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## Class Test - 02

Q1

- a) Write the difference between In-channel signaling and common channel signaling? — (4)
- b) What is PBX? Write briefly about its parts? — (4)
- c) How does signaling Techniques enable? Describe about subscriber, loop, interexchange signaling and inter exchange signaling? — (6)

Q2

- a) What is OSS and BSS Architecture? — (4)
- b) What is switching? Describe the importance of switching and some mathematical concepts about it? — (6)
- c) What is telecommunication? Write some of advantages that future holds? — (4)

03

a) Define briefly about the following topics? → (8)

i) AMPS      ii) FDMA      iii) Digital AMPS

iv) GSM      v) CDMA

b) Write about 3G and its advantages? → (6)

04

a) What is c/I ratio and Fading? Describe briefly? → (6)

b) What is path loss of a cellular system? → (4)

c) What is cellular pre-cellular systems? → (4)

05

a) Write about registration and its classification? → (5)

b) What is Root Roaming and tell briefly about MSC and cellular structure?

c) What is fading systems of a cellular system? → (4)

→ (5)

Q6

- a) How many basic topologies are used in the process of interconnecting exchange of telephone network? → (6)
- b) What is PSIN? Describe the major systems of any telecommunication network? → (4)
- c) What is subscriber loop systems? How it works → (4)

Q7

- a) What is transmission plan? write about it? → (6)
- b) Draw the echo echo as reflected signal and draw the diagram of attenuation as echo delay. → (6)
- c) Write down the basic three categories of transmission system? → (2)

Q8

- a) How a national number consist of? Describe it? → (4)
- b) What do you mean about the types of numbering? → (6)
- c) How many categories used to place Radio communication for long distance? → (4)

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### Ans to the ques! No:- 01 (a)

a) The difference between In-channel signaling and common channel signaling is as follows:-

In channel signaling	Common channel signaling
I) Trunks are held up during signaling.	I) Trunk are not required for signaling
II) Interference between voice and control signals may occur	II) No interference since the voice and control channel are separate
III) Separate signaling equipment required in each trunk hence expensive	III) Only one set of signaling equipment is required for a large group of trunk circuits hence economical
IV) Can be misused by customers since it is easy to mimic voice signaling.	IV) Control channel is inaccessible to users.
V) Signaling is relatively slow	V) Signaling is much faster.
VI) It is difficult to change signals or add new signals.	VI) There is flexibility to add new signals or change existing signal.

Ans: to the ques: No. 01 (b)

- b) PBX: PBX stands for Private Branch Exchange. Private Branch Exchange (PBX) is a telephone system within a local area that switches calls between those users on local lines while allowing all users to share a certain number of external phone lines. The main purpose of PBX is to save the cost of requirement for a line to each user to the central exchange office.

The parts of PBX is given below:-

- I) A telephone trunk that contains many phone lines, which are terminated at PBX.
- II) A computer that handles the incoming and outgoing calls of PBX along with switching between different calls within the local loop.
- III) The networks of lines within the PBX.
- IV) A human operator console, which is optional.

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Ans: to the ques: No:- 01 (c)

Signaling techniques enable the circuit to function as a whole by inter connecting all varieties of switching systems. There are three forms of signaling involved in a telecommunication network. These are:-

1) Subscriber loop signaling:-

The intra exchange signaling refers to the internal portion of a switching system that is heavily dependent upon the type and design of a switching system which varies depending upon the model.

II) Inter exchange signaling:-

The inter exchange signaling takes place between exchanges. This helps in the exchange of address digit, which passes from exchange to exchange on a link by link basis.

Ans: to the ques! No:- 02 (a)

a) OSS: OSS stands for operational support system. It is a term used by operators to manage their communications networks. Originally known as telecommunication Network Management tools, these solutions are now so much more sophisticated. They allow an organisation to coordinate customers, services, resources, processes and activities. They assist operators to design, build, operate and maintain communications networks.

BSS: BSS stands for Business Support System, BSS is the term traditionally used to describe the business or customer-facing functionality. These tools allow an organisation to connect with their customers, create offers for them, issue customers will bill as well as cross-carrier transaction.

Ans: to the ques: No:- 02 (b)

b) switching:- Switching is process to forward packets coming in from one to a port leading towards the destination. When data comes on a port it is called ingress, and when data goes out one port then it is called egress.

Importance of switching:-

- I) If there are no switching machine each phone would have to be directly connected to all others.
- II) It helps circuit form many essential work that is very useful for switch system.
- III) It helps carry information one place to another without any problem.

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Approximately 250 million phones

Fully connected:  $\frac{n(n-1)}{2} \approx \frac{250000000}{2} \approx 3 \times 10^{16}$  pairs

Average wire pair cross-section =  $\pi r^2 = \pi (2\text{mm})^2$   
 $= 12.5 \text{ mm}^2$   
 $\approx 12.5 \times 10^{-12} \text{ km}^2$

Assume average connection is 2000 km long

Therefore Volume of wiring =  $3 \times 10^{16}$  pairs  $\times$   
 $2000 \text{ km} \times 12.5 \times 10^{-12}$   
 $= 750 \text{ million km}^3$

$\therefore$  depth of wiring =  $\frac{750 \text{ million km}^3}{12.5 \text{ million km}} = 60 \text{ km}$

So ~~deep~~ deep is 60 km.

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Ans: to the ques: No: 02 (c)

Q) Telecommunication: "tele" Greek for distant  
And "Communication" - Italian for connection  
So telecommunication is distant connection  
or transfer of meaningful information  
from one location to another.

Some of advantages that future hold:-

- I) Expansion to the developing world:-
  - Opportunities to build "green fields" network design,
  - Short cut to the latest technology
  - Huge role for fixed wireless and satellite.
- II) Machine to machine communication:-
  - More machines than humans,
  - Can exchange data more quickly
  - Pervasive computing
  - Seamless human-machine interfaces, wearable computers,

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iii) "Convergence" of -

- Telephone, TV, musics, telemetry, monitoring, Internet.

iv) "Future Application" -

- Virtual reality, 3D holography, tele presence, Web agent, robots, weather prediction.

Advantages and disadvantages of multimedia

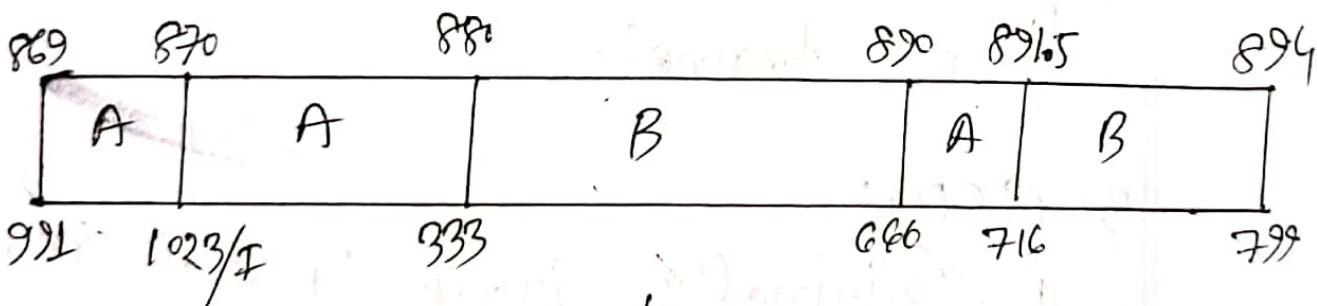
Advantages of multimedia

Ans! to the ques: No 03 (a)

i) AMPS: Advanced Mobile Phone System  
(First generation system)

- Still used in Alberta and across North America.
- Analog System (FM) developed in 1977, introduced in 1983

ii) FDMA: FDMA system as "pairs" of frequencies assigned. Each pair of frequencies is dedicated to a call in each cell.



- Block A: non-wireline companies
- Block B: wireline
- FDD: Uplink frequencies are the same but 95 MHz line for the same channel

## 2) Digital AMPS:-

- a) Digital system in AMPS bands.
- b) the first digit to arrive here.
- c) Intended to be backwards compatible with AMPS.
- d) FDD and same frequencies band as AMPS.
- e) In this manner, the MSC and many components of the BSC are the same.
- f) TDMA method - each frequency channel is divided into 3 time channels.

## 3) GSM:-

Originally, Group Special mobile until 1992. Then Global system for Mobile Communication.

- i) European digital standard, later brought to Canada by microcell and later Rogers.

- iii) In Europe, usually used in 800/900 MHz band.
- iv) TDMA system, that hopes from one frequency channel to the next to avoid being in a frequency selective fade for a long period of time.
- v) Digital (GMSK,  $\approx 3.69 \mu s$  symbol duration)

### ⑨ CDMA -

- i) A 2-2.5 generation standard
- ii) A mobile is assigned a channel code
- iii) Transmission occur at the same time and over the same frequency band.
- iv) Bandwidth of channel is  $1.25 \text{ MHz}$  in PCS band.
- v) Uses fast power control
- vi) FDD system on uplink.

Ans: to the ques: NO: 03 (b)

b)

### 3G mobile networks:-

- i) 3G technology allows for advanced technology, multimedia services and larger network capacity.
- ii) It helps a wider variety of cell phones to operate on the network.
- iii) It allows a wider spectrum which helps in faster data transmission.
- iv) The carriers can deliver 3G at a reduced cost compared to 2G.

### Advantages:-

- i) 3G technology allows location services such as the weather reports on the mobile.
- ii) It is cheaper for the providers.
- iii) The plans are more expensive due to the high cost of implementation of 3G Networks.

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- iv) 3G enables video calls, business conferencing between cities, states and even countries.
- v) The picture messaging allows this generation people to access music, pictures, and videos.
- vi) It helps people to access

Ans. -

Ans: to the ques: No:- 04 (a)

a)

### C/I ratio:-

i) The Carrier to Interference ratio, C/I, of the signal of the mobile from the transmitter in a given cell, can be found in an approximate manner by summation of interference from all base stations using the same frequency. Usually expressed in dB

$$\frac{C}{I} = \frac{R^{-n}}{\sum_{i=1}^m P_i^{-n}}$$

ii) If we assume all ~~base~~ base stations are identically spaced, and are at the centres of their cells, we have the C/I approximation of :

- m is the number of interference base in the first tier (this is always  $m=6$  for hexagonal cells with the standard patterns  $k=3, 4, 7, 12, 19, \dots$ )

$$\frac{C}{I} = \frac{(\sqrt{3}k)^n}{m}$$

## Fading:-

During transmission from the base station to the mobile, the received power fluctuates. We can generalize the factors that affect the received power level into 3 main groups.

- i) path loss (does not change in time)
  - Change only with distance from transmitter.
  - there are also losses associated with the frequency of transmission, size/height of transmit/receive antenna.
- ii) Long term fading or shadowing:
  - Caused by buildings or tunnels
  - 'Shadowing' transmission from BS changes with mobile position.
- iii) Short time fading:
  - due to multiples paths of transmission arriving at the mobile at the same time.

→ If there are other paths that arrives with same delay. It is called multipath fading.

Ans: to the ques: No: 04 (b)

### Path loss:-

→ Power radiates from the transmitter at antenna in a spherical manner.

→ The power at  $d$  metres away from the transmitter is given by in reference to the power  $P_0$  at same  $d$  metre away.

$$\frac{P_d}{P_0} = \frac{4\pi d_0}{4\pi d}, P_d = P_0 \left(\frac{d}{d_0}\right)^{-2}$$

→ In general and terrain characteristics can result in a different power law for the previous equation we generalize the power law by the coefficient  $\eta$ , where  $\eta$  usually ranges from 2 to 4.

$$P_d = P_0 \left(\frac{d}{d_0}\right)^{-n}, \text{ or } P_d \text{ dBm},$$

$$P_d (\text{dBm}) = P_0 (\text{dBm}) - 10n \log\left(\frac{d}{d_0}\right)$$

Ans: to the ques: No:- 04 (c)

### Wireless pre-cellular systems:-

- Wireless transmission was originally shown as a method to remain continuous contact with ships.
- In 1946, FM consumer mobile phone systems were introduced.
  - A group of frequency allocated to a large geographic zone.
  - When moving to a new zone, call had to be reinitiate
  - 120 kHz per channel due to poor filter technology.
  - Half-duplex system.
  - most users not connected to PSTN

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- Later progressed to GMTS

→ By the 1960's IMTS (Improved mobile Telephone System)

→ 30 kHz channels in the 450 MHz range

→ Only 12 channels in NYC in 1976  
poor service due to call blocking  
and usage over a few channels

→ Still in use in the US. in 1995

→ In 1973, AT&T developed the first mobile telephone system in the US.  
→ It was a two way radio system using a single frequency for both transmission and reception.  
→ It had a range of about 10 miles.  
→ It was used for emergency services.

Ans: to the ques: No:- 05 (a)

Registration: Registration is the process of notifying the network that a phone is active on the system.

- When a phone is switched on, it registers by signalling to the MSC via the base station on a step-up or control channel.
- Periodic registration is when the phone announce itself on a regular basis.
- Forced registration is when the phone monitors a control channel which provides information including the cell identification.
- If the channel strength fades below a threshold, the phone selects another channel.
- If the new channel has a new cell ID, then the phone registers

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Ans: to the ques: No:- 05 (b)

b) Roaming:- Roaming is when a phone is outside its home area or local region.

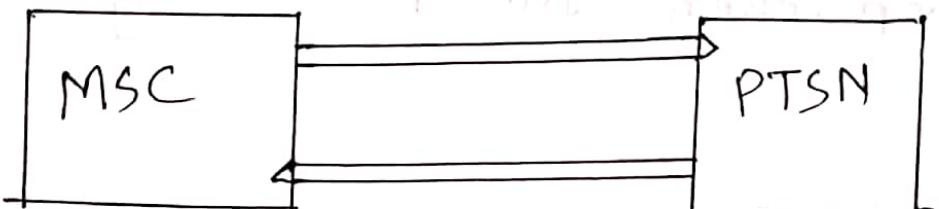
→ If the phone register outside its home area, the MSC contacts the phone's home area and confirms that the phone is OK.

→ MSC then notifies home area of the phone's current location and provider instructions for routing incoming calls to the phone.

Cellular structure:-

→ MSC - Mobile switching centre (also called MTSO - Mobile Telephone Switching Office)

→ PSTN - Public switched telephone Network



Ans: to the ques: No:- 05 (c)

c) Fading: During transmission from the base station to the mobile, the received power fluctuates, we can generalize the factors that affects the received power level into 3 main groups.

- I) Path loss (does not change in time)  
— Changes only with distance from transmitter  
— there are also losses associated with the frequency of transmission size/height of transmit/receive antenna etc.

- II) Long-term fading or shadowing:  
Caused by buildings or tunnels' shadowing transmission from BS.  
— Changes with mobile position (log-normal distribution)

(iii) Short-term fading (or small scale fading):

due to multiple paths of transmission (reflections) arriving at the mobile at the same time (flat-fading)

→ If there are other paths that arrive with some delay, it is called multi-path fading.

Ans: to the ques: No:- 06 (a)

In the process of interconnecting exchanges, there are three basic topologies, such as

i) Mesh Topology: Mesh Topology as the name implies is a fully connected network. The number of trunk groups in a mesh network is proportional to the square of the exchanges being interconnected. Hence, these mesh topologies are widely used in metropolitan areas where there is heavy traffic.

ii) Star topology: Star topology is connected in the shape of a star, which utilizes an intermediate exchange called a tandem exchange which all exchanges communicate. The star network is used when traffic levels are comparatively low. Many star networks can be used by interconnecting through additional exchange.

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Hierarchical: The Hierarchical topology is used to handle heavy traffic with minimal number of trunk groups. The traffic flows through the final route which is the highest level of hierarchy. If the traffic intensity between any pair of exchanges is high, direct trunk routes may be established between them as indicated by dashed lines.

Ans: to the ques: No:- 06 (b)

### Public Switched Telephone Network:

(PSTN) is understood as an aggregate of world's circuit switched telephone network used for providing public communication. The PSTN networks are called POTS (Plain Old Telephone system). These networks are operated regionally, locally, nationally and internationally using telephone lines, fiber

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optic cables, microwave transmission links or cellular communication.

The major system of any telecommunication network is given below:-

- I) Subscriber end instruments or equipments
- II) Subscriber loop system.
- III) Switching System.
- IV) Transmission Systems
- V) Signalling Systems.

Ans: to the ques! No:- 06 (c)

■ Subscriber loop system:-

In general telephone network every subscriber has two dedicated lines connecting to the nearest switching exchanges, which are called the loop lines of that subscriber. The laying of lines to

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the subscriber premises from the exchange office is called cabling. And it is difficult to run cables from each subscriber's premises to the exchange, large cables are used through which the loop wires are taken to distribution point.

The drop wires are connected to wire pairs distribution point, in the cables. Such distribution cables from nearby geographical area are connected to the main feeder cable.

The subscriber cable pairs from the exchange will also terminate at MDF through <sup>feeder</sup> main cables that carry large number of wire pairs. These subscriber pairs and exchange pairs are interconnected at the MDF using jumpers.

Ans: for the ques: No:- 07 (a)

### Transmission Plan:-

For reasons of transmission quality and efficiency of operation of signaling It is desirable to limit the number of circuits connected in tandem. In tandem chain, the apportionment of links between national and international circuit is necessary to ensure quality telecommunication.

CCITT lays down certain guidelines in this regard in its recommendation.

- i) The maximum number of circuits to be used in an international is call. 12.
- ii) No more than four transmission international circuits can be used in tandem between the originating and the terminating international switching centres.

Transmission loss budget should provide for two factors other than the line and switches losses:

- 1) keeping echo levels within limits
- 2) Control ringing

Ans: to the ques: No:- 07 (b)

The figure of echo as reflected signal and the Attenuation echo delay is given below:-

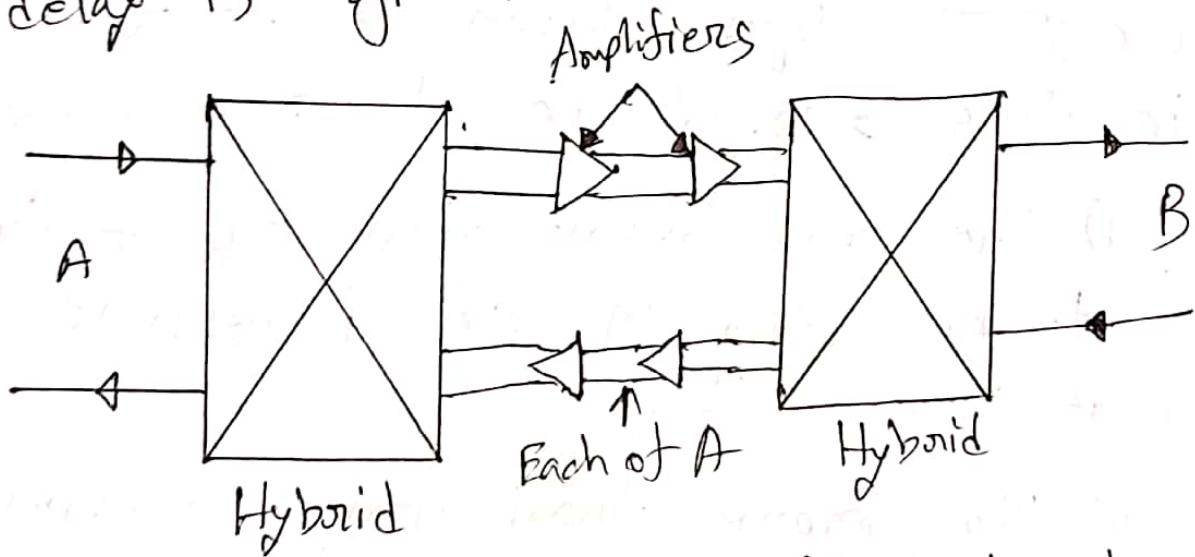


Fig: Echo as reflected signal

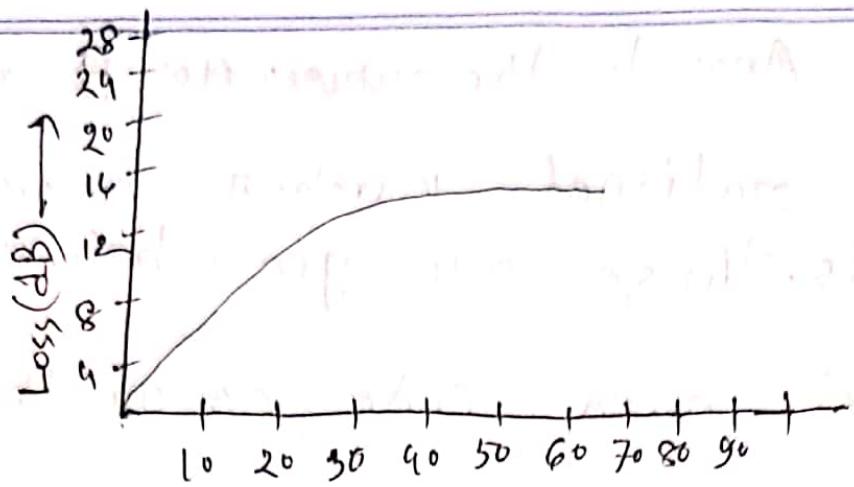


Fig:- Attenuation VS Echo delay

Ans: to the ques: No:- 07 (c)

There are three types of transmission system.

- i) Radio systems
- ii) Coaxial cable systems
- iii) Optical fiber systems

Ans: to the ques: No:- B (a)

a) A national number consist of three parts, these are given below:

i) Area code as on the trunk code:-

This code identifies a particular area or multi exchange area of the called subscriber. If is with this code, the routing for a trunk call is determined and changed for it.

ii) Exchange Code:

This code identifies a particular exchange within a numbering area. It determines the routing for increasing a trunk call from another numbering area or for a call originating from one exchange and described to another in the same numbering area.

### iii) Subscriber line Number:

It is used to select the called subscriber line at the terminating exchange. The combination of the exchange code and the subscriber line number is called the subscriber line number in CCITT terminology.

Ans: to the ques: No:- 08 (b)

### Types of numbering plan:-

The numbering plans are described briefly in below:-

- ① Open numbering plan:- This is also called the non-uniform numbering plan and it permits wide variation in the number of digits to be used to identify a subscriber within a multi-exchanges area or within a country.

ii) Semi-open numbering plan:- This plan permits number lengths to differ by almost one or two digits. The semi-open numbering plan is commonly used in countries such as India, Sweden, Belgium, Switzerland and UK.

iii) Closed Numbering plan:- This is also called Uniform Numbering plan where the number of digits in a subscriber number are fixed. This is used in a few countries such as France, Belgium, Canada, Hawaii and in a few parts of USA.

Ans: to the ques: No:- 08 (c)

Radio Communication is the modern long distance transmission systems. It deals with electronic radiation of electro magnetic energy from one point to another through the ~~atph.~~ atmosphere or free space. It is possible only in a certain portion of the electromagnetic frequency spectrum. This portion includes frequencies from 9 kHz to 4000 Hz while there are international allocation for the radio spectrum upto 2750 Hz, most of the commercial uses take place between 100 kHz and 200 Hz. different layers of the atmosphere play a role in propagating radio waves. The atmosphere consist of four layers.