SIXTH SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY-
MARCH, 2014

MOBILE COMPUTING

(Common for CT, CM & IF)

(Maximum Mark:100)   (Time: 3hr)

PART - A

I. Answer the following questions in one or two sentences .Each question carries two mark.

1. Name any four mobile and wireless devices.

   Mobile phone,Laptop,pager,PDA

2. Define the term 'device portability'.

A portable device is any device that can easily be carried. It is a small form factor of a
computing device that is designed to be held and used in the hands. Portable devices are
becoming an increasingly important part of personal computing as the capabilities of devices
like laptops, tablets and smartphones continue to improve.

3. Define the terms 'elevation angle' and 'foot print' with respect to satellite system.

   The **elevation angle** ε is defined as the angle between the

center of the satellite beam and the plane tangential to the earth's surface.

   footprint can be defined as the area on earth where the signals of the

satellite can be received.

4. What is a basic service set in IEEE 802.11?

The **basic service set** (**BSS**) provides the basic building-block of an 802.11 wireless LAN.
In infrastructure mode, a single access point (AP) together with all associated stations (STAs) is
called a BSS;[1]not to be confused with the coverage of an access point, known as the **basic
service area** (**BSA**).[2] The access point acts as a master to control the stations within that BSS;
the simplest BSS consists of one access point and one station.

**5. List any two advantages of CDMA 2000.**

- Increased Voice Capacity
- Higher Data Throughput

PART – B

II. Answer any five of the following. Each question carries 6 marks.

1. **Explain the near/far effect**.

The **near/far effect** is a severe problem of wireless networks using CDM. All signals should arrive at the receiver with more or less the same strength.Otherwise a person standing closer to somebody could always speak louder than a person further away. Even if the senders were separated by code, the closest one would simply drown out the others. Precise power control is needed to receive all senders with the same strength at a receiver. For example, the UMTS system presented in chapter 4 adapts power 1,500 times per second.
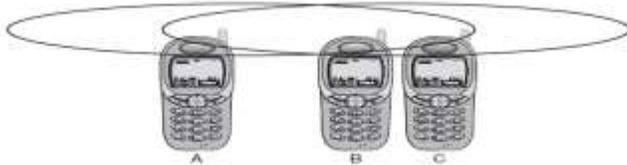
2. **Draw the GSM system architecture**.
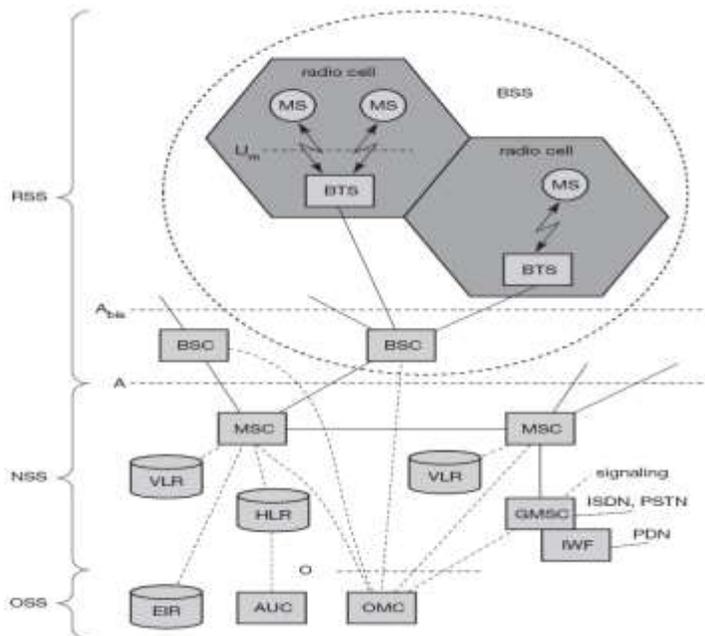
3. **Present the details of cyclical repetition of data.**

The cyclical repetition of data blocks sent via broadcast is often called a **broadcast disk** according to the project in Acharya (1995) or data carousel, e.g., according to the DAB/DVB standards (ETSI, 2002). Different patterns are possible

- The sender repeats the three data blocks A, B, and C in a cycle. Using a **flat disk**, all blocks are repeated one after another. Every block is transmitted for an equal amount of time,

the average waiting time for receiving a block is the same for A, B, and C.

- **Skewed disks** favor one or more data blocks by repeating them once or several times. This raises the probability of receiving a repeated block (here A) if the block was corrupted the first time. Finally, **multi-disks** distribute blocks that are repeated more often than others evenly over the cyclic pattern. This minimizes the delay if a user wants to access, e.g., block A.
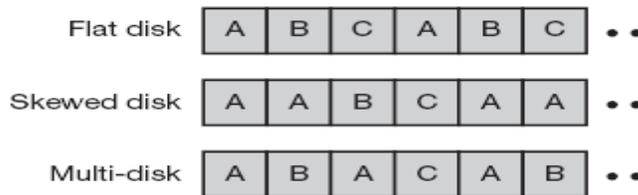
4. **Comment on the IEEE 802.11 standard.**
   - The IEEE 802.11 standard only covers the physical layer **PHY** and medium access layer **MAC** like the other 802.x LANs do. The physical layer is subdivided into the **physical layer convergenc protocol (PLCP)** and the **physical medium dependent** sublayer **PMD**). The basic tasks of the MAC layer comprise medium access, fragmentation of user data, and encryption.
   - The PLCP sublayer provides a carrier sense signal, called clear channel assessment (CCA), and provides a common PHY service access point (SAP) independent of the transmission technology. Finally, the PMD sublayer handles modulation

   and encoding/decoding of signals.
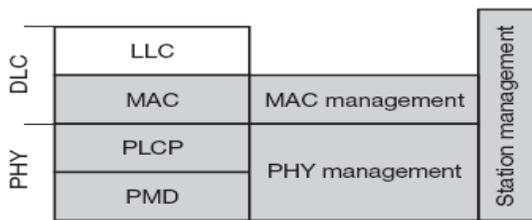
5. Explain the infra red technology.

Infra red technology uses diffuse light reflected at walls, furniture etc. or directed light if a line-of-sight (LOS) exists between sender and receiver. Senders can be simple light emitting diodes (LEDs) or laser diodes. Photodiodes act as receivers.

advantages :

- cheap senders and receivers which are integrated into nearly all mobile devices available today. PDAs, laptops, notebooks, mobile phones etc. have an infra red data association (IrDA) interface.

Disadvantages:

- low bandwidth compared to other LAN technologies. Typically, IrDA devices are internally connected to a serial port limiting transfer rates to 115 kbit/s. Even 4 Mbit/s is not a particularly

high data rate. However, their main disadvantage is that infra red is quite easily shielded.

6. Give the concept of WiMAX.

WiMAX (**Worldwide Interoperability for Microwave Access**) is a wireless communications standard designed to provide 30 to 40 megabit-per-second data rates,[1] with the 2011 update providing up to 1 Gbit/s[1] for fixed stations. The name "WiMAX" was created by the **WiMAX Forum**, which was formed in June 2001 to promote conformity and interoperability of the standard.

The bandwidth and range of WiMAX make it suitable for the following potential applications:

- Providing portable mobile broadband connectivity across cities and countries through a variety of devices.

- Providing a wireless alternative to cable and digital subscriber line (DSL) for "last mile" broadband access.

- Providing data, telecommunications (VoIP) and IPTV services (triple play).

- Providing a source of Internet connectivity as part of a business continuity plan.

- Smart grids and metering

7. Explain the idea of WLL.

Wireless means transmitting signals using radio waves as the medium instead of wires. Wireless technologies are used for tasks as simple as switching off the television or as complex as supplying the sales force with information from an automated enterprise application while in the field.

- **Mobility:** A wireless communications system allows users to access information beyond their desk and conduct business from anywhere without having a wire connectivity.

- **Reachability:** Wireless communications systems enable people to be better connected and reachable without any limitation of any location.

- **Simplicity:** Wireless communication system are easy and fast to deploy in comparison of cabled network. Initial setup cost could be a bit high but other advantages overcome that high cost.

- **Maintainability:** Being a wireless system, you do no need to spend too much to maintain a wireless network setup.

- **Roaming Services:** Using a wireless network system, you can provide service any where any time including train, buses, aeroplanes etc.

- **New Services:** Wireless communications systems provide new smart services like SMS and MMS.

PART – C

(Answer one full question from each unit, Each question carries 15 mark)

Unit -1

III. (a) Explain the concept of internet working. (7)

The **standard signaling system**

- **No. 7 (SS7)** is used for this purpose. SS7 covers all aspects of control signaling for digital networks (reliable routing and delivery of control messages,establishing and monitoring of calls). Features of SS7 are number portability, free phone/toll/collect/credit calls, call forwarding, three-way calling etc. An

MSC also performs all functions needed for supplementary services such as call forwarding, multi-party calls, reverse charging etc.

- **Home location register (HLR)**: The HLR is the most important database in a GSM system as it stores all user-relevant information. This comprises static information, such as the **mobile subscriber ISDN number (MSISDN)**, subscribed services

mobile subscriber ISDN number (MSISDN), subscribed services (e.g., call forwarding, roaming restrictions, GPRS), and the **international mobile subscriber identity (IMSI)**. Dynamic information is also needed, e.g., the current **location area (LA)** of the MS, the **mobile subscriber roaming number (MSRN)**

- **Visitor location register (VLR)**: The VLR associated to each MSC is a dynamic database which stores all important information needed for the MS users currently in the LA that is associated to the MSC (e.g., IMSI, MSISDN, HLR address). the **mobile subscriber roaming number (MSRN)**, the current VLR and MSC. As soon as an MS leaves its current LA, the information in the HLR is updated. This information is necessary to localize a user in the worldwide GSM network.

(b) List and explain any four location dependent services of mobile computing.   (8)

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.2 Using mobile computers, a follow-on service could offer, for instance, the same desktop environment wherever you are in the world.

● **Location aware services**: Imagine you wanted to print a document sitting in the lobby of a hotel using your laptop. If you drop the document over the printer icon, where would you expect the document to be printed? Certainly not by the printer in your office! However, without additional information about the capabilities of your environment, this might be the only thing you can do. For instance, there could be a service in the hotel announcing that a standard laser printer is available in the lobby or a color printer in a hotel meeting room etc.

● **Privacy**: The two service 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 services from reaching you and you do not want to be disturbed.

● **Information services**: While walking around in a city you could always use your wireless travel guide to 'pull' information from a service, e.g., 'Where is the nearest Mexican restaurant?' However, a service could also actively 'push' information on your travel guide, e.g., the Mexican restaurant just around the corner has a special taco offer.

<div align="center">

OR

</div>

IV. (a)Mention the advantages and disadvantages of cellular systems with small cells.   (7)

> **Advantages**:

● **Higher capacity**: Implementing SDM allows frequency reuse. If one transmitter is far away from another, i.e., outside the interference range, it can reuse the same frequencies. As most mobile phone systems assign frequencies to certain users (or certain hopping patterns), this frequency is blocked

for other users.

● **Less transmission power**: While power aspects are not a big problem for base stations, they are indeed problematic for mobile stations. A receiver far away from a base station would need much more transmit power than the current few Watts. But energy is a serious problem for mobile handheld devices.

● **Local interference only**: Having long distances between sender and receiver results in even more interference problems. With small cells, mobile stations and base stations only have to deal with 'local' interference.

● **Robustness**: Cellular systems are decentralized and so, more robust against the failure of single components. If one antenna fails, this only influences communication within a small area.

> **Disadvantages**:

● **Infrastructure needed**: Cellular systems need a complex infrastructure to connect all base stations. This includes many antennas, switches for call forwarding, location registers to find a mobile station etc, which makes the whole system quite expensive.

Handover needed: The mobile station has to perform a handover when changing from one cell to another. Depending on the cell size and the speed of movement, this can happen quite often.

● **Frequency planning**: To avoid interference between transmitters using the same frequencies, frequencies have to be distributed carefully. On the one hand, interference should be avoided, on the other, only a limited number of frequencies is available.
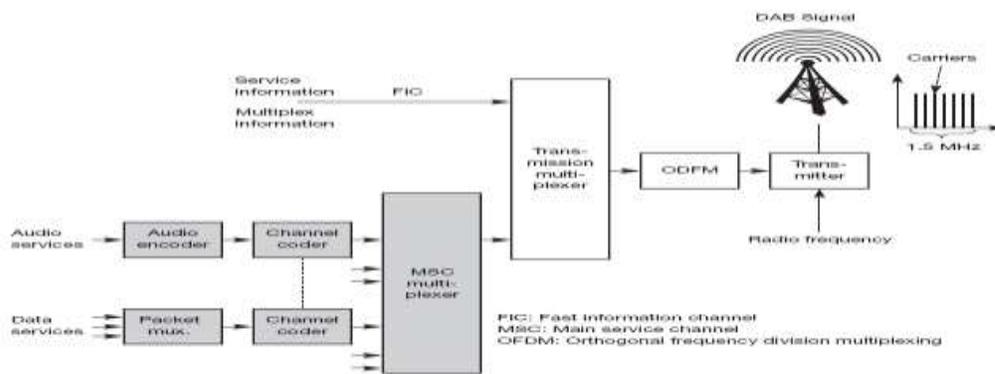
(b) Explain SDMA and FDMA. (8)

Space Division Multiple Access (SDMA) 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 (depending on the technology). Typically, SDMA is never used in isolation but always in combination with one or more other schemes. The basis for the SDMA algorithm is formed by cells and sectorized antennas which constitute the infrastructure implementing **space division multiplexing (SDM)**

Channels can be assigned to the same frequency at all times, i.e., pure FDMA, or change frequencies according to a certain pattern, i.e., FDMA combined with TDMA. The latter example is the common practice for many wireless systems to circumvent narrowband interference at certain frequencies, known as frequency hopping. Sender and receiver have to agree on a hopping pattern, otherwise the receiver could not tune to the right frequency. Hopping patterns are typically fixed, at least for a longer period.

Unit – II

V. (a) Draw a simplified overview of a DAB sender. (7)

FIC: Fast information channel
MSC: Main service channel
OFDM: Orthogonal frequency division multiplexing

(b) Explain the handovers of GSM. (8)

Intra-cell handover: Within a cell, narrow-band interference could make transmission at a certain frequency impossible. The BSC could then decide to change the carrier frequency (scenario 1).

● **Inter-cell, intra-BSC handover:** This is a typical handover scenario. The mobile station moves from one cell to another, but stays within the control of the same BSC. The BSC then performs a handover, assigns a new radio channel in the new cell and releases the old one (scenario 2).

● I**nter-BSC, intra-MSC handover:** As a BSC only controls a limited number of cells; GSM also has to perform handovers between cells controlled by different BSCs. This handover then has to be controlled by the MSC (scenario 3).
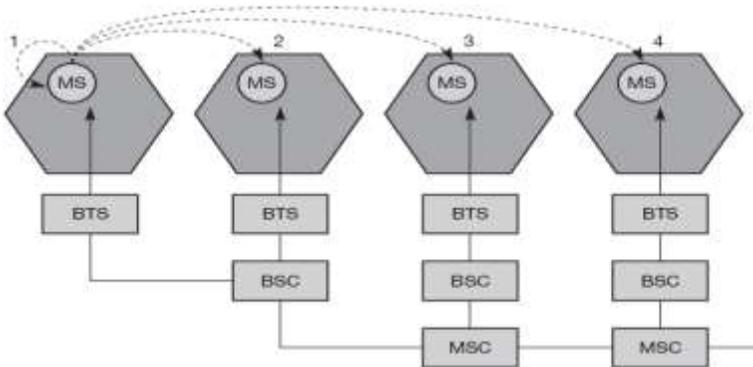
● **Inter MSC handover:** A handover could be required between two cells belonging to different MSCs. Now both MSCs perform the handover together

OR

VI. (a) Give the characteristics, advantages and disadvantages of GEO and LEO. (8)

GEO:

If a satellite should appear fixed in the sky, it requires a period of 24 hours. Using the equation for the distance between earth and satellite $r = (g \cdot R2/(2 \cdot \Box \cdot f)2)1/3$ and the period of 24 hours $f = 1/24h$, the resulting distance is 35,786 km. The orbit must have an inclination of 0 degrees.

● **Advantages:** Three GEO satellites are enough for a complete coverage of almost any spot on earth. Senders and receivers can use fixed antenna positions, no adjusting is needed. GEOs are ideal for TV and radio broadcasting. Lifetime expectations for GEOs are rather high, at about 15 years. GEOs typically do not need a handover due to the large footprint. GEOs do not exhibit any Doppler shift because the relative movement is zero.

● **Disadvantages:** Northern or southern regions of the earth have more problems receiving these satellites due to the low elevation above a latitude of 60°, i.e., larger antennas are needed in this case. Shading of the signals in cities due to high buildings and the low elevation further away from the equator limit transmission quality. The transmit power needed is relatively high (some 10 W) which causes problems for battery powered devices.

LEO:

As LEOs circulate on a lower orbit, it is obvious that they exhibit a much shorter period (the typical duration of LEO periods are 95 to 120 minutes). Additionally, LEO systems try to ensure a high elevation for every spot on earth to provide a high quality communication link.

Advantages: Using advanced compression schemes, transmission rates of about 2,400 bit/s can be enough for voice communication. LEOs even provide this bandwidth for mobile terminals with omni-directional antennas using low transmit power in the range of 1W.LEOs can provide a much higher elevation in polar regions and so better global coverage.

● **Disadvantages:** The biggest problem of the LEO concept is the need for many satellites if global coverage is to be reached. Several concepts involve 50–200 or even more satellites in orbit. The short time of visibility with a high elevation requires additional mechanisms for connection handover between different satellites.

(b) List and explain the component of radio subsystem in GSM system architecture. **(7)**
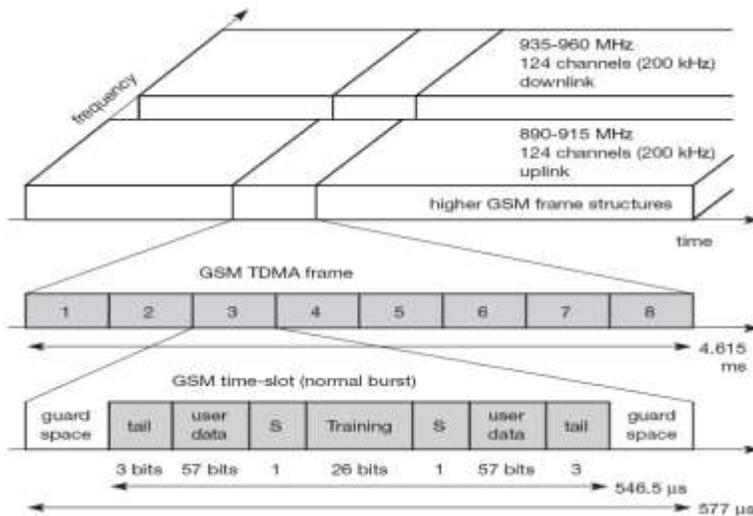
The first and last three bits of a normal burst (**tail**) are all set to 0 and can be used to enhance the receiver performance. The **training** sequence in the middle of a slot is used to adapt the parameters of the receiver to the current path propagation characteristics and to select the strongest signal in case of multi-path propagation. A flag **S** indicates whether the **data** field contains user or network control data.

> Apart from the normal burst, ETSI (1993a) defines four more bursts for data transmission: a **frequency correction** burst allows the MS to correct the local oscillator to avoid interference with neighboring channels, a **synchronization burst** with an extended training sequence synchronizes the MS with the BTS in time, an **access burst** is used for the initial connection setup between MS and BTS, and finally a **dummy burst** is used if no data is available for a slot.

Unit – III

VII. (a) Give the concept and application of Bluetooth technology. (8)

Bluetooth fulfills these criteria so the WPAN group cooperated with the Bluetooth consortium. IEEE founded its own group for WPANs, IEEE 802.15, A POS has been defined as a radius of 10 m around a person in which the person or devices of this person communicate with other devices

Connection of peripheral devices: Today, most devices are connected to a desktop computer via wires (e.g., keyboard, mouse, joystick, headset, speakers).

> This type of connection has several disadvantages: each device has its own type of cable, different plugs are needed, wires block office space. In a wireless network, no wires are needed

for data transmission. However, batteries now have to replace the power supply, as the wires not only transfer data but also supply the peripheral devices with power.

● **Support of ad-hoc networking:** Imagine several people coming together, discussing issues, exchanging data (schedules, sales figures etc.). For instance, students might join a lecture, with the teacher distributing data to their personal digital assistants (PDAs). Wireless networks can support this Type of interaction; small devices might not have WLAN adapters following the IEEE 802.11 standard, but cheaper Bluetooth chips built in.

(b) Present the networking concept of Bluetooth technology. (7)

A master Bluetooth device can communicate with a maximum of seven devices in a piconet (an ad-hoc computer network using Bluetooth technology), though not all devices reach this maximum. The devices can switch roles, by agreement, and the slave can become the master (for example, a headset initiating a connection to a phone will necessarily begin as master, as initiator of the connection; but may subsequently prefer to be slave).

The Bluetooth Core Specification provides for the connection of two or more piconets to form a scatternet, in which certain devices simultaneously play the master role in one piconet and the slave role in another.

At any given time, data can be transferred between the master and one other device (except for the little-used broadcast mode.) The master chooses which slave device to address; typically, it switches rapidly from one device to another in a round-robin fashion. Since it is the master that chooses which slave to address, whereas a slave is (in theory) supposed to listen in each receive slot, being a master is a lighter burden than being a slave. Being a master of seven slaves is possible; being a slave of more than one master is difficult. The specification is vague as to required behavior in scatternets.

Many USB Bluetooth adapters or "dongles" are available, some of which also include an IrDA adapter

Bluetooth is a standard wire-replacement communications protocol primarily designed for low-power consumption, with a short range based on low-costtransceiver microchips in each device. Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other, however a quasi optical wireless path must be viable. Range is power-class-dependent, but effective ranges vary in practice; see the table on the right.

VIII. (a) Explain infrastructure and ad-hoc networks in detail. (10)
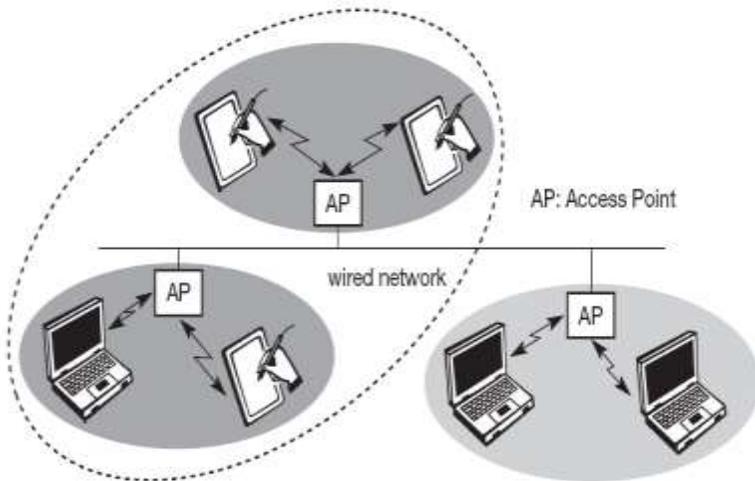
the design of infrastructure-based wireless networks is simpler because most of the network functionality lies within the access point, whereas the wireless clients can remain quite simple. This structure is reminiscent of switched Ethernet or other star-based networks, where a central element (e.g., a switch) controls network flow. This type of network can use different access schemes with or without collision. Collisions may occur if medium access of the wireless nodes and the access point is not coordinated. However, if only the access point controls medium access, no collisions are possible.
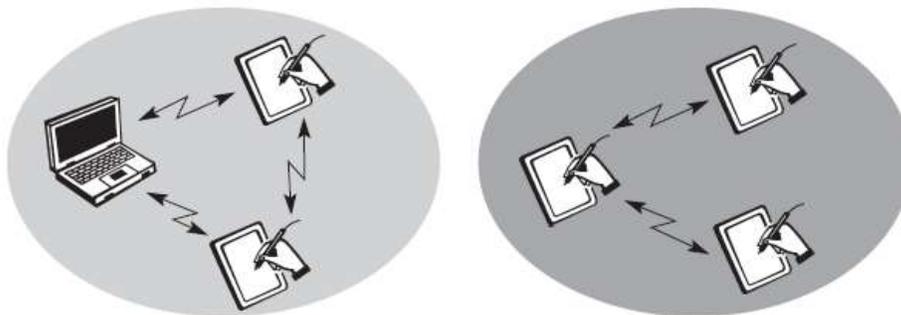
The two basic variants of wireless networks, infrastructure-based and ad-hoc, do not always come in their pure form. There are networks that rely on access points and infrastructure for basic services (e.g.,

authentication of access, control of medium access for data with associated quality of service, management functions), but that also allow for direct communication between the wireless nodes.

(b) List the advantages of WLAN. (5)

Advantages of WLAN:

- User mobility

- Voice and data services

- Scalable architecture

- Availability of all HiPath VoIP network services

- Access to central applications

- Handover between access points

- Robust model for industry

- Economical access points

- Plug-and-Play architecture

- Robust controller

- Security on the level of fixed networks

- "Small Enterprise" option with own controller

- "Branch Office" option for small branches where remote controller is used

Unit – IV

IX. (a) Present the concept of Wi-Fi. (8)

Wi-Fi, also spelled **Wifi** or **WiFi**, is a local area wireless technology that allows an electronic device to exchange data or connect to the internet using 2.4 GHzUHF and 5 GHz SHF radio waves. The name is a trademark name, and is a play on the audiophile term Hi-Fi. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards".[1] However, since most modern WLANs are based on these standards, the term "Wi-Fi" is used in general English as a synonym for "WLAN". Only Wi-Fi products

that complete Wi-Fi Alliance interoperability certification testing successfully may use the "Wi-Fi CERTIFIED" trademark

Many devices can use Wi-Fi, e.g., personal computers, video-game consoles, smartphones, digital cameras, tablet computers and digital audio players. These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can comprise an area as small as a single room with walls that block radio waves, or as large as many square kilometres achieved by using multiple overlapping access points.
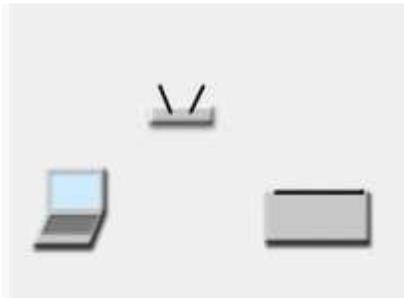
Depiction of a device sending information wirelessly to another device, both connected to the local network, in order to print a document.

Wi-Fi can be less secure than wired connections (such as Ethernet) because an intruder does not need a physical connection. Web pages that use SSL are secure but unencrypted internet access can easily be detected by intruders. Because of this, Wi-Fi has adopted various encryption technologies. The early encryption WEP proved easy to break. Higher quality protocols (WPA, WPA2) were added later. An optional feature added in 2007, called Wi-Fi Protected Setup (WPS), had a serious flaw that allowed an attacker to recover the router's password.[2] The Wi-Fi Alliance has since updated its test plan and certification program to ensure all newly certified devices resist attacks.

(b) Mention the advantages and disadvantages of WAP. (7)

Advantages of using WAP

The conditions of the mobile network are harsh. Hence, given these harsh conditions, it is essential to select an appropriate application environment and design the application for the mobile user and the challenges provided by the mobile network.

The mobile network in comparison provides resources of 9.6kbps for a user. The challenges for developing an application for the mobile environment are mainly these obvious differences between the Mobile network and the Wired environment.

Disadvantages of WAP

he main limitations of WAP today are related to the devices used and the mobile networks. The limiting factors of the device means that large amounts of data, especially graphics and animations are not recommended. Although, WAP supports images today only black and white images are possible. Colour Images and Animations will be supported in future releases of WAP.

OR

X. Explain Virtual Private Network in detail. (15)

VPN Defined
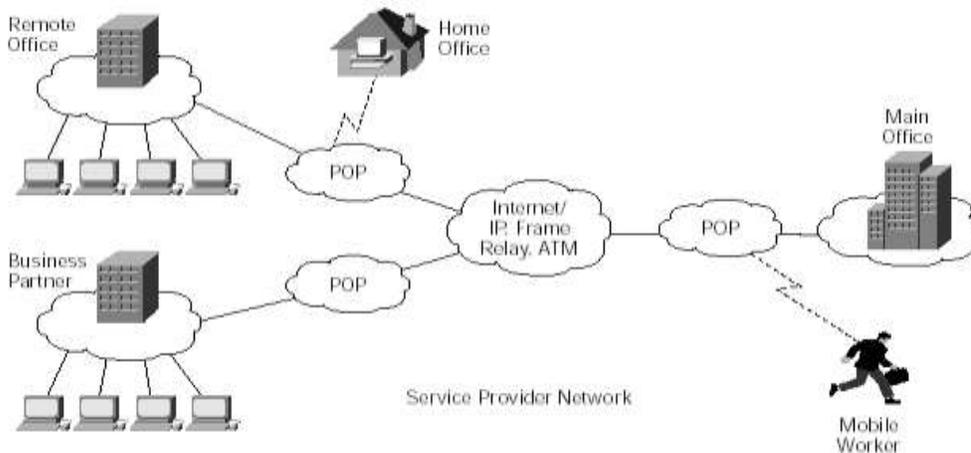
Four Categories:

- • Trusted VPN

- • Secure VPN

- • Hybrid VPN

- • Provider-provisioned VPN

● From the user's perspective, it appears as a network consisting of dedicated network links

These links appear as if they are reserved for the VPN clientele

Because of encryption, the network appears to be private

Must emulate a point-to-point link

- Done by encapsulating the data that would facilitate allow it to travel the Internet to reach the end point

Must emulate a private link

- Done by encrypting the data in the data packets

Tunnel

- The portion of the network where the data is encapsulated

Connection

- The portion of the network where the data is encrypted

- Provide users with secured remote access over the Internet to corporate resources

Connect two computer networks securely over the Internet

- Example: Connect a branch office network to the network in the head office

Secure part of a corporate network for security and confidentiality purpose