Biyani Institute of Science and Management
I Internal Examination Sept. 2019
Paper- Wireless Technologies (Set: A)
MCA V

Time: 1:30 hrs **MM: 20**

[I] Answer the following questions **(2*1=2)**

1. Describe Signals.

A digital **signal** is a **signal** that is constructed from a discrete set of waveforms of a physical quantity so as to represent a sequence of discrete values. A logic **signal** is a digital **signal** with only two possible values, and **describes** an arbitrary bit stream.

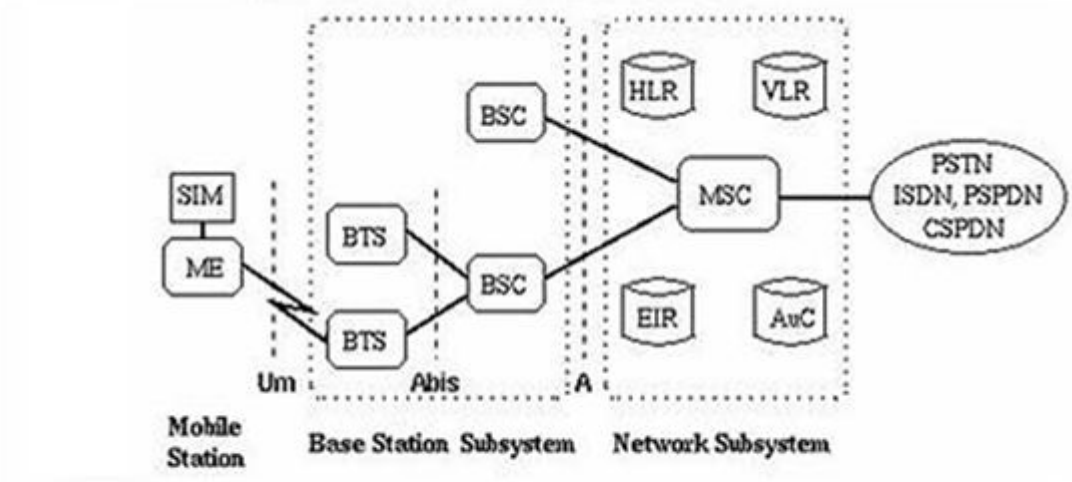
2. What is modulation?

Modulation is a process through which audio, video, image or text information is added to an electrical or optical carrier signal to be transmitted over a telecommunication or electronic medium. Modulation enables the transfer of information on an electrical signal to a receiving device that demodulates the signal to extract the blended information.

[II]-Write the short note on following. **(2*3=6)**

1. What is GSM. Explain with diagram.

The wireless link interface between the MS and the Base Transceiver Station (BTS), which is a part of BSS. Many BTSs are controlled by a Base Station Controller (BSC). BSC is connected to the Mobile Switching Center (MSC), which is a part of NSS.**Figure** shows the key functional elements in the **GSM**network architecture.



SIM Subscriber Identity Module
ME Mobile Equipment
BTS Base Transreceiver station
BSC Base Station Controller
HLR Home Location Register
VLR Vistor Location Register
MSC Mobile service switching center
EIR Equipment Identity Register
AuC Authentication Center

2. Explain radio interface?

The technology used for the **radio** transmission between mobile devices and the base station in a cellular network. It is the wireless counterpart of the physical layer 1 in the OSI model (see OSI model). Also called a "**radio interface**," the **air interface**defines the frequency, channel bandwidth and modulation scheme.

Characteristics

Currently, there are several types of networks in the world using the GSM standard, but at different frequencies.

- The GSM-900 is the most common in Europe and the rest of the world. Its extension is E-GSM.
- The DCS-1800 operates in the 1,800-MHz band and is used mainly in Europe, usually to cover urban areas. It was also introduced to avoid saturation problems with the GSM-900.
- The PCS-1900 is used primarily in North America.
- The GSM-850 is under development in America.
- The GSM-400 is intended for deployment in Scandinavian countries in the band previously used for the analog *Nordic Mobile Telephony* (NMT) system.

The system is based on *frequency-division duplex* (FDD), which means that the uplink (radio link from the mobile to the network-that is, mobile transmit, base receive), and downlink (from the network to the mobile-that is, base transmit, mobile receive) are transmitted on different frequency bands. For instance, in the 900-MHz E-GSM band, the block 880-915 MHz is used for transmission from mobiles to network, and the block 925-960 MHz is used for the transmission from network to mobiles. Table 1.1 gives a summary of uplink and downlink frequency bands for the different GSM systems.

[III]- Long answer question **(2*6=12)**

1. Compare SDMA, TDMA, FDMA and CDMA.

Approach	**SDMA**	**TDMA**	**FDMA**	**CDMA**
Idea	Segment spaced into cells or sectors.	Segments sending time into disjoint time slots demand driven or fixed patterns.	Segment the frequency band into disjoint subbands	Spread the spectrum using orthogonal codes.

Approach	SDMA	TDMA	FDMA	CDMA
Terminals	Only one terminal can be active in one cell or one sector.	All terminals are active for short periods of time on same frequency.	Every terminal has its own frequency uninterrupted	All terminals can be active at the same place at the same moment uninterrupted.
Signal separation	Cell structure, directed antennas	Synchronization in time domain	Filtering in the frequency domain.	Code plus special receivers.
Transmission scheme	Continuous	Discontinuous	Continuous	Continuous
Cell capacity	Depends on cell area	Limited	Limited	No absolute limit on channel capacity but it is an interference limited system
Advantages	Very simple, increases capacity per	Established fully digital, flexible	Simple, established, robust	Flexible, less frequency planning needed, soft handover
Disadvantages	Inflexible, antennas typically fixed	Guard space needed (multipath propagation), synchronization difficult	Inflexible, frequencies are scarce resource	Complex receivers, needs more complicated power control for senders

Approach	SDMA	TDMA	FDMA	CDMA
Comment	Only in combination with TDMA, FDMA or CDMA useful	Standards in fixed networks, together with FDMA or SDMA used in many mobile networks	Typically combined with TDMA and SDMA	Still faces some problems, higher complexity, lowered expectations, will be integrated with TDMA or FDMA

2. What is GPRS? Explain localization and Calling.

   General Packet Radio Service (**GPRS**) is a packet oriented mobile data standard on the 2G and 3G cellular communication network's global system for mobile communications (GSM). ... **GPRS** is integrated into GSM Release 97 and newer releases.

   he GPRS provides a set of GSM services for data transmission in packet mode within a PLMN. In packet-switched mode, no permanent connection is established between the mobile and the external network during data transfer. Instead, in circuit-switched mode, a connection is established during the transfer duration between the calling entity and the called entity. In packet-switched mode, data is transferred in data blocks, called packets. When the transmission of packets is needed, a channel is allocated, but it is released immediately after. This method increases the network capacity. Indeed, several users can share a given channel, since it is not allocated to a single user during an entire call period.

   One of the main purposes of GPRS is to facilitate the interconnection between a mobile and the other packet-switched networks, which opens the doors to the world of the Internet. With the introduction of packet mode, mobile telephony and Internet converge to become mobile Internet technology. This technology introduced in mobile phones allows users to have access to new value-added services, including:

   - *Client-server services,* which enable access to data stored in databases. The most famous example of this is access to the *World Wide Web* (WWW) through a browser.
   - Messaging services, intended for user-to-user communication between individual users via storage servers for message handling. *Multimedia Messaging Service* (MMS) is an example of a well-known messaging application.

- Real-time conversational services, which provide bidirectional communication in real-time. A number of Internet and multimedia applications require this scheme such as voice over IP and video conferencing.
- Tele-action services, which are characterized by short transactions and are required for services such as SMS, electronic monitoring, surveillance systems, and lottery transactions.

GPRS allows for radio resource optimization by using packet switching for data applications that may present the following transmission characteristics:

- Infrequent data transmission, as when the time between two transmissions exceeds the average transfer delay (e.g., messaging services);
- Frequent transmission of small data blocks, in processes of several transactions of less than 500 octets per minute (e.g., downloading of several HTML pages from a browsing application);
- Infrequent transmission of larger data blocks, in processes of several transactions per hour (e.g., access of information stored in database centers);
- Asymmetrical throughput between uplink and downlink, such as for data retrieval in a server where the uplink is used to send signaling commands and the downlink is used to receive data as a response of the request (e.g., WEB/WAP browser).

As the GPRS operator optimizes radio resources by sharing them between several users, he is able to propose more attractive fees for data transmission in GPRS mode than in circuit-switched mode. Indeed, the invoicing in circuit-switched mode takes into account the connection time between the calling user and the called user. Studies on data transmission show that data are exchanged from end to end during 20% of a circuit-switched connection time. For example, a user browses the WWW, downloads an HTML page identified by a *uniform resource locator* (URL), reads the content of the HTML page, then downloads a new HTML page to read. In this example no data is exchanged from end to end between the two HTML page downloads. For this type of application, a more appropriate invoicing would take into account the volume of data exchanged instead of the circuit-switched connection time. In packet mode, the GPRS user may be invoiced according to the requested service type, the volume of data exchanged.

GSM (Global System for mobile communication) provides many useful services in which, one of the most important is the automatic, worldwide localization of users. The service provider system always knows where a user currently is, and the same phone number is valid worldwide.

For localization of users, GSM performs periodic location updates even if a user does not use the mobile phones or some other devices but user should not be out of GSM network and is not completely switched off their devices.

GSM uses two types of databases:

Home Location Register (HLR)
Visitor Location Register (VLR)

The Home Location Register is a database from a mobile network in which information from all mobile subscribers is stored.

The VLR contains the exact location of all mobile subscribers currently present in the service area.

VLR is responsible for the MS (Mobile Station) to inform the HLR about location changes.

As soon as user moves from one location to another location, the HLR sends all user data needed to the new VLR (New Location). Changing of one VLR to another VLR and their uninterrupted services is called as Roaming.

Roaming can be taken place as follows:

- Within the network of one provider
- Between two providers in one country (National Roaming)
- Different providers in different countries (International Roaming)

To locate an MS and to address the MS, several numbers are needed:

- Mobile station international ISDN number (MSISDN)
- International mobile subscriber identity (IMSI)
- Temporary mobile subscriber identity (TMSI)
- Mobile station roaming number (MSRN)

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[I] Answer the following questions **(2*1=2)**

1. What is Telecommunication?

Telecommunications refers to the exchange of information by electronic and electrical means over a significant distance. A complete telecommunication arrangement is made up of two or more stations equipped with transmitter and receiver devices. A single co-arrangement of transmitters and receivers, called a transceiver, may also be used in many telecommunication stations.

2. What is logical channel?

Logical channels are a portion of a physical communications channel that is used to for a particular (logical) communications purpose. The physical channel may be divided in time, frequency or digital coding to provide for these logical channels. The GSM system has two key types of channels; traffic channels and control channels.

Channels can be shared by multiple users (common channels) or the can be used for one-to-one communication (dedicated channels)

[II]-Write the short note on following. **(2*3=6)**

1. What is an antenna?

An antenna is a transducer that converts radio frequency (RF) fields into alternating current or vice versa. There are both receiving and transmission antennas for sending or receiving radio transmissions. Antennas play an important role in the operation of all radio equipment. They are used in wireless local area networks, mobile telephony and satellite communication.

2. What is Satellite system?

In general, a satellite is anything that orbits something else, as, for example, the moon orbits the earth. In a communications context, a satellite is a specialized wireless receiver/transmitter that is launched by a rocket and placed in orbit around the earth. There are hundreds of satellites currently in operation. They are used for such diverse purposes as weather forecasting, television broadcast, amateur radio communications, Internet communications, and the Global Positioning System, (GPS).

[III]- Long answer question **(2*6=12)**

1. Write short note on:

(a) MAC

The Media Access Control Layer is one of two sublayers that make up the Data Link Layer of the OSI model. The MAC layer is responsible for moving data packets to and from one Network Interface Card (NIC) to another across a shared channel.

The MAC sublayer uses MAC protocols to ensure that signals sent from different stations across the same channel don't collide.

(b) ALOHA

ALOHA is a system for coordinating and arbitrating access to a shared communication Networks channel. It was developed in the 1970s by Norman Abramson and his colleagues at the University of Hawaii. The original system used for ground based radio broadcasting, but the system has been implemented in satellite communication systems.

A shared communication system like ALOHA requires a method of handling collisions that occur when two or more systems attempt to transmit on the channel at the same time. In the ALOHA system, a node transmits whenever data is available to send. If another node transmits at the same time, a collision occurs, and the frames that were transmitted are lost.

(c) Polling

Polling is the process where the computer or controlling device waits for an external device to check for its readiness or state, often with low-level hardware. For example, when a printer is connected via a parallel port, the computer waits until the printer has received the next character.

2. What is handover? Explain logical channel.

A handover is a process in telecommunications and mobile communications in which a connected cellular call or a data session is transferred from one cell site (base station) to another without disconnecting the session. Cellular services are based on mobility and handover, allowing the user to be moved from one cell site range to another or to be switched to the nearest cell site for better performance.

Handovers are a core element in planning and deploying cellular networks. It allows users to create data sessions or connect phone calls on the move. This process keeps the calls and data sessions connected even if a user moves from one cell site to another.

There are two types of handovers:

1. Hard Handover: An instantaneous handover in which the existing connection is terminated and the connection to the destination channel is made. It is also known as a break-before-make handover. The process is so instantaneous that the user does not hear any noticeable interruption.

2. Soft Handover: A substantial handover where the connection to the new channel is made before the connection from the source channel is disconnected. It is performed through the parallel use of source and destination channels over a period of time. Soft handovers allow parallel connection between three or more channels to provide better service. This type of handover is very effective in poor coverage areas.