MODEL TEST PAPER

SUBJECT CODE: 303

BRANCH: EL YEAR - III

2017 - 18

Ques. 1 Draw and explain the block diagram of digital communication system.

Ans. 1

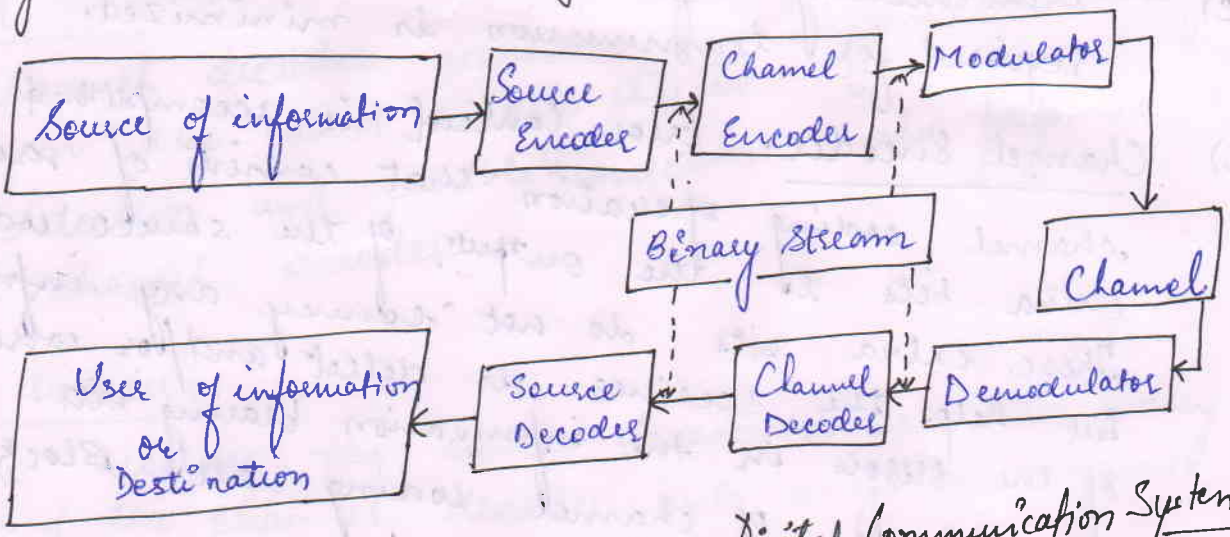


fig: 1 : Block diagram of a Digital Communication System

Fig. 1 shows the functional elements of a digital communication system

a) Source of information can be Analog information sources and digital information sources.

Analog information sources:→ microphone actuated by speech, T.V. camera scanning a scene, continuous amplitude signals.

Digital information sources :→ It can be the numerical o/p of computer which consists of a sequence of discrete symbols or letters.

An analog information is transformed into a discrete information through the process of sampling and quantization.

(b) Source Encoder: It converts the input i.e. symbol sequence into a binary sequence of 0's and 1's by assigning the codewords to the symbols in the input sequence. The important parameters of a source encoder are block size, code word length, average data and efficiency of the encoder. Aim of the source coding is to remove the redundancy in the transmitting information so that the bandwidth required for transmission is minimized.

(c) Channel Encoder: Error control is accomplished by the channel coding operation that consists of adding extra bits to the output of the source coder. These extra bits do not convey any information but helps the receiver to detect and/or correct some of the errors in the information bearing bits. 2 methods of channel coding are Block coding and convolution coding.

(d) Modulator:
The modulator converts the input binary stream into an electrical waveform suitable for transmission over the communication channel.

(e) Channel:
The channel provides the electrical connection between the source and the destination. The different channels are: pair of wires, coaxial cable, optical fibre, radio channel, satellite channel or combination of any of them.
The communication channels have only finite bandwidth the signal often suffers amplitude and phase distortion as it travels over the channel. The signal is corrupted by unwanted, unpredictable electrical signals referred to as Noise. Therefore, the important parameters of the channel are Signal to Noise power Ratio (SNR),

sable bandwidth, amplitude and phase response and the statistical properties of noise.

f) **Demodulator:**
The extraction of the message from the information bearing waveform produced by the modulation is accomplished by the demodulator. The output of the demodulator is bit stream.

g) **Channel Decoder:**
The channel decoder recovers the information bearing bits from the coded binary stream. Error detection and possible correction is also performed by the channel decoder.

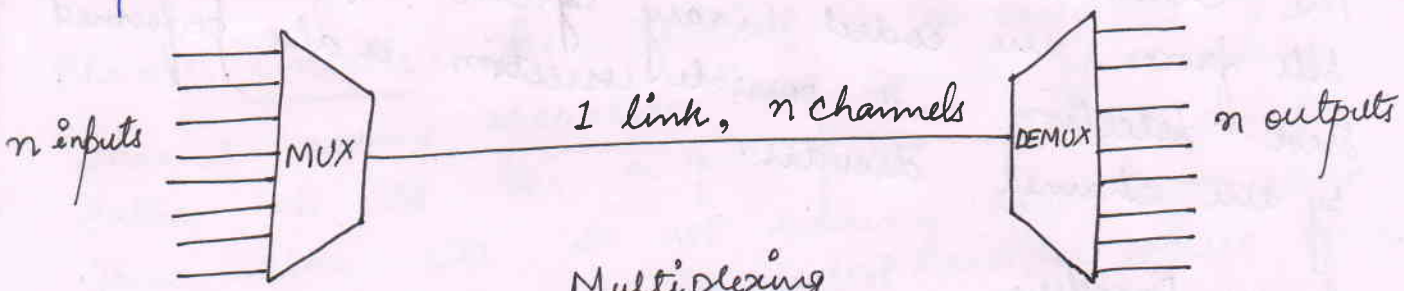
(h) **Source Decoder:**
At the receiver, the source decoder converts the binary output of the channel decoder into a symbol sequence

(i) **Destination:**
Finally, the decoded signal i.e. the message reaches the destination or the end point where it is to be used.

Ques.2 What is multiplexing? Write a short note on FDM and TDM.

Ans. 2 Multiplexing can be defined as technique that combines multiple analog or digital signals bound for transmission through a single communication line or computer channel.
This technique has been introduced to increase channel utilization in multicomputer communication systems and time sharing systems and to reduce the communication cost and make the most effective use of the scarce resource i.e bandwidth.

There are n inputs to a multiplexer. The multiplexer is connected by a single data link to a demultiplexer. The link is able to carry 'n' separate channels of data. The multiplexer combines (multiplexes) data from the 'n' input lines and transmits over a higher capacity data link. The demultiplexer accepts the multiplexed data stream, separates (demultiplexes) the data according to channel and delivers them to the appropriate output lines.



Multiplexing

Frequency Division Multiplexing (FDM):

This technique permits a fixed frequency band to every user in the complete channel bandwidth. Such a frequency slot is allotted continuously to that user. For eg. consider that the channel bandwidth is 1 MHz. Let there be 10 users, each requiring about 100 kHz bandwidth. Then the complete channel bandwidth of 1 MHz can be divided into 10 frequency bands ie. each of 100 kHz and every user can be alloted one independent frequency band. This techniques is known as FDM. This is mainly used for modulated signals. A number of signals can be carried simultaneously if each signal is modulated onto a different carrier frequency and the carrier frequencies are sufficiently separated so that the bandwidths of the signals do not overlap. Each signal requires a certain bandwidth centered around its carrier frequency referred to as a channel.

o prevent interference, the channels are separated by guded bands, which are unused portions of the spectrum. At the receiver, these frequency multiplexed signals can be separated by the use of tuned circuits (i.e. band pass filters) of their respective frequency band. And for every band, there are independent tuned circuits and demodul -ators.

Time Division Multiplexing (TDM):

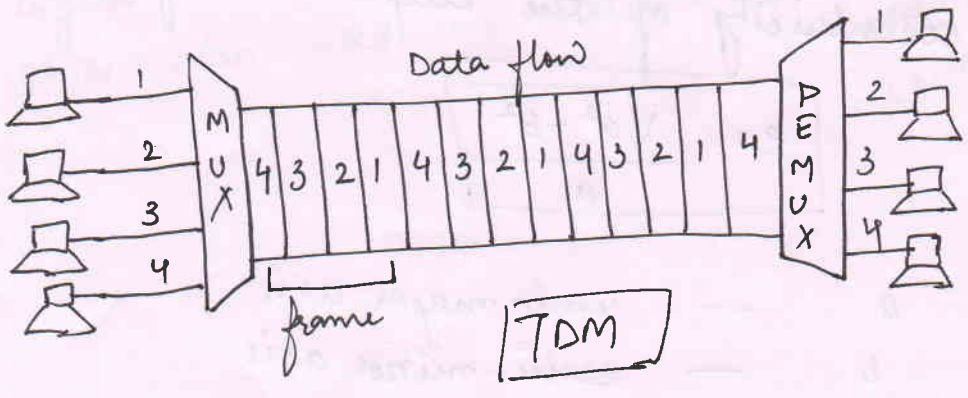
In TDM, the complete chamel bandwidth is allotted to one user for a fixed time slot. As an eg., if there are ten users, then every user can be given the time slot of one second. Thus, complete chamel can be used by each user for one second time in every 10 seconds. This technique is suitable for digital signals as digital signals are transmitted intermittently and the time spacing between two successive digital codewords can be utilized by other signals.

The sequence of time slots dedicated to a particular source is called a chamel. One cycle of time slots (one per source) is called a frame.

There are 2 major types of TDM:

(a) Synchronous TDM: the one in which the time slots are preassigned and fixed. Timing of transmission from various sources is synchronized

(b) Asynchronous TDM: It allows time on the medium to be allocated dynamically.



TDM

Ques. 3 Explain Kepler's first law.

OR

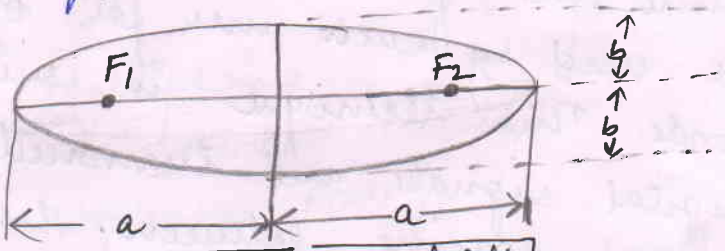
Explain the following Multiple Acess Techniques.

(a) FDMA

(b) TDMA.

Ans. 3 **Kepler's first Law:**

Kepler's first law states that the satellite follows an elliptical path in its orbit around the primary body. The ellipse has two focal points F_1 and F_2. as shown in figure below.



Satellite Elliptical Path

The centre of mass of the two-body system always lies on one of the foci and is refered as 'barycentre'.

When there is enormous difference between the masses of two bodies (as in case of earth and man-made satellites), the centre of mass always coincides with the centre of the earth. Thus the centre of the earth is either at F_1 or at F_2.

The eccentricity of the ellipse is defined as

$$e = \frac{\sqrt{a^2 - b^2}}{a}$$

where

a — semi-major axis

b — semi-minor axis

FDMA (Frequency Division Multiple Access)

FDMA divides the shared medium bandwidth into individual channels. Subcarriers modulated by the information to be transmitted occupy each subchannel. The best eg. of this is the cable television system. The medium is a single coax cable that is used to broadcast hundreds of channels of video/audio programming to homes. The coax cable has a useful bandwidth from about 4 MHz to 1 GHz. This bandwidth is divided into 6-MHz wide channels. With digital techniques multiple TV channels may share a single band due to compression and multiplexing techniques used in each channel. The major disadvantage of FDMA is its susceptibility to station cross-talk and intercarrier interference from nearby carriers.

TDMA (Time Division Multiple Access)

TDMA is a channel access method for shared medium networks. It allows the several users to share the same frequency channel by dividing the signal into different time slots. The users transmit in rapid succession each using its own time slot. This allows multiple stations to share the same transmission medium. TDMA is used in the digital 2G cellular systems such as GSM (Global System for Mobile Communications), Digital Enhanced Cordless Telecommunications (DECT) etc. It is also used in satellite systems.

Charulika Saraswat