CS3001 - DATA COMMUNICATIONS

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Q1. Answer the following briefly

(a) Differentiate between Data and Signal.

	Data	**Signal**
1	Data is the information we want to transmit.	Signal is the waveform format used to send data over channel.
2	Acts as payload of carrier	Acts as carrier which carries data or payload.
3	Bit rate in bps or Kbps or Mbps or Gbps	Signal rate or baud rate in Baud, KBaud or Mbaud
4	Higher the bit rate, higher is the speed	lower the signal rate, lower is the bandwidth

(b) Define: Channel Capacity, Quantization, Bandwidth & Stair Case Signal?

(i) **Channel Capacity -** The channel capacity, C, is defined to be the maximum rate at which information can be transmitted through a channel.

(ii) **Quantization -** A process in which the continuous range of values of an analog signal is sampled and divided into non-overlapping (but not necessarily equal) subranges and a discrete, unique value is assigned to each subrange.

(iii) **Bandwidth -** Network bandwidth is a measurement indicating the maximum capacity of a wired or wireless communications link to transmit data over a network connection in a given amount of time

(iv) **Stair Case Signal** - a waveform that consists of a series of discrete steps resembling a staircase.

(c) Write the full forms of PCM, DM, ADM, ASK, BFSK, BPSK, OPSK, QAM, SAR

(i) PCM - Pulse Code Modulation
(ii) DM - Direct Message
(iii) ADM - Add/Drop multiplexing
(iv) ASK - Amplitude Shift Keying
(v) BFSK - Binary Frequency Shift Keying
(vi) BPSK - Binary Phase Shift Keying
(vii) QPSK - Quadrature Phase Shift Keying
(viii) QAM - Quadrature Amplitude Modulation
(ix) SAR - Specific Absorption Rate

(d) Under what condition, the wired communication is preferred over wireless? Justify.

Users can move around freely within the area of the network. Not having to lay lots of cables and put them through walls etc. can be a considerable advantage in terms of time and expense.

When configured properly wired networks provide reliability and stability. Once the hubs, switches and Ethernet cables are installed, the end result is system that is extremely reliable Another reason wired networks are reliable is because the signal is not influenced by other connections. For example, if you have wireless networks that are close to one another, one signal could interfere with another which can compromise stability.

(e) Write the difference between Twisted Pair Cable and Optical Fibre.

	Twisted Pair Cable	**Optical Fibre**
1	the transmission of signals takes place through the metallic conducting wire	the transmission of signals happens via glass fibre
2	Twisted pair cable has a large diameter	Optical fibre cable has a small diameter as it is thin and flexible.
3	attenuation is very large	attenuation is very small

(f) Differentiate between granular noise and slope overhead distortion.

Granular noise	**Slope overload distortion**
Granular noise exists because the decoded output signal can assume only a specified number of levels in the range of interest.	Slope overload noise occurs when the slope of the input signal is greater than the delta modulator is capable of reproducing.

(g) What are the components in a data communication system?

Message, Sender, Receiver, Protocol, Transmission Medium

(h) What are the advantages of Delta Modulation (DM) over PCM? Give example application for DM & PCM.

Advantages of DM over PCM:

1. The signaling rate and transmission channel bandwidth is quite small for delta modulation compared to PCM.

2. The transmitter and receiver implementation is very much simple for delta modulation.

PCM is mostly used in video telephony and audio telephony.

DM is mostly used in speeches as well as images.

(i) What happens when interference occurs at the receiver?

Interference at receiver may prevent reception altogether or may cause only a temporary loss of a signal.

(j) Write at least one merit and one demerits of Successive Approximation Method of A to D conversion over PCM.

Merit: It is economical method of analog to digital conversion.

Demerit: Incorrect reading is obtained when the noise signal is occurred.

Q2. Select the correct answer with justification:

(i) Which type of data transfer allows simultaneous transfer of data: **(a) Serial**

(ii) Serial transmission can be? (**c) Both (a) & (b)**

(iii) Which type of communication needs n channels if n bits are to be transferred? **Parallel Data Transmission Mode**

(iv) Which type of transmission needs Start, Stop and Gap between Start & Stop Bits **Asynchronous Mode**

(v) Specify the type of data transmission between Keyboard and Computer. **Simplex Data Transmission Mode**

(vi)Serial transmission without start bit, stop bit and gap between start and stop bits is known as - **Synchronous Mode.**

(vii) How many characters are sent using parallel transmission capable of transmitting 80 Kbps in each line? **80,000**

(viii) In synchronous serial transmission, if we send 80 Kbps, we send **(a) 10000** characters per sec.

(ix) State TRUE or FALSE. “All secured communication systems are reliable”. Justify.

True. We prefer reliable transmission of information. Theoretically secure communication over adversarial multi-path networks.

(x) If the ASCII “m” character is received as “n”, this is called (**b) A burst Error**

Q3. Answer the following.

(i) A digital Signal has 200 bps data rate, what is the duration of bit interval?

Bit interval = 1/200 = 5 ms

(ii) What is the impact on sampling at receiver for varying bit interval?

When bit interval varies , data transfer rate varies, If the sampling rate of the receiver becomes less than bit rate at any point in time (bandwidth of receiver decreases) data loss will occur.

(iii) An Amplitude of a signal can be measured in Volts, Amps, Watts and Angles. Sate whether TRUE or False.

False

Amplitude unit depends on type of wave

(iv) If the maximum amplitude of a signal is 10 Volts, What is the minimum amplitude value?

-10 Volt

(v) The **c. Period** of a signal is expressed in seconds.

(vi) Express 10 nano seconds in terms of second, microsecond and picosecond.

10^-9 sec, 10^-3 us, 10^3ps

(vii) What is the equivalent of 20 MHz in terms of Hz, KHZ and GHz?

20 x 10^6 Hz, 20 x 10^3 KHz, 20 x10^-3 GHz

(viii) What is the bandwidth value when a sine signal is decomposed into two signals of frequency 10 and 90 respectively?

Bandwidth = 90-10=80 Hz

(ix) A signal is decomposed into three sine waves with frequencies of 10, 20 and 30 Hz respectively. What is the bandwidth in Hz?

Bandwidth = 30-10=20 Hz

(x) The bandwidth of a signal is 10 KHz. The frequency of the sine wave with highest frequency is 11Khz. What is the frequency in Hz with lowest frequency?
10=11-x , So x = 1 KHz

Q4. Write the similarities & differences between the followings:

(i) Bit interval, Bit rate, Baud and Frequency.

Similarity – These all terms are used to measure the speed of data transmission

Difference – All of them follow various conventions to measure the speed like baud carries 5-bit teletype code, bit rate = no. Of bits transmitted per second, etc.

(ii) Infrared, Radio wave, Microwave and Satellite Communication.

Similarity – These all are various kind of waves used in satellite communication

Difference – The Wavelength and Frequency of these waves are different

Wavelength – Radio > Micro > Infrared

Frequency – Radio < Micro < Infrared

(iii) Synchronous, Asynchronous, Serial and Parallel Communication.

Similarity – Classification of communication based on synchronization between devices.

Difference – Start and stop bits are used in Asynchronous Communication but not in Synchronous Communication.

(iv) Simplex, Half Duplex, and Full Duplex Communications.

Similarity – These are classification of the type of communication based on the direction of data transmission.

Difference – Simplex: Unidirectional

Half Duplex: Bidirectional but not simultaneous

Full Duplex: Bidirectional and simultaneous

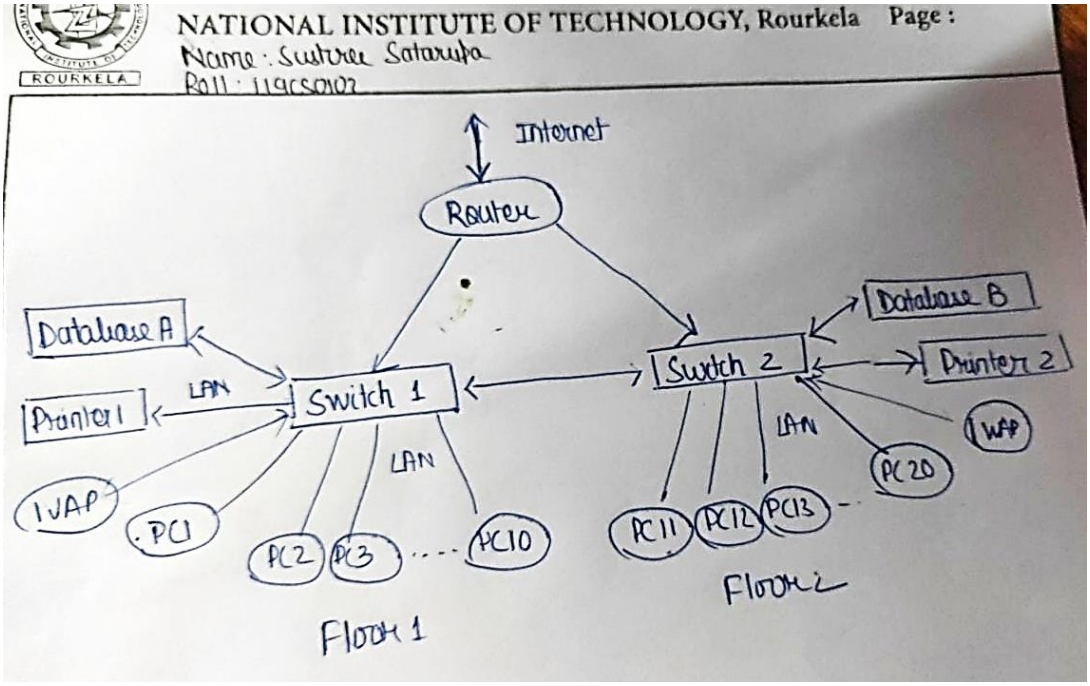
(v) Twisted Pair Cable, Coaxial and Optical Fibre Channels.

Similarity – These all are the type of cables used in data transmission.

Difference – The data transmission speed(Bit Rate) is different because they all use different encoding techniques.

Q5. Consider a Computer Network of 20 Computers to be used in a building where 2o users have to share Printers and Data base. Answer the following with proper justification.

(i) Draw the architecture and topology of the Network with a neat diagram?



(ii) Specify the type of data transmission, transmission medium, protocol and standard to be adopted?

All workstations(desktop PC) are connected to a switch forming LAN(Local Area network) using 1G Ethernet (IEE 802.3 standards, a serial communication method, medium of transmission is twisted pair cables CAT6)

2 wireless access points provide wifi coverage (IEE 802.11 standards, a serial communication method, medium of transmission is air)

(iii) Specify the various constraints and limitations while installing?

Initial cost high, router is only single point of failure in this configuration

(iv) Which techniques are to be adopted for reliable and secured data transmission?

File Transfer Protocol (FTP) and Secure File Transfer Protocol (SFTP)

Secure HyperText Transfer Protocol

(v) What type noises may be encountered? Which type of modulation is suitable?

(vi) How the tradeoff between cost overhead and performance can be balanced?

For better performance we split the load into two switch and here router is only single point of failure but solving that will become costly.

(vii) Draw a flow chart showing the detailed process of installation specifying the required hardware and softwares.

(viii) What is the major factor to address scalability?

If you anticipate your company and network expanding, or if you'd like it to be able to, it'll save you time and hassle down the line to use an easily modifiable network topology.

(ix) How Collision free and Fault Tolerant measures are to be undertaken?

Multiple switch all interconnected and splitting database into two parts and putting RAID4 configuration on storage ensures there is no single point of failure and load is split between two switches.

(x) Specify a scheme for active users to access a common shared channel for all 20 computers.