecommunications and networking. Wireless communication refers to technology that transmits information over short or long distance without using connecting wires. It is alternative to using network cables. The demand for wireless communication is rapidly increasing today.

Advantages of Wireless Networks

1. Wireless networks can easily add users without having to change the physical connection.
2. Wireless networks provide robust security protections. Traffic of a wireless network can be filtered or simply blocked very easily.

3. Using wireless networks users are no longer tied to a specific location, as were with a wired connection. With a laptop computer or mobile device, access can be available at different locations.

4. In most of the wireless networks, users can connect automatically if they are within the range.

5. Setting up a wireless network can be much more cost effective than buying and installing cables. Because wireless networks eliminate or reduce wiring costs.

6. Adding new computers to a wireless network is very easy. We can easily expand wireless network with existing equipment, while a wired network might require additional wiring.

7. Wireless networks provide remote access to the company's key applications and resources help employees to get the job done while they are away from the company.

Disadvantages of Wireless Networks

1. The main disadvantage of the wireless network is security breach. Intruders (hackers) can tap into a wireless network relatively easier than a wired network.

2. Another disadvantage is about its coverage that somewhere users might face problems of range of signals.

3. Sometimes wireless networks speed can be slower than wired networks because of the low signals.

4. Because wireless networks use radio signals and similar techniques for transmission they are susceptible to interference from magnetic or electronic effects.

5. Wireless signal energy weakens rapidly as the signal passes through the environment consisting of trees, buildings, etc..

6. In wireless networks, bad weather also plays a role in weakening the signals.

ii. Describe the following short distance communications.

 ➢ Wi-Fi
 ➢ Wi-Max
 ➢ Bluetooth
 ➢ Infra-red

Answer

Wi-Fi

Wi-Fi (Wireless Fidelity) is a wireless communication system very commonly used at home and office. It is also called WLAN (Wireless LAN). It is a popular wireless networking technology, which uses radio waves to provide wireless high-speed Internet and network connections. Wireless networks are easy to setup and are inexpensive. In Wi-Fi, information travels over the air. These networks are extremely limited in range due to low power of transmissions allowing users to connect only within close proximity to a router or signal repeater. Wi-Fi is common in home networking applications, which provides portability without any need of cables. Wi-Fi networks need to be secured with passwords for security purposes in order not to be accessed by others.

Wi-Max

Wi-Max (Worldwide Interoperability for Microwave Access) is a wireless network that provides public network service to users. It is very similar to Wi-Fi but covers a big range of 40 to 50 Km. Wi-Max creates a Metropolitan Area Network (MAN) and provides a wireless alternative to Cable TV and DSL Internet connection. It provides service just about anywhere you go within a city. It transmits information through microwave and uses a more complex technology than Wi-Fi.

Bluetooth

Bluetooth is a short-range and low speed wireless communication technology. Its range is around 10 meters with the data transfer rate up to 723 Kbps and it consumes low power. It provides a way to connect and exchange information between devices such as mobile phones, laptop computers, PCs, printers, digital cameras, and video game consoles. Bluetooth can be used to replace cables between the PC and the linking devices such as printers, keyboards, mouse, etc..

Infra-red

Infra-red (IR) waves are extremely high frequency waves which are used for short range communication.

Applications of Infra-red Technology

Some common applications of Infra-red technology are listed below.

1. Car locking systems use Infra-red technology for automatic locking and unlocking the doors of cars.
2. Modern Computers have Infra-red enabled mouse, keyboards, and printers.
3. Home security systems have Infra-red enabled burglar alarm system.
4. Remote control system in TVs, Toys, etc. uses Infra-red technology.

iii. Describe cellular communication and mention its advantages and disadvantages.

Answer

Cellular Communication

Cellular communication refers to wireless communication systems that divide a geographical region into sections called cells. Each cell has a Base Station (BS) at the center bat contains a transceiver and controller that provides radio communication to mobile phones.

In cellular communication, each mobile phone uses a separate temporary radio frequency (channel) to talk to the Base Station (BS). The BS talks to many mobile users at the same time as shown in Fig.6.5.
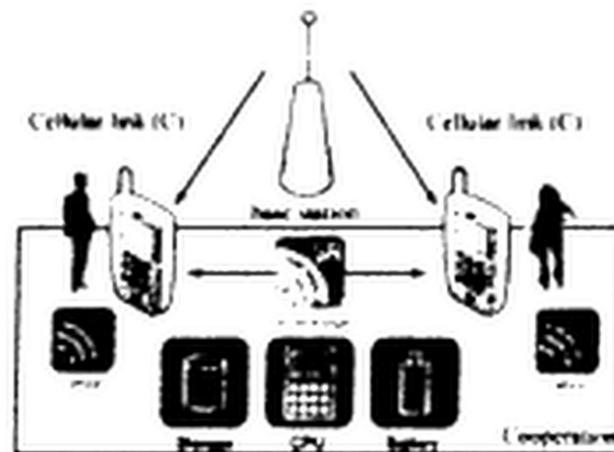

Fig 6.5 Cellular communication network

Channels use a pair of frequencies for communication. One frequency, the uplink is used for the mobile phone to communicate with the BS and another frequency for the downlink for BS to communicate with the mobile phone.

The basic concept of cellular communication is that it reuses the radio frequency by the cell that is at a distance where there is no interference of the other.

Advantages of cellular communication

1. Cellular communication makes communicating with family, friends and colleagues a lot easier.
2. Cellular communication is really useful in emergency situations.

Disadvantages of cellular communication

1. Privacy leak is a big disadvantage of cellular communication.
2. Reparability in cellular communication is really hampered because of the designs nowadays.
3. Potential loss of data if stolen.

iv. Describe GEO, MEO and LEO.

Answer

GEO (Geostationary Earth Orbit)

A Geostationary Earth Orbit (GEO) or Geostationary Orbit is an orbit directly above the earth's equator (at 0° latitude), with a period equal to the earth's rotational period. An object in a geostationary orbit appears to be fixed in the sky if observed from the earth. Communication satellites and weather satellites are generally placed in geostationary orbits, so that the satellite earth antennas (placed on earth) that communicate with them do not have to track them, but can be placed permanently at the fix position where they stay.

MEO (Medium Earth Orbit)

A Medium Earth Orbit (MEO) is located above low earth orbit (altitude of 2,000 kilo meters) and below geostationary earth orbit (altitude of 35,786 kilo meters). The satellites placed in this orbit are generally used for navigation, such as the Global Positioning System at an altitude of 20,200 km. For example, GLONASS (a Russian satellite-based navigation system) is at an altitude of 19,100 Km and GALILEO (a European Union (EU) satellite-based navigation system) is at an altitude of 23,222 Km from the earth

LEO (Low Earth Orbit)

A Low Earth Orbit (LEO), also known as low orbit, is generally defined from the earth's surface up to an altitude of 2,000 km. But the commonly used definition for LEO is from 160 km to 2,000 km above the earth surface. Less energy is required to place a satellite into a low earth orbit and it requires low power amplifiers for communication. Therefore, this orbit is used for many communication applications. Most of the satellites, like the International Space Station, the Space Shuttle, and the Hubble Space Telescope are all exist in Low Earth Orbit.

v. Explain how mobile communication is achieved?

Answer

Communication between mobile phones is achieved by connecting to a cellular network as shown in Fig 6.7.
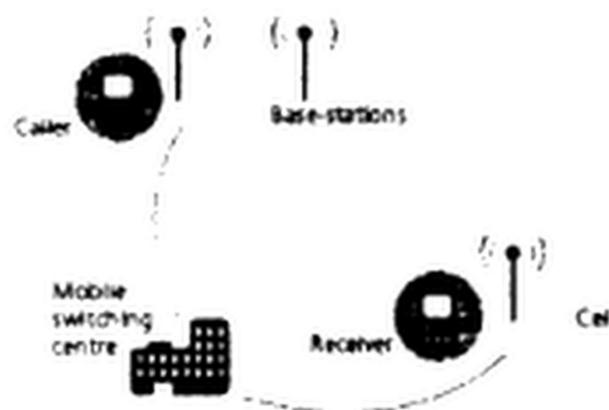

Fig.6.7 Mobile Phone Network

The following are the components required to achieve mobile communications:

➢ Mobile phone
➢ Base station
➢ Switching node
➢ Landline telephone network

1. Mobile phone

Mobile phone is a device that allows making and receiving calls over a cellular network. Modern mobile phones also support services such as text messaging, MMS, email and Internet.

2. Base station

Base station communicates with many mobile phones at the same time. It is equipped with a transceiver and antenna for transmitting and receiving signals from mobile phones. It is responsible for handling traffic and signaling between mobile phones.

3. Switching node

Switching node is a component of cellular network that carries out switching and mobility management functions for mobile phones on network of base station. Switching nodes are owned and deployed by mobile phone operators and allow-mobile phones to communicate with each other and telephone landline network.

4. Telephone Landline

Telephone Landline Network is a wired Public Switched Telephone Network (PSTN) that is connected with cellular network to provide communication between mobile phone and telephone on PSTN.

vi. What are the features and limitations of mobile communication?

Answer

Features of mobile communication systems

Following are the features and limitations of mobile communication system.

1. Mobile devices readily access information from the World Wide Web. The validity and accuracy of information cannot be guaranteed since anybody can easily upload any information on Web sites unlike books that undergo a process of scrutiny before publication.

2. Mobile Internet users' copy and paste information from Web sites without the permission of publisher and this is violations of property rights.

3. Daily use of mobile computing devices will eventually make people more dependent on them instead of relying on their own potentials.

Limitations of mobile communication systems

1. Without proper protection, hackers can install spyware on other's mobile devices for capturing credit card information, account login details and password, which can be very harmful.

2. Wireless mobile communication has the limitation of low processing capability, high error rate and low storage availability.

3. Handheld mobile devices have the limitations of small display, low memory, limited battery power and limited CPU power.

⊛—LAB ACTIVITIES

Following lab activities are to be carried out during the practical periods.

1) A Wireless Local Area Network (WLAN) should be created to demonstrate wireless communication.

Answer

Practical Work

2) Sharing of files/folders on WLAN should be demonstrated.

Answer

Practical Work

3) Use of Bluetooth for communication between a mobile and computer should be demonstrated.

Answer

Practical Work

4) GPS installed in a Car may be demonstrated to the students through video/animation.

Answer

Practical Work