MID SEMESTER EXAMINATION

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Prepared by:

Name		Roll Number
ARPIT JAIN	:	03CS3009
MAYANK JAIN	:	03CS3010

Ans 1(a)

- Application Layer
- Presentation Layer
- Session Layer
- Transport Layer
- Network Layer
- Datalink Layer
- Physical Layer

Ans 1(b) *Bandwidth* is the difference between the lowest and highest frequency components of a signal or device.

Ans 1(c) *Spectrum* of a signal is the range of frequencies that it contains.

Ans 1(d) *Attenuation* is the process of weakening or reducing the amplitude of a signal.

Ans 1(e) Coaxial cable, Twisted cable, Optical Fibre.

Ans 1(f) It is the propagation of signal where transmitting and receiving antennas must be within and effective line of sight of each other.

Ans 1(g) If data are to be exchanged in both directions over a period of time, the two parties must co-operate. For example, for two parties to engage in a telephone conversation, one party must dial the number of the other, causing signals to be generated that result in the ringing of the called phone. The called party completes a connection by lifting the receiver. For data processing devices several other things must be decided on, like whether both devices may transmit simultaneously, the amount of data to be send at one time and format of the data.

Ans 1(h)
SNR = Signal to Noise Ratio = Signal/Noise.
It is the ratio of power in a signal to the power contained in the noise that is present at a particular point in the transmission.

Ans 1(i)
Simplex: Data can be transmitted only on one side at a time. *Half-Duplex*: Data can be transmitted in both sides, but only in one direction at a time. *Full-Duplex*: Data can be transmitted in both sides simultaneously.

Ans 1(j) *Frequency-Hopping Spread Spectrum* is a form of spread spectrum in which the signal is broadcast over a seemingly random series of radio-frequencies, hopping from frequency to frequency at fixed intervals.

Ans2(a)
$\cos(100t) + 0.1\cos(5t)\cos(100t) = \sin(\pi/2 + 100t) + 0.05[\sin(\pi/2 + 105t) + \sin(\pi/2 + 95t)]$
$\sin(\pi/2 + 100t)$: amplitude = 1; frequency = $100/(2*\pi)$; phase = $\pi/2$;
$0.05\sin(\pi/2 + 95t)$: amplitude = 0.05; frequency = $95/(2*\pi)$; phase = $\pi/2$;
$0.05\sin(\pi/2 + 105t)$: amplitude = 0.05; frequency = $105/(2*\pi)$; phase = $\pi/2$;

Ans2(b)
Decibel-Watt: Power(in dBW) = $10\log_{10}$(power(in W)/1W)
Output in dBW = $10\log_{10}20$ = 13.01dBW

Ans2(c) *Channel Capacity*: The maximum rate at which a data can be transmitted over a given communication path or channel under given conditions. Four key factors affecting channel capacity are :

- Data Rate
- Bandwidth
- Error Rate
- Noise

Ans2(d)
Nyquist bandwidth: C = $2B\log_2 M$
Where
C = Channel capacity in bits/s.
B = Bandwidth
M = No. of Signal levels.

Shannon's Capacity Formula:
SNR = S/N
Where
SNR = Sound to Noise Ratio
S = Signal Power
N = Noise

Relation between two is :
C = $B\log_2(1+ SNR)$

Given:
Bandwidth = 1 Hz.
SNR = 24 dB
Solution:
SNR_{dB} = 24dB = 10log(SNR)
SNR = 251
$2B\log_2 M = B\log_2(1 + SNR)$
M = 2^4 = 16 ... *Ans.*

Ans2(e)
Source: This device generates the data to be transmitted.
Transmitter: This device transforms and encodes the information in such a way as to produce electromagnetic signals that can be transmitted across some sort of transmission system.
Transmission System: This can be a single transmission line or a complex network connecting source and destination.
Receiver: The receiver accepts the signal from the transmission system and converts it into a form that can be handled by the destination device.
Destination: Takes the incoming data from the receiver.
Note: Figure on Page 7 (figure 1)

Ans3(a)
Advantages of Digital Transmission :

- LSI/VLSI improved mostly in digital direction.
- Data Integrity (Repeaters)
- Capacity Utilization

- Security (data encoding)
- Integration (analog signals can be easily sent through digital channels)

Ans3(b)
At 290K, the *thermal noise power density* is :

$N_0 = (1.38 \text{ X } 10^{-23}) \text{ X } 290 = 4 \text{ x } 10^{-21}$ W/Hz = -204dBW/Hz

Ans3(c)
No of lines scanned = 483
Effective no of lines for vertical retracing = 42
Horizontal Scanning Frequency is = (483+42)X30 scans/sec = 15,750 lines/sec or 63.5 μs/line
Time for Horizontal retrace = 11 μs
So Net Time to scan per line = 63.5-11 = 52.5 μs
Width/Height = 4/3
Horizontal Resolution = 4/3 X 483 = 644 lines or 322 cycles
Bandwidth = 322/52.5 = 6 MHz ... *ans.*

Ans3(d)
E_b/N_0dB = S(dBW) - 10logR - 10logk - 10logT
= S(dBW) - 10logR + 228.6dBW - 10logT
So,
8.4 = S(dBW) - 10log2400 - 228.6dBW - 10log290
$\Rightarrow$ 8.4 = S(dBW) - 10X3.38 + 228.6dBW - 10X2.46
$\Rightarrow$ S = -161.8dBW

Ans4(a)
Datagram Technique of Packet Switching:

- Each packet treated independently
- Packets may follow different paths to the destination
- May arrive out-of-order or get lost
- Intermediate nodes need to decide where to forward packets (routing)
- Up to receiver to re-order packets and recover missing packets

Advantages of Datagram Technique over Virtual Circuits:

- No call setup phase.
- Better if few packetsMore flexible and reliable

- Routing can be used to avoid congested parts of the network.
- Loss of a single node does not drop all packets

Disadvantages of Datagram Technique over Virtual Circuits:

- Network does not provide sequencing and error control
- Routing decisions need to be made at nodes, which increases time take to forward a packet.

Ans4(b)
Routing Protocol Goals:

- **Correctness:** It should find a correct route from source to destination.
- **Optimal:** It should compute "best" route possible.
- **Efficiency/Low overhead:** It should not send too many messages to find route
- **Robust:** It should be able to handle failures like link failure, node crashes, Raπd convergence when network conditions change

Ans5(a)
NOTE : Figure on Page 8.

Ans5(b)
Given:
Sampling Rate = 7000 samples/sec.

Sol.:
Required Data Rate = (7000 samp./sec) X (8 bits per/sample)
= 5.6 kbps

Ans5(c)
In *Biphase Encodig*, one extra transition takes place in middle of bit.
Two types of biphase encoding are:

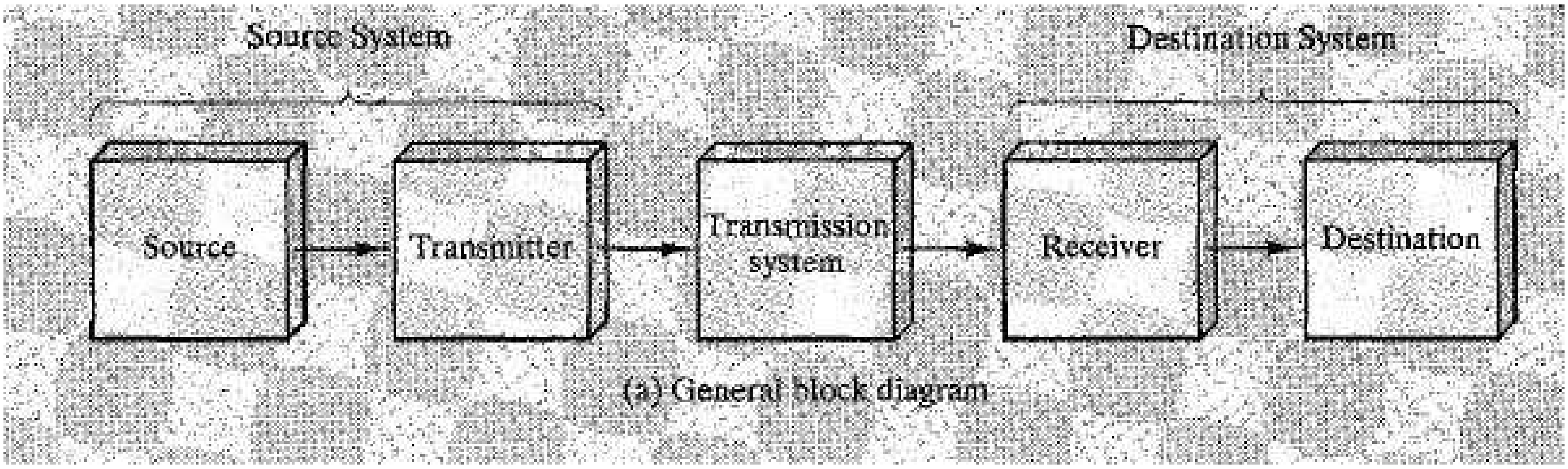
- **Manchester Encoding:** In Mancester code, there is a transition at the middle of each bit period. The midbit transition serves as a clocking mechanism and also as data : a low-to-high transition represents 1, and a high-to-low transition represents.

- **Differential Manchester Encoding:** In Differential Mancheter, the midbit transition is used only to provide clocking. There is always a transition in the middle in case of this encoding.

Ans5(d)
Two principal reasons for analog modulation of analog signals:

- A higher frequency may be needed for effective transmission. For unguided transmission, it is virtually impossible to transmit baseband signals; the required antennas would be many kilometers in diameter.

- Modulation permits frequency division multiplexing.


Source System
Destination System
Source
Transmitter
Transmission system
Receiver
Destination
(a) General block diagram

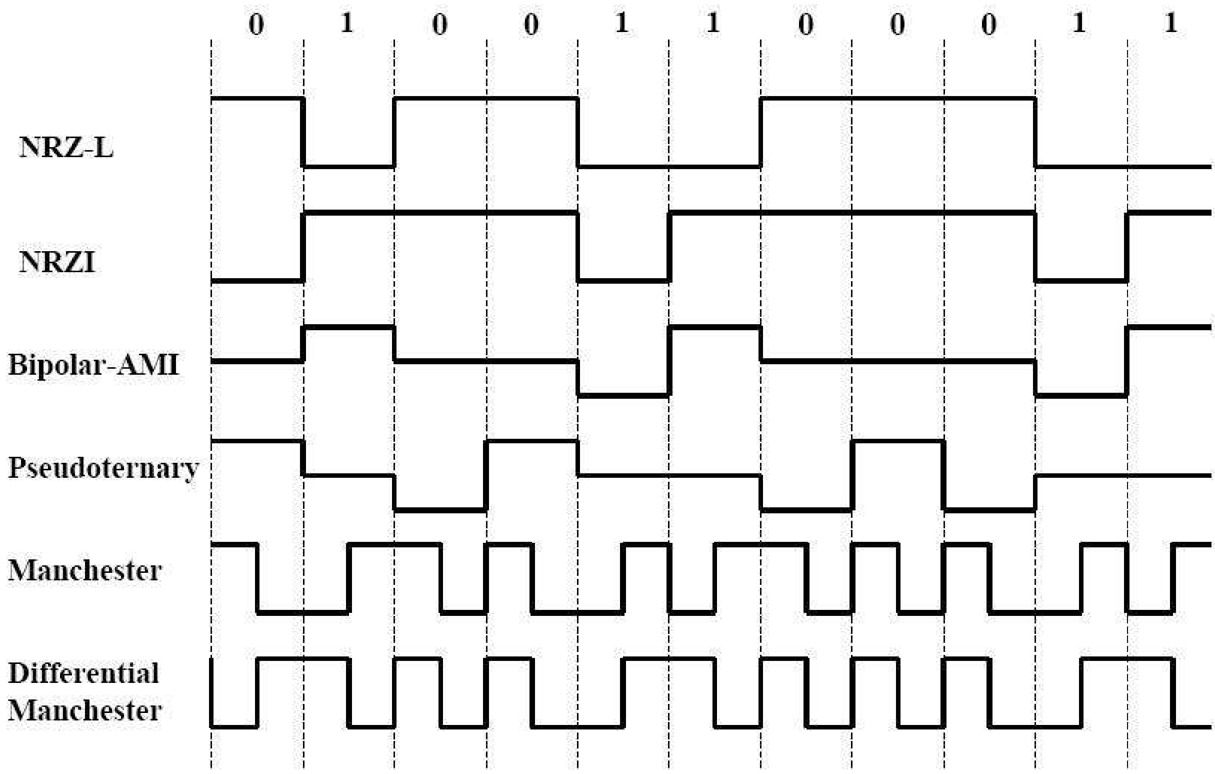


Figure 2: Ans 5(a) Different Encodings of Given Sring.