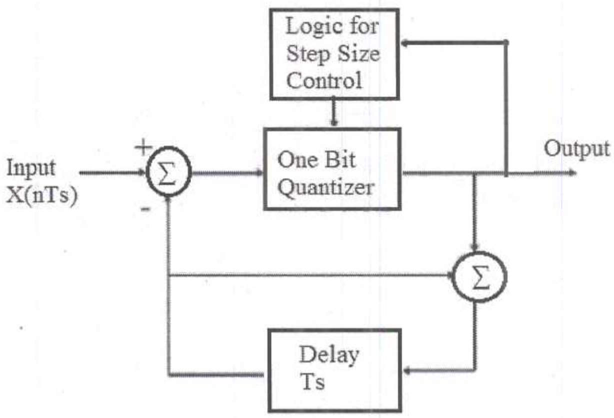
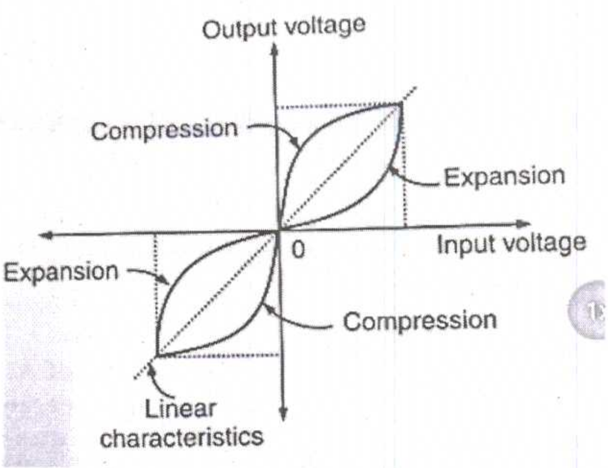
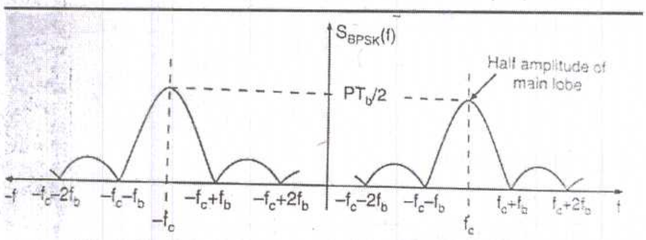
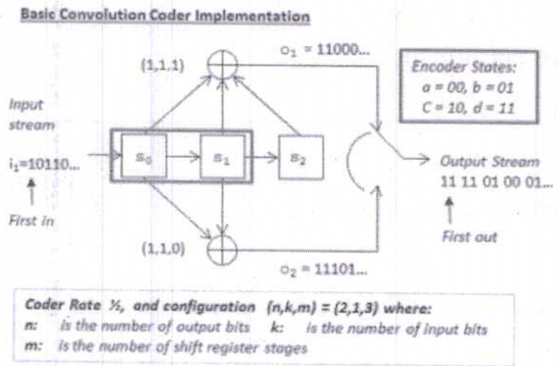
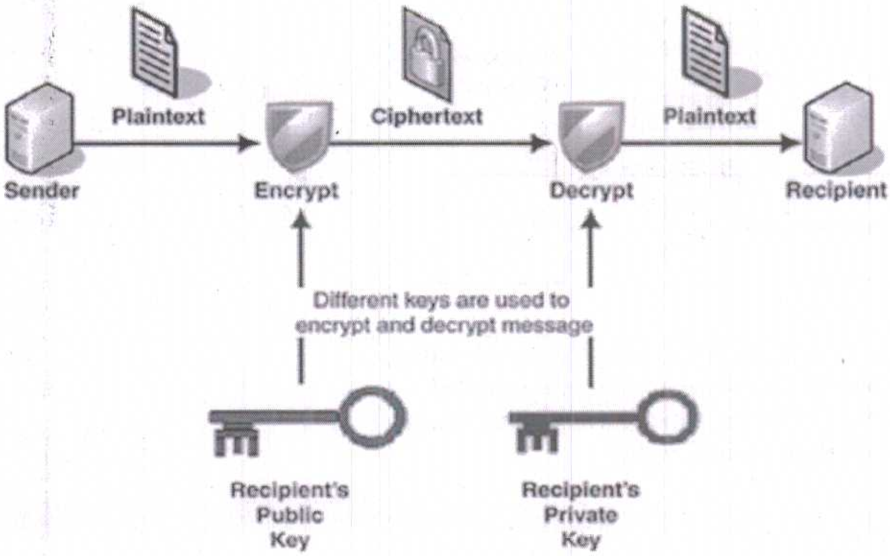
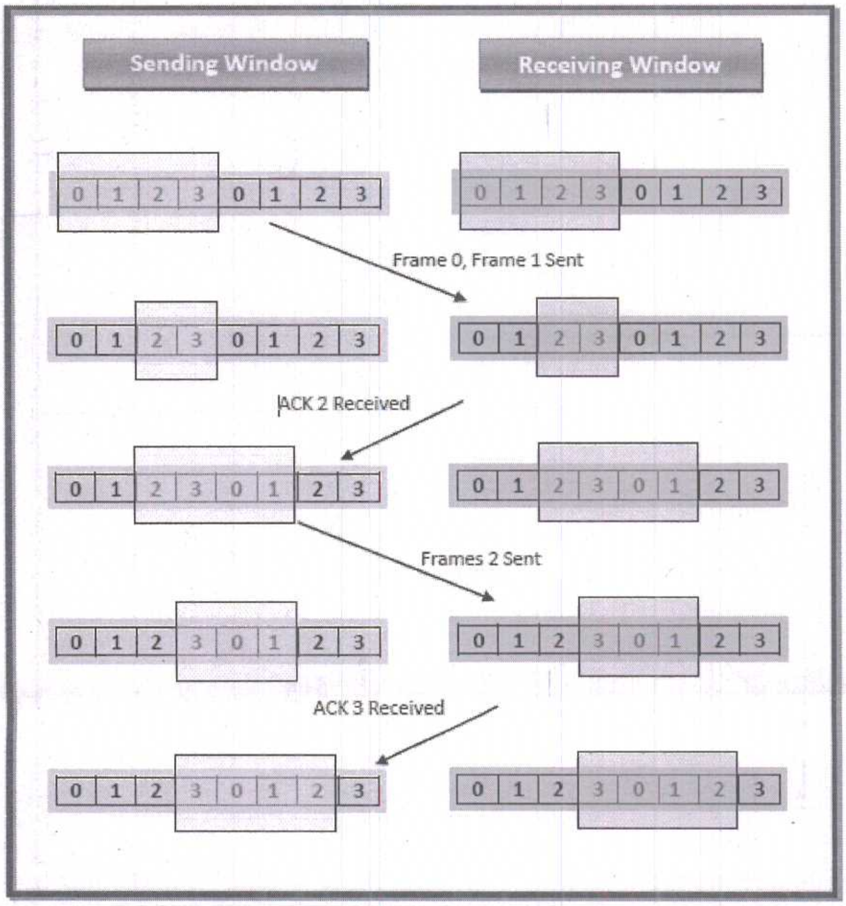
SCHEME OF VALUATION
(Scoring indicators)

A	Revision : 2015 Course Code: 5201 Course Title : DIGITAL COMMUNICATION			
Qst. No.	Scoring Indicator	Split up score	Sub Total	Total
1	Granular or Idle noise occurs when the step size is too large compared to small variation in the input signal.	2		
2	In signal processing and related disciplines, aliasing is an effect that causes different signals to become indistinguishable (or aliases of one another) when sampled	2		
3	Lower bandwidth than BFSK, good noise immunity, offers best performance than other digital modulation techniques	2		
4	Average amount of information content per source symbol	2		
5	Encryption, Cryptography, Data masking	2		
II 1		4 (block)+ 2 Explanation	6	
II 2	 Companding = Compression + Expansion	4 (block) +2 Expl.	6	

	Companding is the process of compression and then expansion. With companded system, the higher amplitude analog signals are compressed (amplified less than lower amplitude signals) prior to transmission and then expanded (amplified more than the lower amplitude signals) in the receiver.			
II 3	 Fig. 6.12. Plot of power spectral density of BPSK signal.	6	6	
II 4	 Figure 1: Implementation of a (7,6) convolutional coder of rate 1/2, (n,k,m) = (2,1,3). The first two registers provide the basis for the modified grouping of states.	6	6	
II 5	Shannon-Hartley theorem or Shannon's Law, relates the system capacity of a channel with the averaged recieved signal power, the average noise power and the bandwidth. This capacity relationship can be stated as: $C = W \log_2\left(1 + \frac{S}{N}\right)$ where: C is the capacity of the channel (bits/s) S is the average received signal power N is the average noise power W is the bandwidth (Hertz)	6	6	
II 6	Unlike symmetric key cryptography, we do not find historical use of public-key cryptography. It is a relatively new concept. Symmetric cryptography was well suited for organizations such as governments, military, and big financial corporations were involved in the classified communication. With the spread of more unsecure computer networks in last few decades, a genuine need was felt to use cryptography at larger scale. The symmetric key	3		

<table>
<tr><td></td><td>was found to be non-practical due to challenges it faced for key management. This gave rise to the public key cryptosystems.
The process of encryption and decryption is depicted in the following illustration –

</td><td>3</td><td>6</td><td></td></tr>
<tr><td>II 7</td><td>
</td><td>6</td><td>6</td><td></td></tr>
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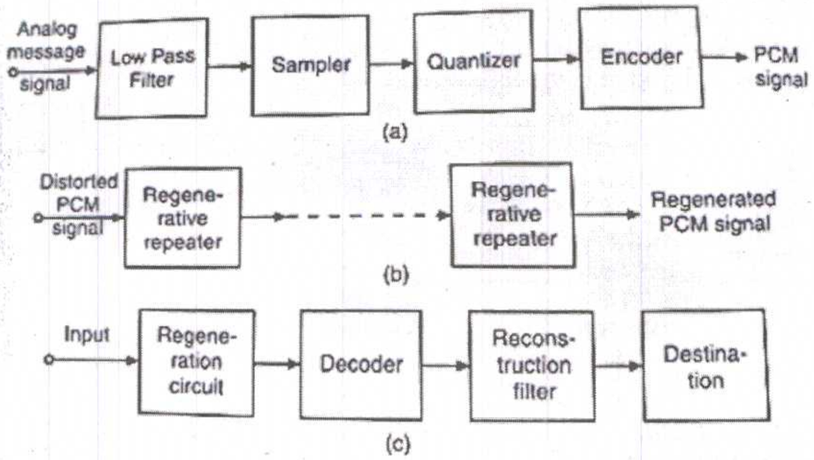
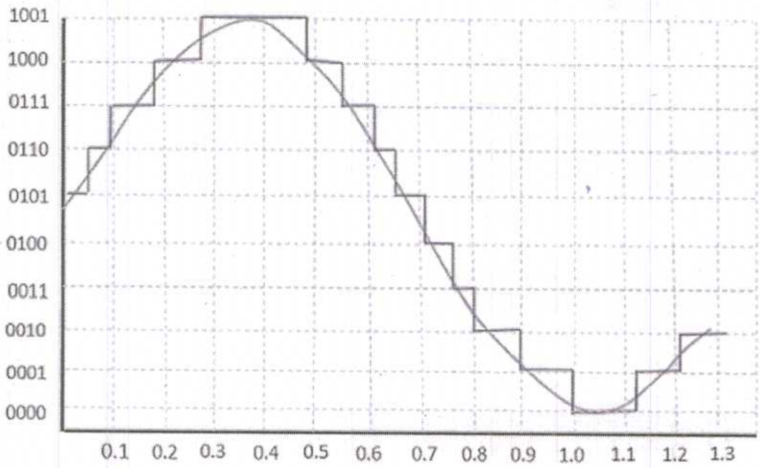
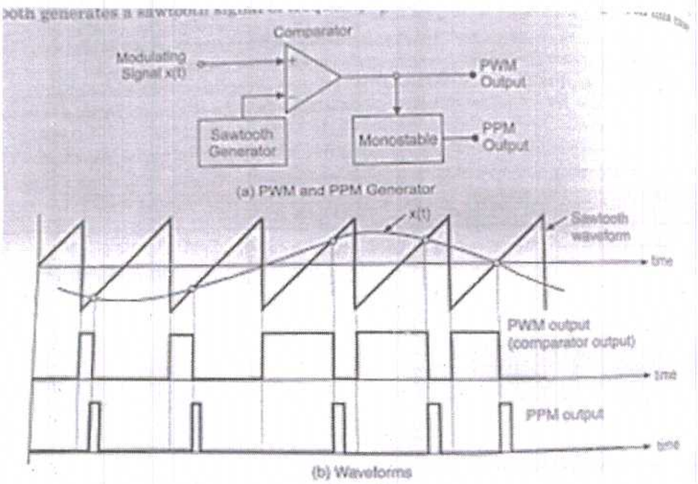
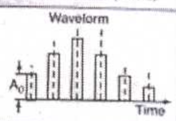
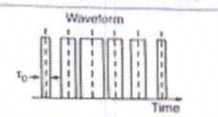
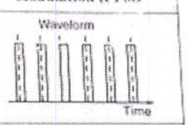
III a		3+3+3	9	15
III b	The quantizing of an analog signal is done by discretizing the signal with a number of quantization levels. Quantization is representing the sampled values of the amplitude by a finite set of levels, which means converting a continuous-amplitude sample into a discrete-time signal. 	3+3	6	
IV a	 Fig. 2.29.	5+4	9	15

IV b (6 | 6)

S. No.	Pulse Amplitude Modulation (PAM)	Pulse Width/Duration Modulation (PWM) or PDM)	Pulse Position Modulation (PPM)
1.	Waveform 	Waveform 	Waveform 
2.	Amplitude of the pulse is proportional to amplitude of modulating signal.	Width of the pulse is proportional to amplitude of modulating signal.	The relative position of the pulse is proportional to the amplitude of modulating signal.
3.	The bandwidth of the transmission channel depends on width of the pulse.	Bandwidth of transmission channel depends on rise time of the pulse.	Bandwidth of transmission channel depends on rising time of the pulse.
4.	The instantaneous power of the transmitter varies.	The instantaneous power of the transmitter varies.	The instantaneous power of the transmitter remains constant.
5.	Noise interference is high. System is complex.	Noise, interference is minimum.	Noise, interference is minimum
6.	Similar to amplitude modulation.	Simple to implement similar to frequency modulation.	Simple to implement similar to phase modulation.

V a (5 | 8 | 15)

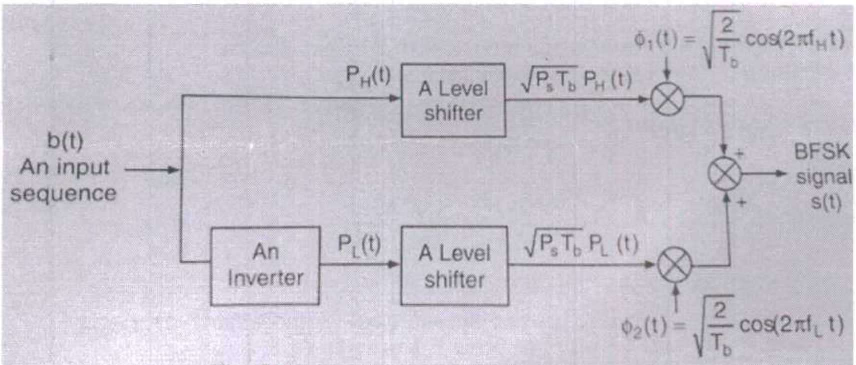


Fig. 6.14. Block diagram for BFSK generation

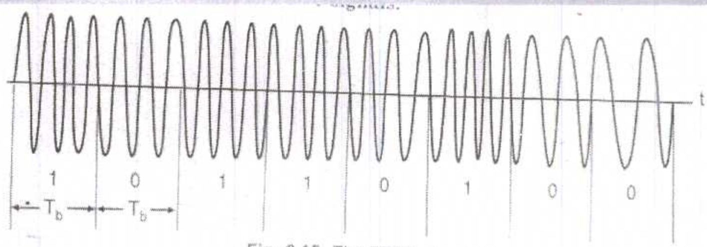


Fig. 6.15. The BFSK signal

3

V b (4 | 7 | 3)

The minimum-shift keying (MSK) scheme is used in GSM, a pioneer and a widely-used digital cellular mobile system. MSK can be viewed as either a special case of binary continuous-phase frequency-shift keying (CPFSK) or a special case of OQPSK. When MSK is viewed as a continuous phase modulation (CPM) scheme, MSK is a binary modulation with interval Tb, but as a quadrature scheme, it is a quaternary modulation over a double interval 2Tb. Regardless of how MSK modulation is viewed, not only it has a constant envelope, but it also has a continuous phase.

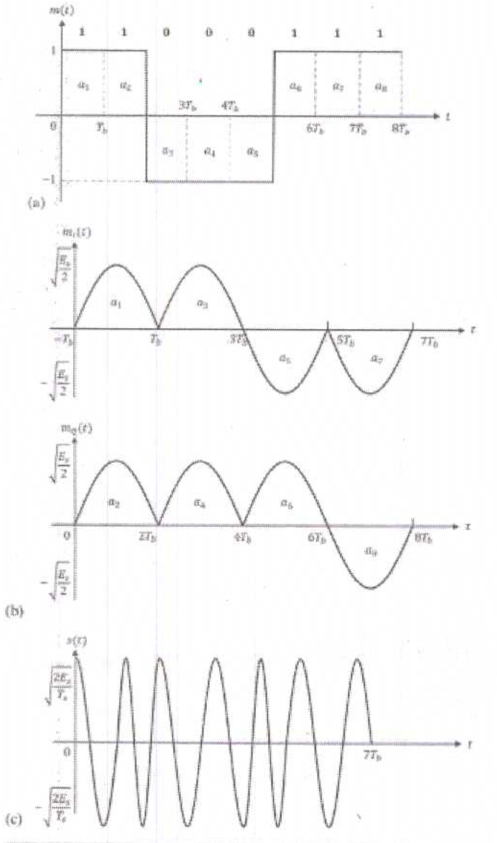
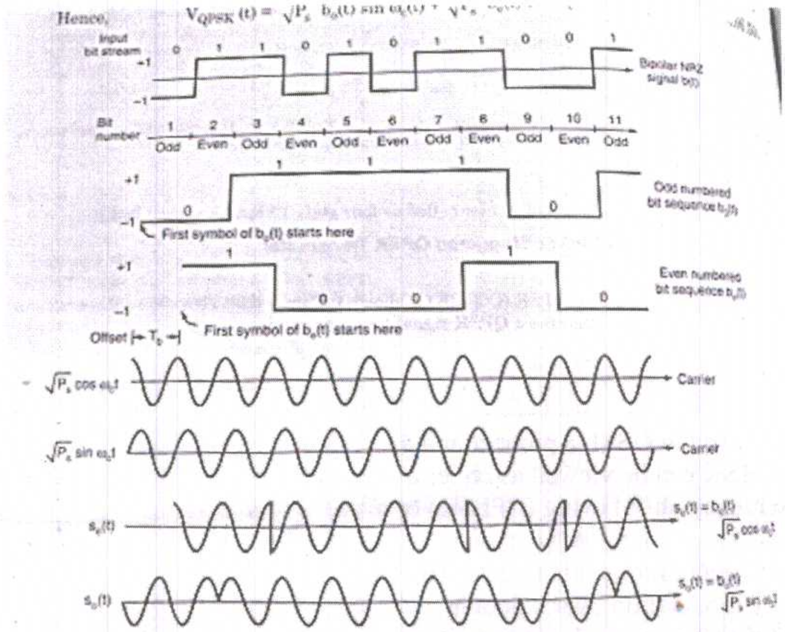
<table>
<tr><td></td><td>
</td><td></td><td></td><td></td></tr>
<tr><td>VI a</td><td>Hence, $V_{QPSK}(t) = \sqrt{P_s}\ b_o(t) \sin \omega_c(t)$ + ...


Fig. 6.31. Waveforms for OQPSK transmitter</td><td>5 + 4 (explanation)</td><td>9</td><td rowspan="2">15</td></tr>
<tr><td>VI b</td><td></td><td>6</td><td>6</td></tr>
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<tr>
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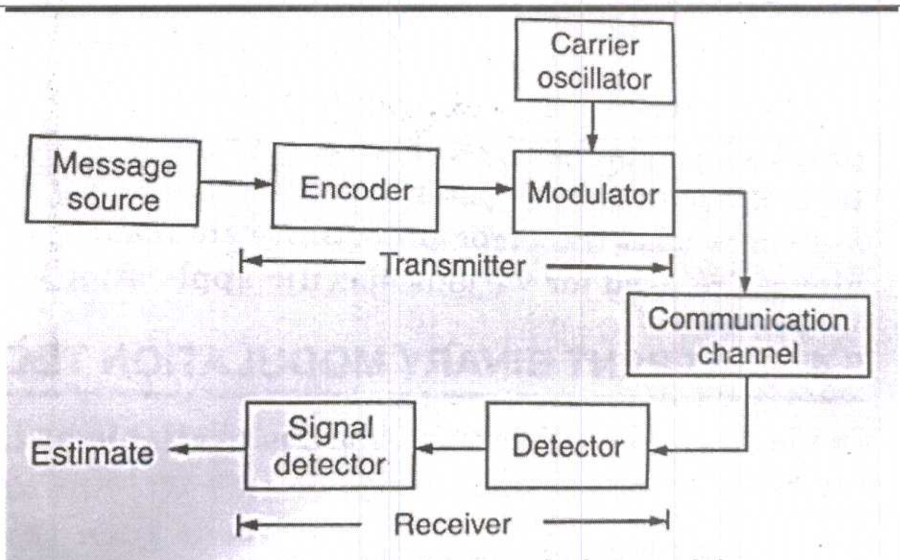
<td>

Fig. 6.1. Passband transmission model</td>
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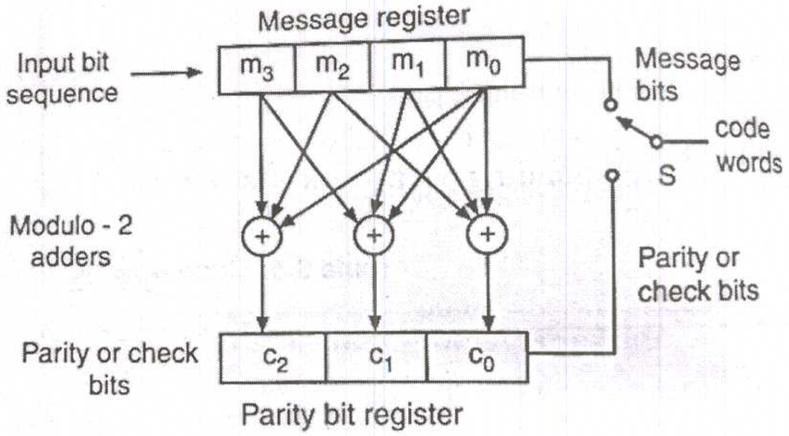
<td rowspan="3">15</td>
</tr>
<tr>
<td>VII a</td>
<td>Hamming code is a block code that is capable of detecting up to two simultaneous bit errors and correcting single-bit errors. It was developed by R.W. Hamming for error correction.


Fig. 9.20. Encoder for (7, 4) Hamming code</td>
<td>5+4(for example)</td>
<td>9</td>
</tr>
<tr>
<td>VII b</td>
<td>The term burst error means that 2 or more bits in the data unit have changed from 1 to 0 or from 0 to 1.
The following figure shows the effect of a burst error on a data unit. In this case, 0100010001000011 was sent, but 0101110101100011 was received. Note that a burst error does not necessarily mean that the errors occur in consecutive bits. The length of the burst is measured from the first corrupted bit to the last corrupted bit. Some bits in between may not have been corrupted.</td>
<td>3</td>
<td>6</td>
</tr>
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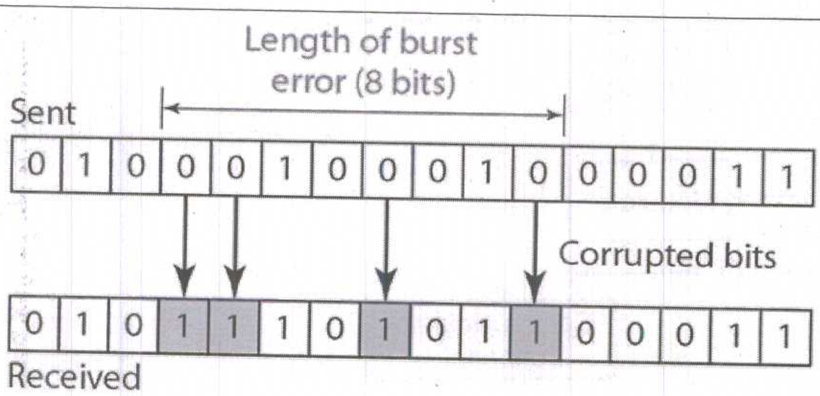


3

VIII a

Shannon Fano Algorithm is an entropy encoding technique for lossless data compression of multimedia. Named after Claude Shannon and Robert Fano, it assigns a code to each symbol based on their probabilities of occurrence. It is a variable length encoding scheme, that is, the codes assigned to the symbols will be of varying length.

1. Create a list of probabilities or frequency counts for the given set of symbols so that the relative frequency of occurrence of each symbol is known.
2. Sort the list of symbols in decreasing order of probability, the most probable ones to the left and least probable to the right.
3. Split the list into two parts, with the total probability of both the parts being as close to each other as possible.
4. Assign the value 0 to the left part and 1 to the right part.
5. Repeat the steps 3 and 4 for each part, until all the symbols are split into individual subgroups.

5 | 9

X	$P(X)$	I (bits)	steps					code
E	0.4	1.32	0					0
A	0.3	1.74	1	0				10
D	0.15	2.74	1	1	0			110
B	0.1	3.32	1	1	1	0		1110
F	0.03	5.06	1	1	1	1	0	11110
C	0.02	5.64	1	1	1	1	1	11111

4 for any example | 15

VIII b

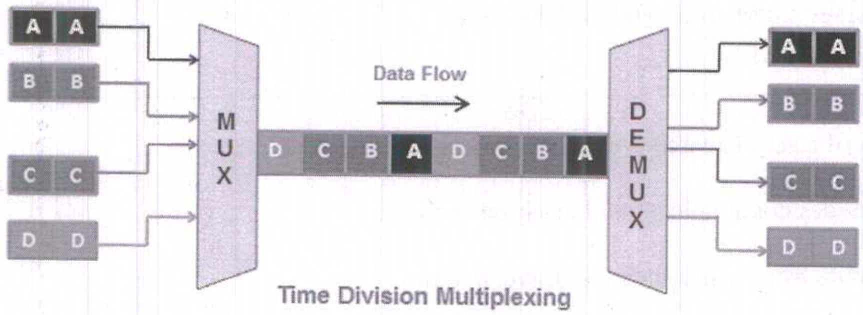
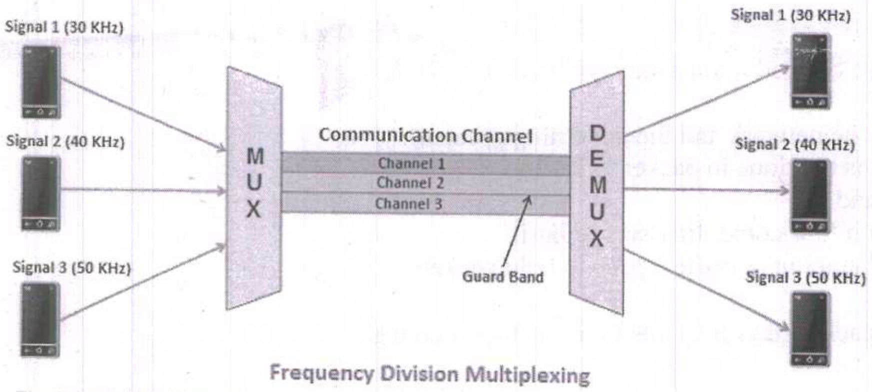
A block interleaver accepts a set of symbols and rearranges them, without repeating or omitting any of the symbols in the set. The number of symbols in each set is fixed for a given interleaver. The interleaver's operation on a set of symbols is independent of its operation on all other sets of symbols.

The set of block interleavers in this library includes a general interleaver/deinterleaver pair as well as several special cases. Each special-case block uses the same computational code that its more general counterpart uses, but provides an interface that is more suitable for the special case.

The Matrix Interleaver block accomplishes block interleaving by filling a matrix with the input symbols row by row and then sending the matrix contents to the output port column by column. For example, if the interleaver uses a 2-by-3 matrix to do its internal computations, then for an input of [1 2 3 4 5 6] the block produces an output of [1 4 2 5 3 6].

6 | 6

	The Random Interleaver block chooses a permutation table randomly using the Initial seed parameter that you provide in the block mask. By using the same Initial seed value in the corresponding Random Deinterleaver block, you can restore the permuted symbols to their original ordering. The Algebraic Interleaver block uses a permutation table that is algebraically derived. It supports Takeshita-Costello interleavers and Welch-Costas interleavers.			
IX a	1) Circuit Switching Circuit switched network consists of a set of switches connected by physical links. In circuit switched network, two nodes communicate with each other over a dedicated communication path. There is a need of pre-specified route from which data will travel and no other data is permitted. Before starting communication, the nodes must make a reservation for the resources to be used during the communication. In this type of switching, once a connection is established, a dedicated path exists between both ends until the connection is terminated. 2) Packet Switching In packet switching, messages are divided into packets of fixed or variable size. The size of packet is decided by the network and the governing protocol. Resource allocation for a packet is not done in packet switching. Resources are allocated on demand. The resource allocation is done on first-come, first-served basis. Each switching node has a small amount of buffer space to hold packets temporarily. If the outgoing line is busy, the packet stays in queue until the line becomes available. 3) Message Switching In message switching, it is not necessary to establish a dedicated path between transmitter and receiver. In this, each message is routed independently through the network. Each message carries a header that contains the full information about the destination. Each intermediate device receives the whole message and buffers it until there are resources available to transfer it to the next hop. If the next hop does not have enough resources to accommodate large size message, the message is stored and switch waits. For this reason a message switching is sometimes called as Store and Forward Switching. Message switching is very slow because of store-and-forward technique. Message switching is not recommended for real time applications like voice and video.	9	9	15
IX b	Cryptography is a method of protecting information and communications through the use of codes so that only those for whom the information is intended can read and process it. Ciphers are arguably the corner stone of cryptography. In general, a cipher is simply just a set of steps (an algorithm) for performing both an encryption, and the corresponding decryption.	3+3	6	

X a	Time Division Multiplexing (TDM): TDM is the multiplexing technique. TDM works with digital signals likewise as analog signals. In TDM, synchronization pulse is important. TDM share the timescale for the various signals.  Time Division Multiplexing FDM is the multiplexing technique which is used in analog system. In FDM, Guard band is required and the spectral efficiency of FDM is low. In FDM, Bandwidth(B) is committed to the different sources.  Frequency Division Multiplexing Physics and Radio-Electronics	3 3 3 3	9	15
X b	Serial Transmission: In Serial Transmission, data-bit flows from one computer to another computer in bi-direction. In this transmission one bit flows at one clock pulse. In Serial Transmission, 8 bits are transferred at a time having a start and stop bit. Parallel Transmission: In Parallel Transmission, many bits are flow together simultaneously from one computer to another computer. Parallel Transmission is faster than serial transmission to transmit the bits. Parallel transmission is used for long distance. Synchronous Transmission: In Synchronous Transmission, data is sent in form of blocks or frames. This transmission is the full duplex type. Between sender and receiver the synchronization is compulsory. In Synchronous transmission, There is no gap present between data. It is more efficient and more reliable than asynchronous transmission to transfer the large amount of data. Asynchronous Transmission: In Asynchronous Transmission, data is sent in form of byte or character. This transmission is the half duplex type transmission. In this transmission start bits and stop bits are added with data. It does not require synchronization.	3+3 (Any two)	6	