

328

Scoring Indicators

(4)

50430

Part A

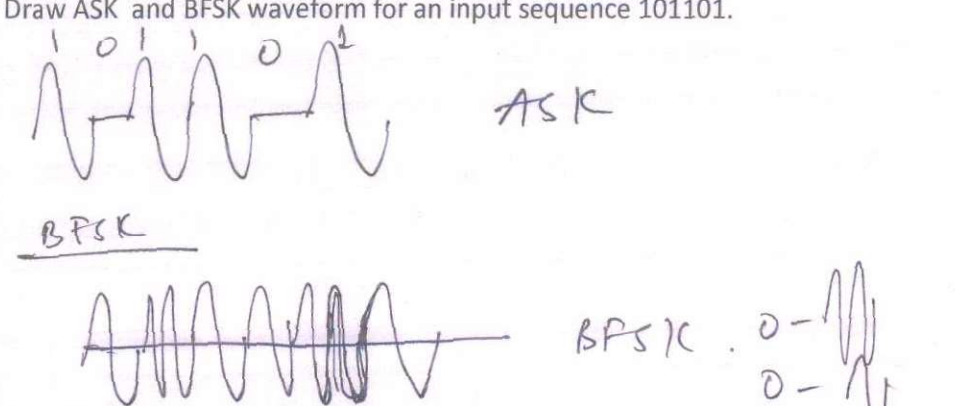
(21)

1	8KHz	1	1
2	It is a rounding error between the analog input voltage value and the output digitized value.	1	1
3	2	1	1
4	Half-duplex is a type of communication in which data can flow back and forth between two devices, but not simultaneously.	1	1
5	Hamming Codes, Convolutional codes	1	1
6	4	1	1
7	Source coding reduces the average bit rate required for the representation of the message.	1	1
8	It is a binary sequence with an autocorrelation that resembles, over a period, the autocorrelation of a random binary sequence	1	1
9	• Security • Call quality is better with more predictable sound when contrasted with GSM. • Diminished call dropping. • Better spectral efficiency • It has Better multipath execution.	Any two .5 x 2	1

Part B

1	Impulse sampling- performed by multiplying the input signal with an impulse signal Natural sampling- performed by multiplying the input signal with by pulse train of period T Flat Top sampling - Here, the top of the samples are flat i.e. they have constant amplitude. Flat top sampling makes use of sample and hold circuit.	3x1	3
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2	<table> <tr> <th>Parameter of Comparison</th> <th>Delta Modulation (DM)</th> <th>Adaptive Delta Modulation (ADM)</th> </tr> <tr> <td>Number of bits</td> <td>It uses only one bit for one sample</td> <td>It uses only one bit for one sample</td> </tr> <tr> <td>Levels and step size</td> <td>Step size is kept fixed and cannot be varied.</td> <td>According to the signal variation, step size varies.</td> </tr> <tr> <td>Quantization error and distortion</td> <td>Slope overload distortion and granular noise are present.</td> <td>Quantization noise is present but other errors are absent.</td> </tr> <tr> <td>Transmission bandwidth</td> <td>Lowest bandwidth is required.</td> <td>Lowest bandwidth is required.</td> </tr> <tr> <td>Feedback</td> <td>Feedback exists in transmitter.</td> <td>Feedback exists.</td> </tr> <tr> <td>Complexity of Implementation</td> <td>Simple</td> <td>Simple</td> </tr> </table>	Parameter of Comparison	Delta Modulation (DM)	Adaptive Delta Modulation (ADM)	Number of bits	It uses only one bit for one sample	It uses only one bit for one sample	Levels and step size	Step size is kept fixed and cannot be varied.	According to the signal variation, step size varies.	Quantization error and distortion	Slope overload distortion and granular noise are present.	Quantization noise is present but other errors are absent.	Transmission bandwidth	Lowest bandwidth is required.	Lowest bandwidth is required.	Feedback	Feedback exists in transmitter.	Feedback exists.	Complexity of Implementation	Simple	Simple	Any three points 3x1= 3	3
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3.	Advantages of PCM ➡It is robust against noise and interference. ➡Uniform transmission quality. ➡Efficient SNR and bandwidth trade off. ➡It provides secure data transmission. ➡It offers efficient regeneration. ➡It is easy to add or drop channels. Disadvantages of PCM ➡Overload appears when modulating signal changes between samplings, by an amount greater than the size of the step. ➡Large bandwidth is required for transmission. ➡Noise and crosstalk leaves low but rises attenuation. ➡An IDN (Integrated Digital Network) can only be realized by gradual extension of noise. ➡The difference between original analog signal and translated digital signal is called quantizing error.	Adv-3 Disadvantage-3 6x0.5 = 3	3																					

4	Frequency division multiplexing (FDM) is a technique of combining more than one signal over a shared medium. In FDM, signals of different frequencies are combined for concurrent transmission. In FDM, the total bandwidth is divided to a set of frequency bands that do not overlap. Each of these bands is a carrier of a different signal that is generated and modulated by one of the sending devices. The frequency bands are separated from one another by strips of unused frequencies called the guard bands, to prevent overlapping of signals.	3	3														
5	Draw ASK and BFSK waveform for an input sequence 101101.  ASK <u>BFSK</u> BFSK . 0 -  0 - 	2x1.5	3														
6	<table><tr><td>1. In <u>Synchronous transmission</u>, data is sent in form of blocks or frames.</td><td>In <u>Asynchronous transmission</u>, data is sent in form of bytes or characters.</td></tr><tr><td>2. Synchronous transmission is fast.</td><td>Asynchronous transmission is slow.</td></tr><tr><td>3. Synchronous transmission is costly.</td><td>Asynchronous transmission is economical.</td></tr><tr><td>4. In Synchronous transmission, the time interval of transmission is constant.</td><td>In Asynchronous transmission, the time interval of transmission is not constant, it is random.</td></tr><tr><td>5. In this transmission, users have to wait till the transmission is complete before getting a response back from the server.</td><td>Here, users do not have to wait for the completion of transmission in order to get a response from the server.</td></tr><tr><td>6. In Synchronous transmission, there is no gap present between data.</td><td>In Asynchronous transmission, there is a gap present between data.</td></tr><tr><td>7. Efficient use of transmission lines is done in synchronous transmission.</td><td>While in Asynchronous transmission, the transmission line remains empty during a gap in character transmission.</td></tr></table>	1. In <u>Synchronous transmission</u> , data is sent in form of blocks or frames.	In <u>Asynchronous transmission</u> , data is sent in form of bytes or characters.	2. Synchronous transmission is fast.	Asynchronous transmission is slow.	3. Synchronous transmission is costly.	Asynchronous transmission is economical.	4. In Synchronous transmission, the time interval of transmission is constant.	In Asynchronous transmission, the time interval of transmission is not constant, it is random.	5. In this transmission, users have to wait till the transmission is complete before getting a response back from the server.	Here, users do not have to wait for the completion of transmission in order to get a response from the server.	6. In Synchronous transmission, there is no gap present between data.	In Asynchronous transmission, there is a gap present between data.	7. Efficient use of transmission lines is done in synchronous transmission.	While in Asynchronous transmission, the transmission line remains empty during a gap in character transmission.	Any six points 0.5 x 6 = 3	3
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7	The Shannon-Hartley theorem states the achievable at an arbitrarily low error rate using an average received signal power through an analog communication channel subject to additive white Gaussian noise (AWGN) of power is given by: $C = B \log_2(1 + SNR)$ This theorem shows that we can trade off increased Channel bandwidth for reduced signal power for a system with given Capacity C	3	3														

8	$P(x_1) = \frac{1}{2}, P(x_2) = \frac{1}{4}, P(x_3) = \frac{1}{8}, P(x_4) = \frac{1}{8}$ <table><tr><th>x_i</th><th>$P(x_i)$</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Code</th></tr><tr><td>x_1</td><td>1/2</td><td>0</td><td></td><td></td><td>0</td></tr><tr><td>x_2</td><td>1/4</td><td>1</td><td>0</td><td></td><td>10</td></tr><tr><td>x_3</td><td>1/8</td><td>1</td><td>1</td><td>0</td><td>110</td></tr><tr><td>x_4</td><td>1/8</td><td>1</td><td>1</td><td>1</td><td>111</td></tr></table>	x_i	$P(x_i)$	Step 1	Step 2	Step 3	Code	x_1	1/2	0			0	x_2	1/4	1	0		10	x_3	1/8	1	1	0	110	x_4	1/8	1	1	1	111	3	3
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9	1. Jam-resistant communication systems 2. CDMA radios: 3. High Resolution Ranging:. 4. WLAN: Wireless LAN (Local Area Networks) widely use spread spectrum communications.	3 points	3																														
10	dpsk ==> greater bandwidth, Complex circuitry, probability error less bpsk ==> lesser bandwidth, Transmitter and receiver is less complex, more probability error	3 points	3																														

Part C

Answer all questions from the following. Each question carries 7 marks

(6x7 = 42 Marks)

Module Outcome Cognitive Level

III

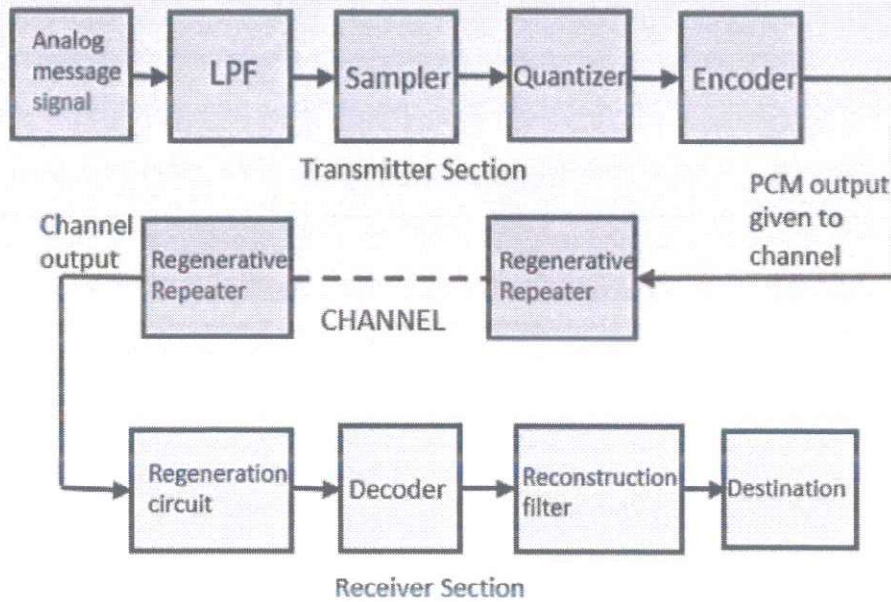
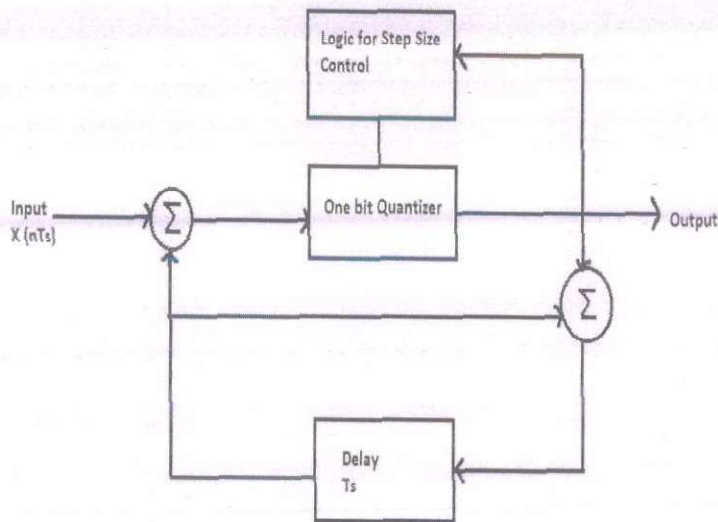


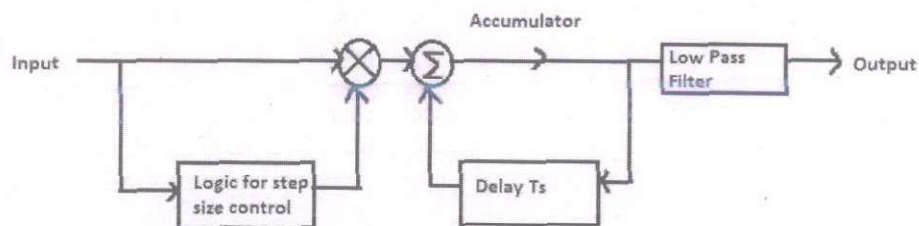
Fig : 4
Exp :3

7

IV

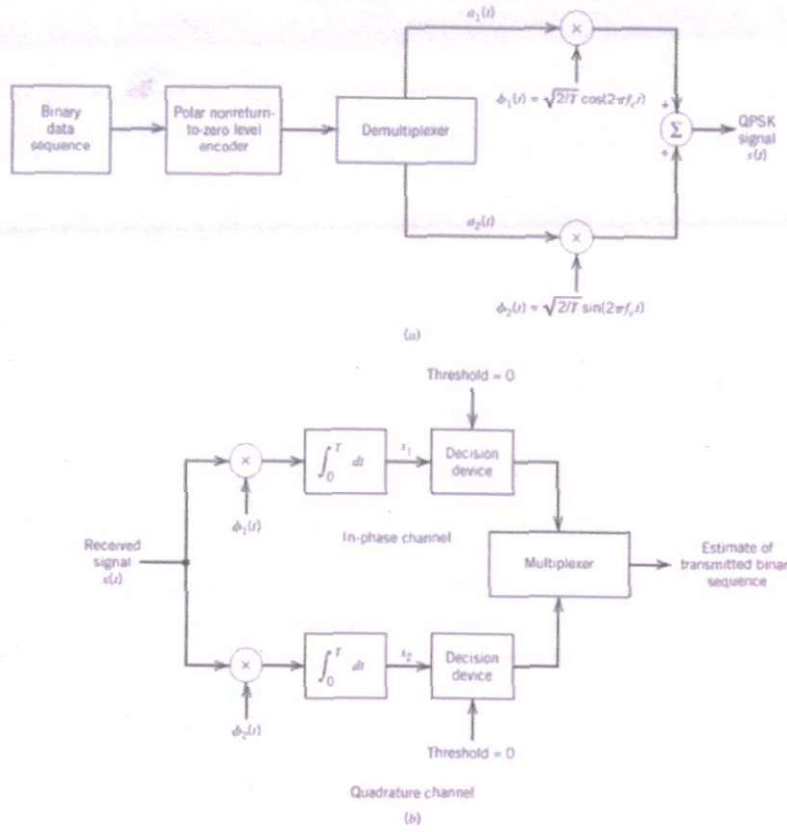
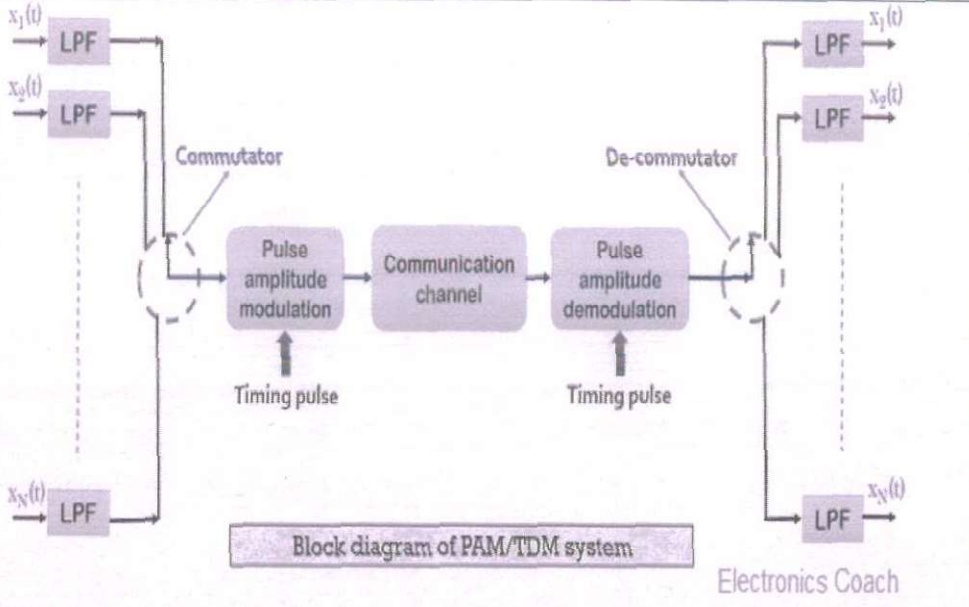


The transmitter has a summer, a quantizer, a delay circuit, and a logic circuit. The logic circuit gives the input to the quantizer to produce required step size. The step size is kept fixed between some predefined maximum and minimum values.

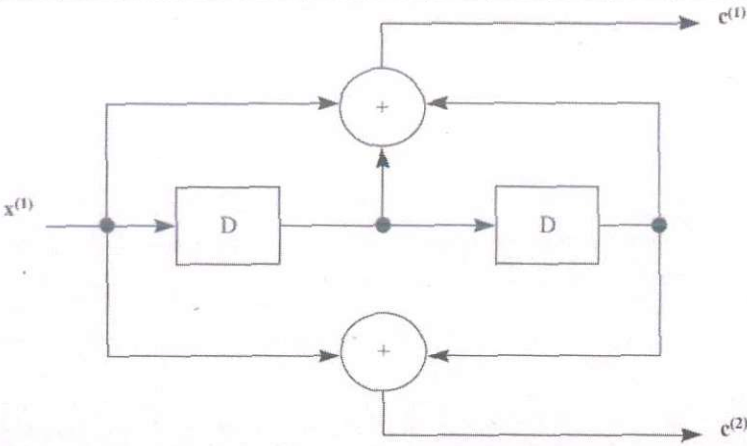


The ADM receiver has two parts. The first part is used to produce the step size from the incoming bits. The bits are then applied to the second part of the receiver which contains an accumulator. The function of the accumulator is to build up the staircase waveform. The signal is then passed through a low pass filter which is used to smoothen the staircase waveform and reconstruct the original signal.

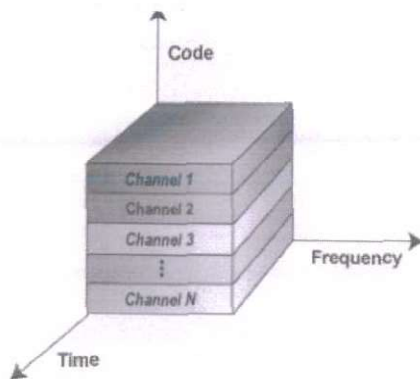
Fig : 4
Exp :37
Mar
ks

V		Fig : 4 Exp :3	7
VI	 Advantages of TDM • Simple circuit design. • It uses entire channel bandwidth for the transmission of the signal.	Fig : 3 Exp :4	7 marks

	- The problem of Intermodulation distortion is not present in TDM. - Pulse overlapping can sometimes cause crosstalk but it can be reduced by utilizing guard time. Thus, is not much serious. Disadvantages of TDM - The transmitting and receiving section must be properly synchronized in order to have proper signal transmission and reception. - Slow narrowband fading can wipe out all the TDM channels.		
VII	A system has a bandwidth of 4kHz and a SNR of 28dB at the input to the receiver. $C = B \log_2 (1 + S/N)$ $= 37.3 \times 10^3 \text{ bits/sec.}$ The capacity is doubled when Bandwidth is doubled.	4+3 7 marks	
VIII	Define entropy. The probabilities of five possible outcomes of an experiment are given as : $P(x_1) = \frac{1}{2}, P(x_2) = \frac{1}{4}, P(x_3) = \frac{1}{8}, P(x_4) = P(x_5) = \frac{1}{16}$ Find information content per each symbol and entropy. $I(x_1) = \log_2 \frac{1}{p(x_1)} = \log_2 2 = 1 \text{ bit}$ $I(x_2) = \log_2 4 = 2$ $I(x_3) = \log_2 8 = 3$ $I(x_4) = I(x_5) = \log_2 16 = 4$ Entropy is the average information content of all the symbols of a source $H(X) = \sum_{k=1}^5 p_k \log_2 \frac{1}{p_k}$ $= 15/8 \text{ bits/symbol.}$	Def: 2 marks Problem is marks. 7 $(I(x) = 2+3)$	

IX	The generator matrix for a (6,3) block code is given below. Find all the code vectors of this code. $\left[\begin{array}{ccc ccc} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{array} \right]$ is of the form $G = [I_3 P]$ where $I_3 = 3 \times 3$ Id-matrix and $P = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$. The code words $[c_0 \ c_1 \ c_2] = [m_0 \ m_1 \ m_2] [P]$. $[m_0 \ m_1 \ m_2]$ is a 8×3 matrix for all possible combinations of 3 bits. $\therefore c_0 \ c_1 \ c_2 = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ and the final code word can be written as. <u><u>$m_0 \ m_1 \ m_2 \ c_0 \ c_1 \ c_2$</u></u>	M3.04	A
X		Fig: 4 marks Exp: 3 marks	7
XI	Different signals can be modulated on the same carrier with the help of different spreading codes to allow many users at the same time. Using orthogonal codes as the spreading codes, interference between the signals is minimal. Also, when signals are received from several mobile stations, the base station is capable of isolating each as they have different orthogonal spreading codes. CDMA has a soft		
XII			

capacity. The greater the number of codes, the more the number of users it can support



CDMA in which each channel is assigned a unique code which is orthogonal to codes used by other users.

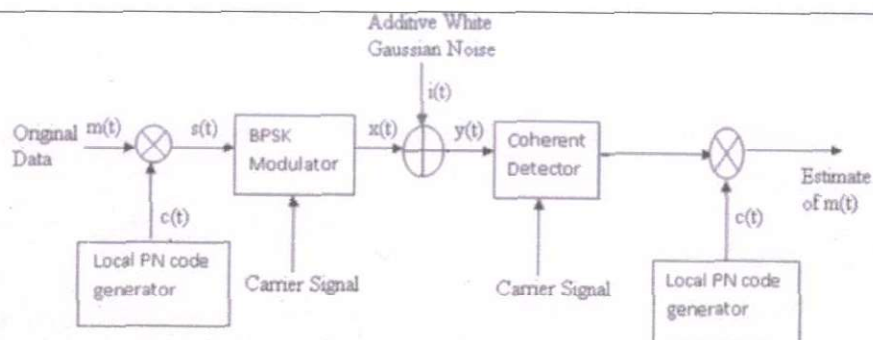
Advantages

- Rake receivers can be used to improve signal reception. Delayed versions of time (a chip or later) of the signal (multipath signals) can be collected and used to make decisions at the bit level.
- Flexible transfer may be used. Mobile base stations can switch without changing operator. Two base stations receive mobile signal and the mobile receives signals from the two base stations.
- Transmission Burst – reduces interference.

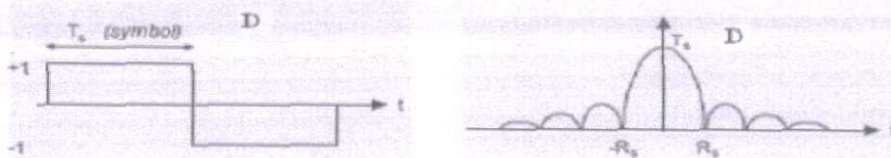
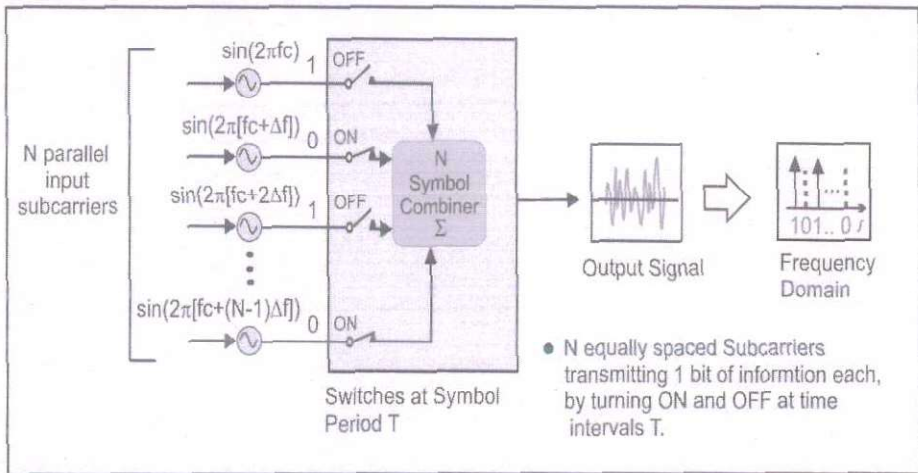
Applications

- Used in broad band devices such as wireless laptop modems, GPS system units and other innovative devices.
- Some of business related services are exempted from the service charges imposed by the operators making CDMA cost effective.
- CDMA has merged with the GSM technology to give a high-speed 4G or LTE internet service

X 11



4+3

			
XIII	Explain the concept and generation of OFDM with the help of a block diagram Orthogonal Frequency Division Multiplexing (OFDM) is a digital multi-carrier modulation scheme that extends the concept of single subcarrier modulation by using multiple subcarriers within the same single channel. Rather than transmit a high-rate stream of data with a single subcarrier, OFDM makes use of a large number of closely spaced orthogonal subcarriers that are transmitted in parallel. Each subcarrier is modulated with a conventional digital modulation scheme (such as QPSK, 16QAM, etc.) at low symbol rate. The combination of many subcarriers enables data rates similar to conventional single-carrier modulation schemes within equivalent bandwidths. In an analog based OFDM system there are N sinusoidal input signals. Each subcarrier transmits one bit of information (N bits total) as indicated by its presence or absence in the output spectrum. The frequency of each subcarrier is selected to form an orthogonal signal set. These frequencies are also known at the receiver for signal recovery. The output is updated at a periodic interval T that forms the symbol period. To maintain orthogonality, T must be the reciprocal of the subcarrier spacing.  Simple OFDM Generation	Fig : 3 Exp :4	7
XIV	FDMA FDMA stands for Frequency Division Multiple Access. Overall bandwidth is shared among number of stations. TDMA TDMA stands for Time Division Multiple Access. Time sharing of satellite transponder takes place.	7 points	7

Guard bands between adjacent channels is necessary.	Guard time between adjacent slots is necessary.		
Synchronization is not required.	Synchronization is necessary.		
Power efficiency is less.	Power efficiency is high.		
It requires stability of high carrier efficiency.	It does not require stability of high carrier efficiency.		
It is basically used in GSM and PDC.	It is basically used in advanced mobile phone systems.		
