Module 2

DIGITAL MODULATION SCHEMES

MULTIPLEXING TECHNIQUES AND DATA TRANSMISSION METHODS

DIGITAL MODULATION SCHEMES

Need /Advantage of digital modulation schemes:-

Digital Modulation provides more information capacity, high data security, quicker system availability with great quality communication. Hence, digital modulation techniques/Schemes have a greater demand, for their capacity to convey larger amounts of data than analog ones.

What is digital modulation ?

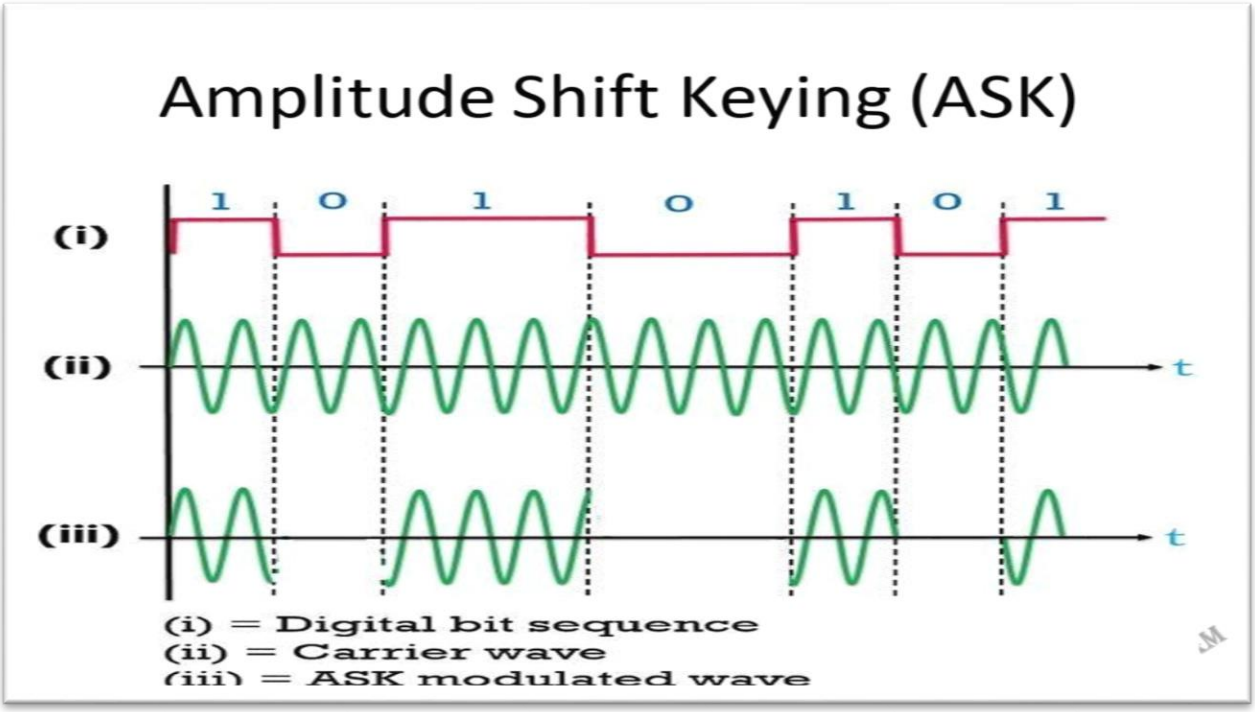
Digital modulation is the process of encoding a digital information signal(binary data{1's &0's}) into the amplitude, phase, or frequency of the transmitted analog signal.

Types of digital modulation techniques:-

Common digital modulation techniques include amplitude-shift keying (ASK), frequency shift keying (FSK), and phase-shift keying (PSK

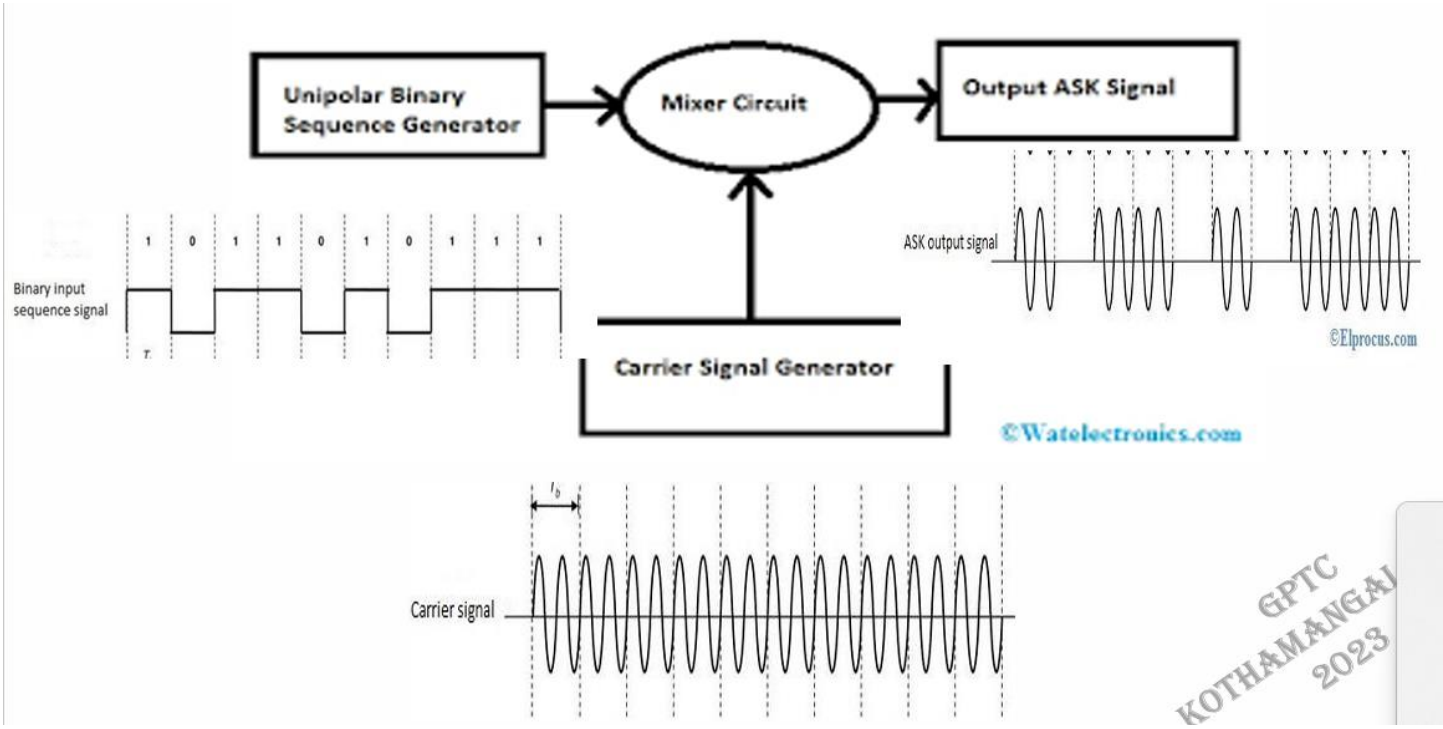
Amplitude Shift Keying (ASK):-

Amplitude Shift Keying (ASK) is a type of Amplitude Modulation which represents the binary data in the form of variations in the amplitude of a signal Normally Bit 1 is represented by high amplitude and bit 0 is represented by low or zero amplitude



Generation of ASK

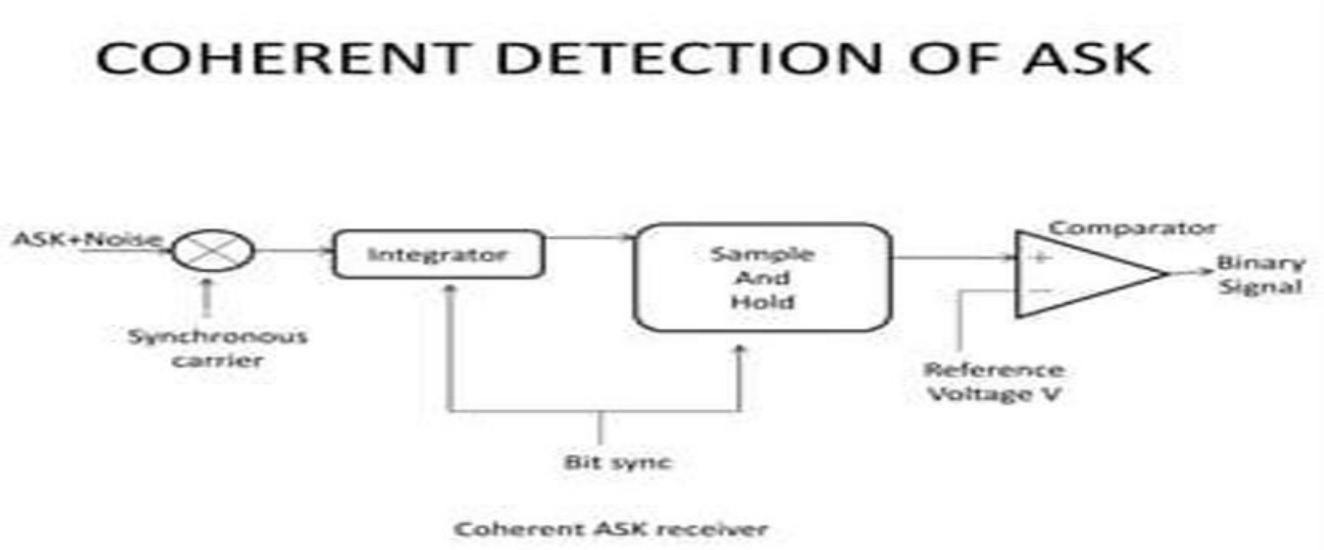
The input binary sequence is applied to the product modulator/mixer circuit. The product modulator amplitude modulates the sinusoidal carrier .it passes the carrier when input bit is '1' .it blocks the carrier when input bit is '0.'



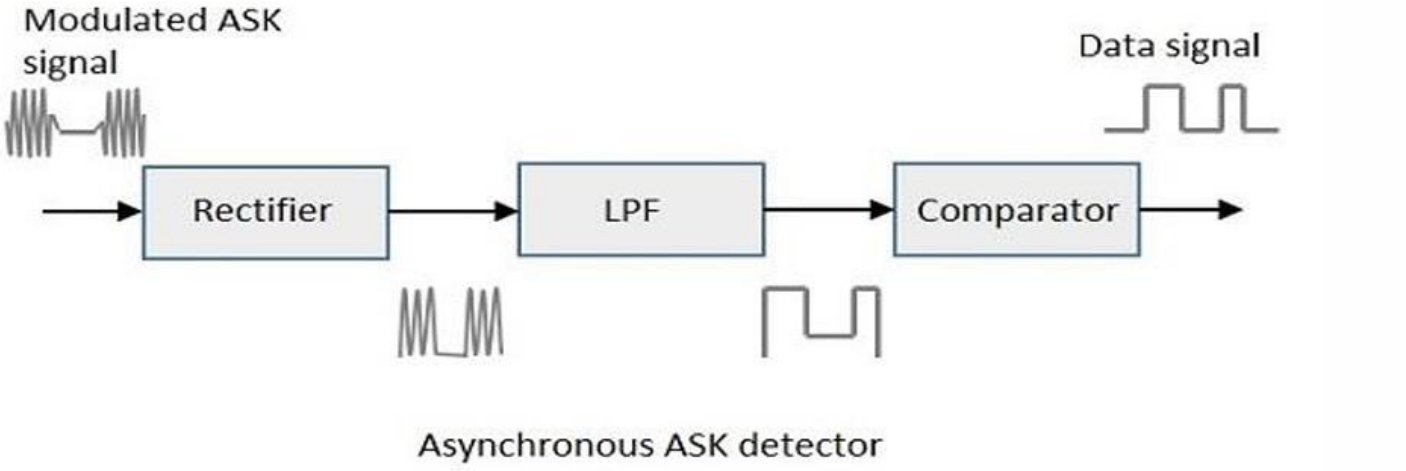
Reception of ASK

There are two type of receiver for ASK:-

1)coherent/synchronous ASK receiver It required a replica carrier wave of the same frequency and phase at the receiver. The received signal and replica carrier are compared and output is obtained



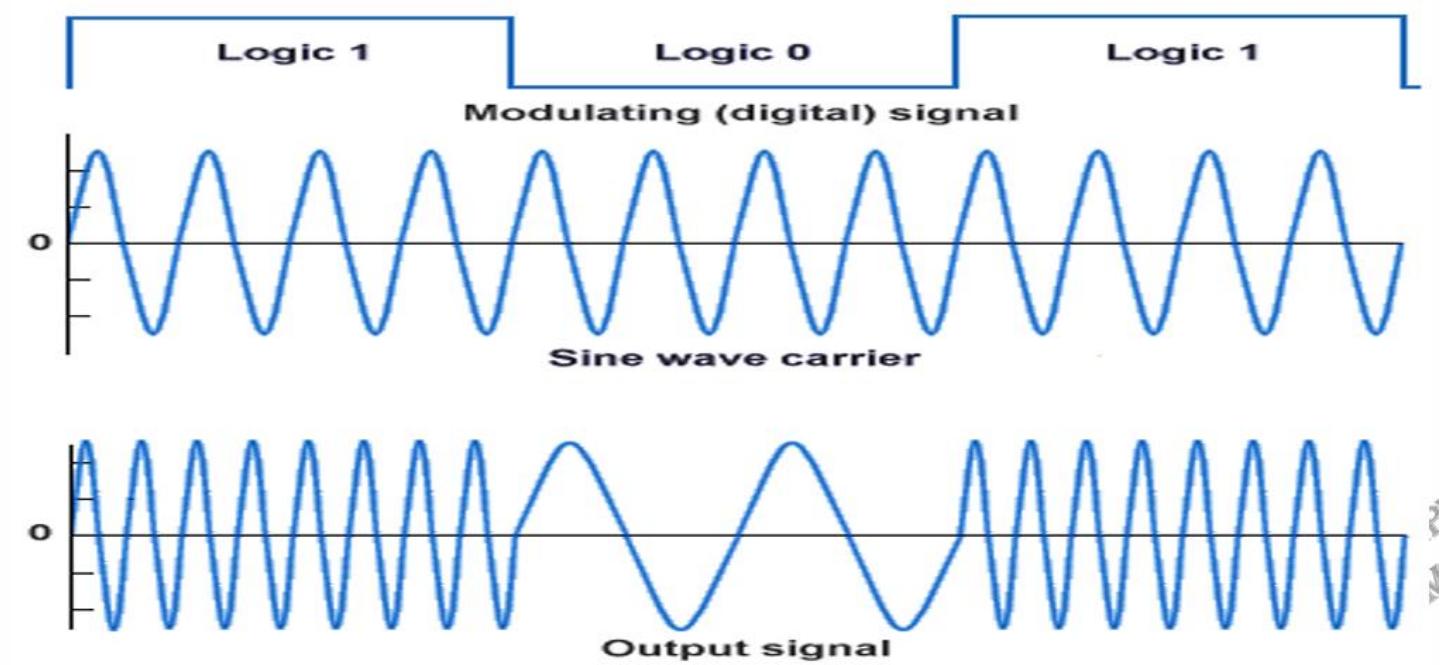
2)non-coherent/asynchronous ASK receiver it does not required a replica carrier wave of the same frequency and phase at the receiver.it is less complex than coherent receiver but have worse performance



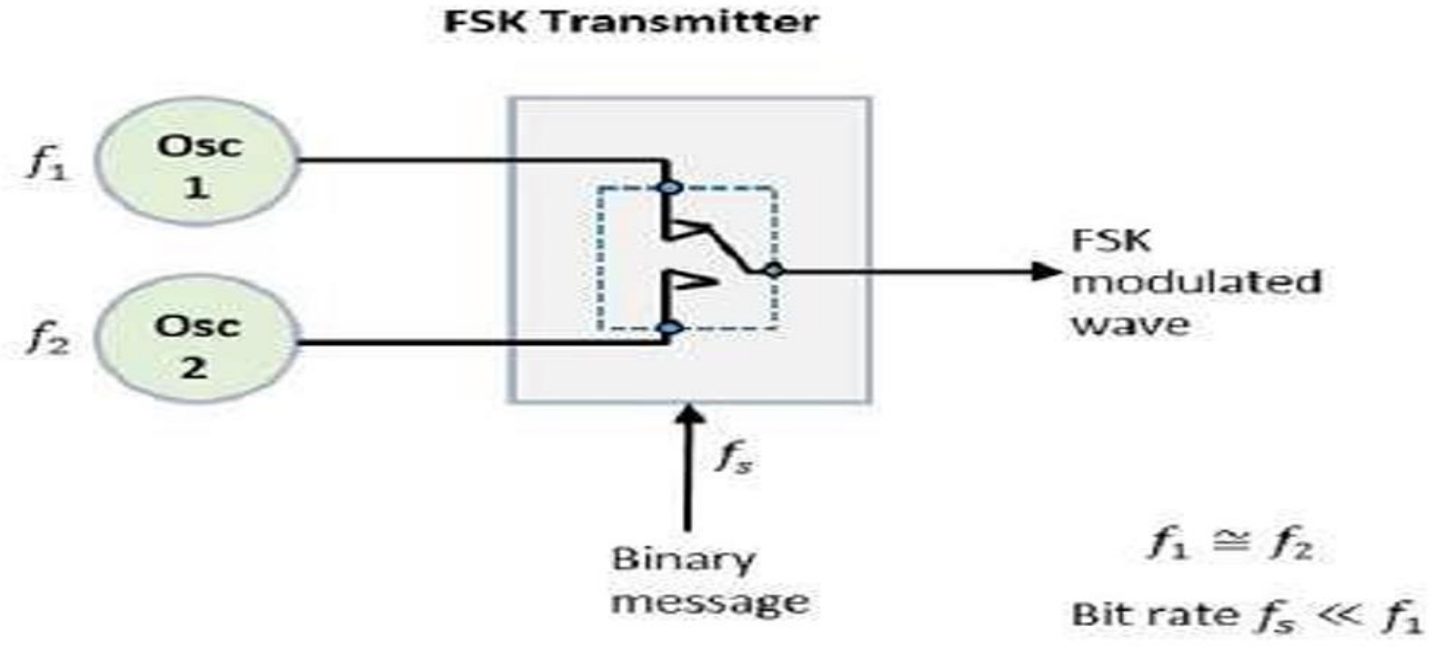
BINARY FREQUENCY SHIFT-KEYING (FSK) /BFSK

•In this system, it shifts the frequency of carrier signal according to the binary symbols (1,0) and phase & amplitude will be un affected.

•In this system, generally binary symbols (1,0) modulate the frequency of carrier.



FSK MODULATOR/GENERATOR



FSK MODULATOR/GENERATOR

• The FSK modulator block diagram comprises of two oscillators with a clock and the input binary sequence

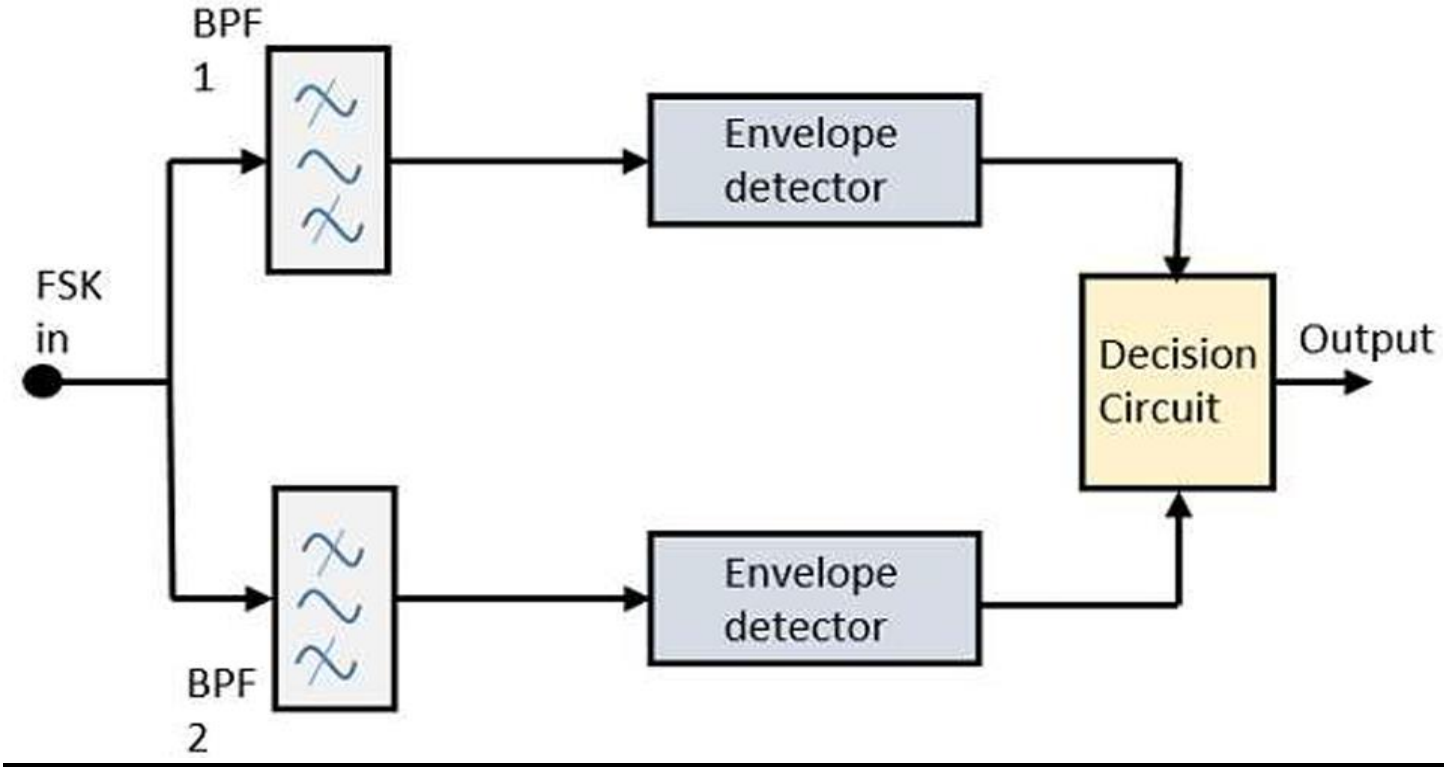
• The two oscillators, producing a higher and a lower frequency signals, are connected to a switch along with an internal clock . The internal clock is to avoid the abrupt phase discontinuities of the output waveform during the transmission of the message

• The binary input sequence is applied to the transmitter so as to choose the frequencies according to the binary input.

FSK DEMODULATOR/RECEPTOR

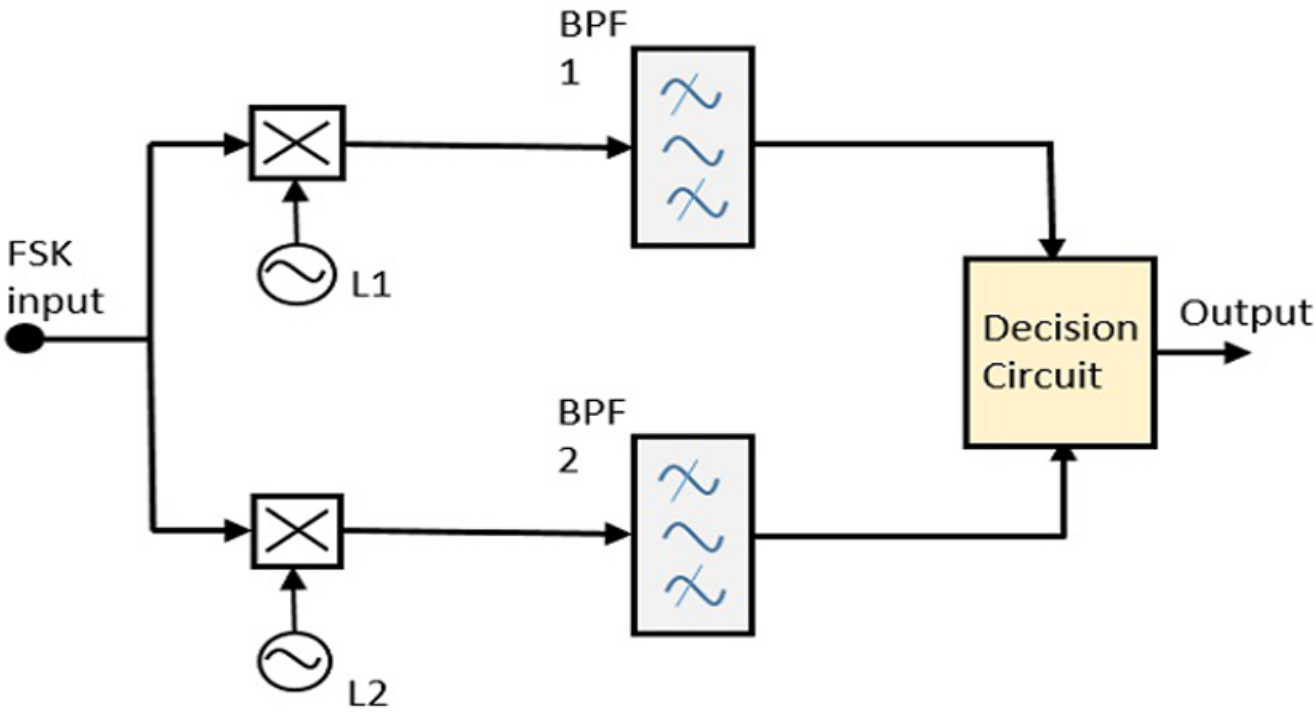
There are two type of demodulators:-

1)Asynchronous FSK Detector



• The FSK signal is passed through the two Band Pass Filters BPFs tune to Space and Mark frequencies corresponding to frequencies of 1's and 0's at transmitter. The output from these two BPFs look like ASK signal, which is given to the envelope detector. The decision circuit/camparator chooses which output having more power and selects it from any one of the envelope detectors.

2) Synchronous FSK Demodulator

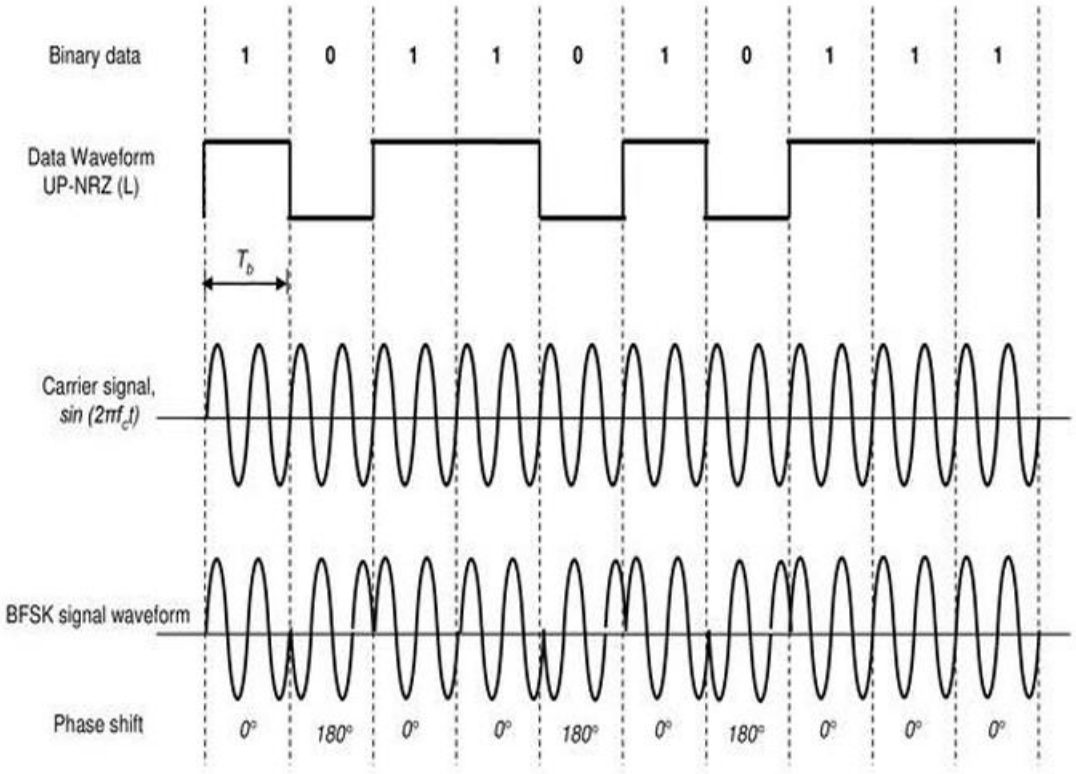


• The FSK signal input is given to the two mixers with local oscillator circuits w. These two are connected to two band pass filters. These combinations act as demodulators and the decision circuit chooses which output is more likely and selects it from any one of the detectors

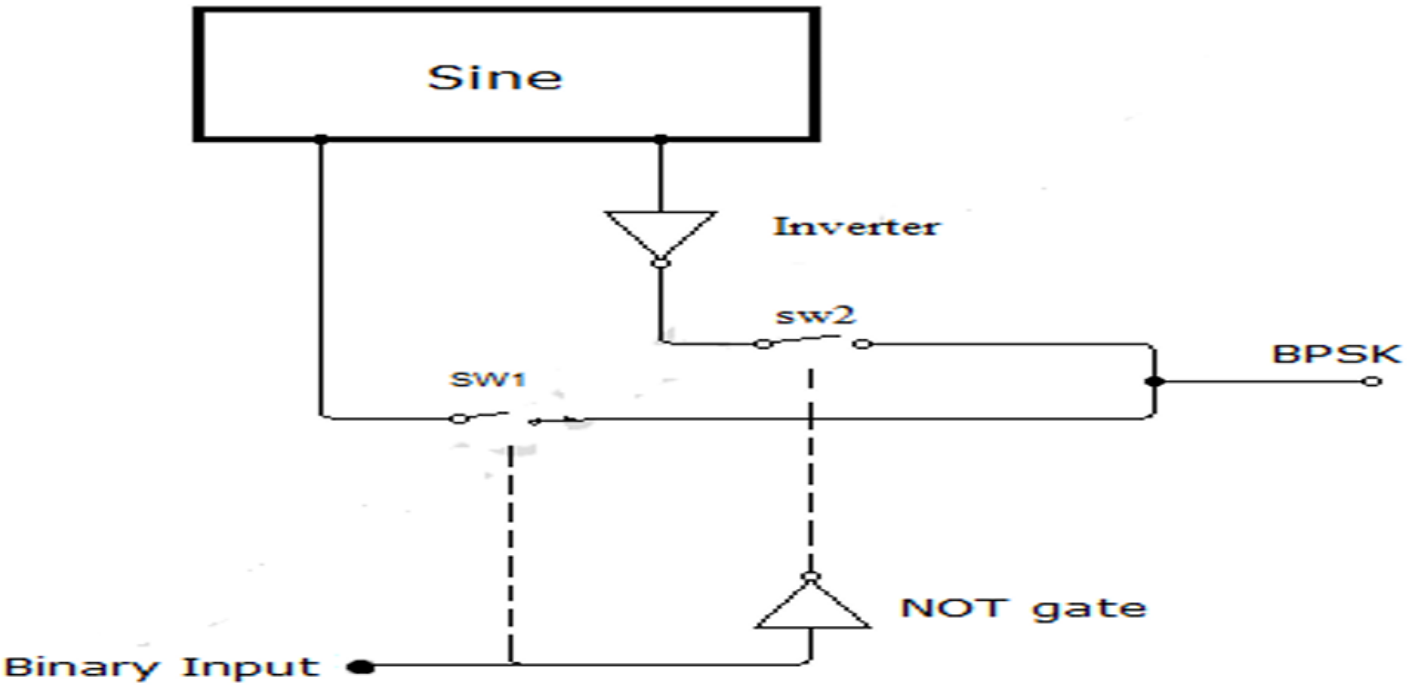
Binary phase shift keying(BPSK)

Also called as 2-phase PSK or Phase Reversal Keying. In this technique, the sine wave carrier takes two phase reversals such as 0°and 180°. BPSK is basically a Double Side Band Suppressed Carrier modulation scheme, for message being the digital information.

Binary phase shift keying(PSK)



BPSK MODULATOR

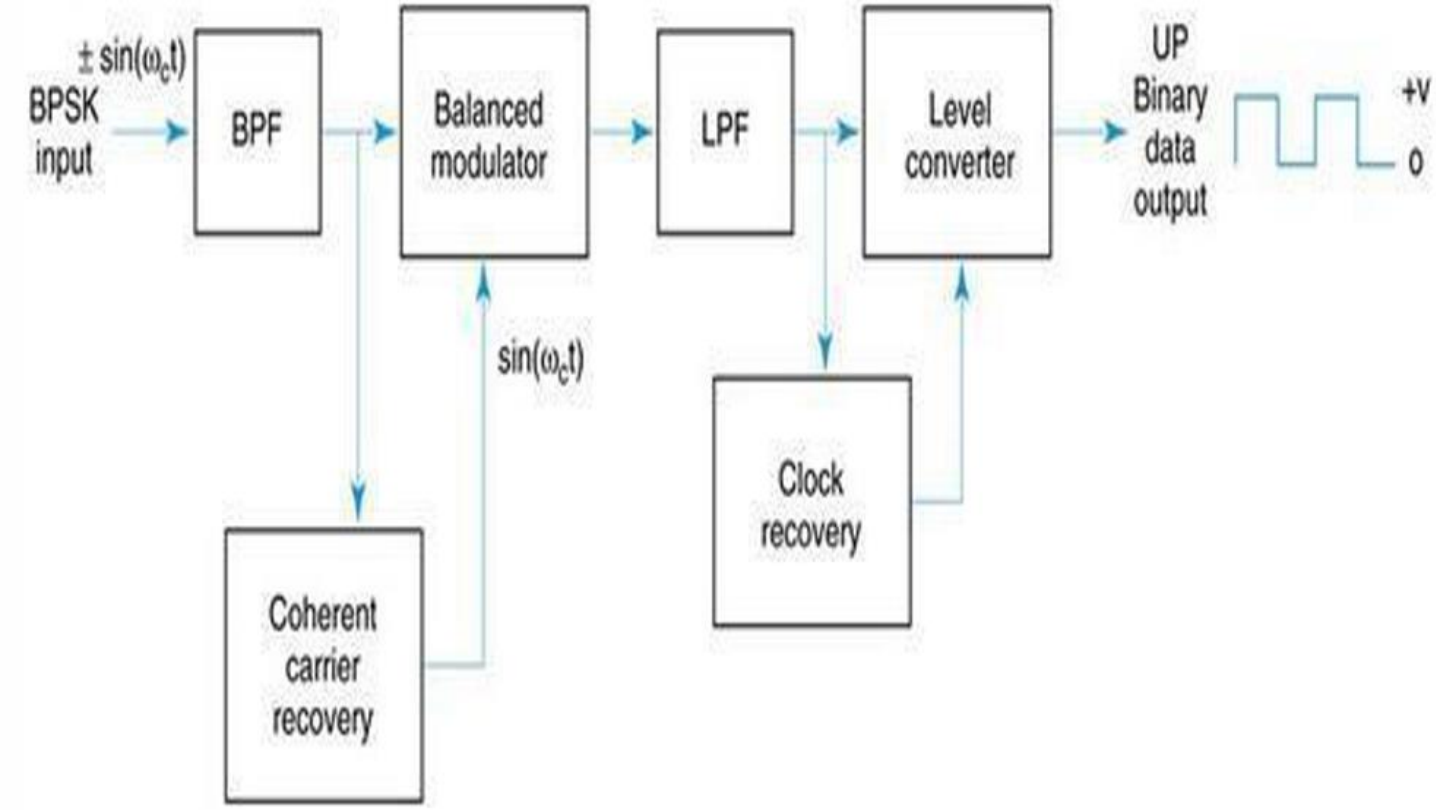


Block diagram of BPSK Modulation

BPSK MODULATOR

Here an inverter circuit is used to get a phase shift of 180 degree When the binary data is 1, a sine wave is switched to output because the sine wave is connected. When binary data is 0, the1stswitch is disabled and the 2nd switch is enabled using NOT gate arrangement. Thus we get inverted sine at the output.

BPSK DEMODULATOR



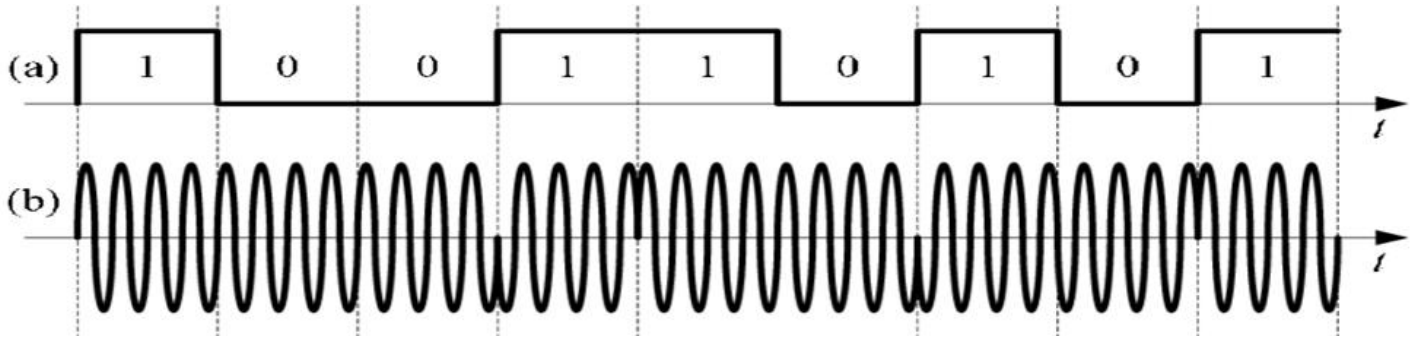
The input signal maybe+ sin ωct or - sin ωct .The coherent carrier recovery circuit detects and regenerates a carrier signal that is both frequency and phase coherent with the original transmit carrier. Balanced modulator output is the product of the two inputs , as a result in phase waves product will result a positive dc voltage and out off phase will produce –ve dc voltage. LPF will pass only the dc component. Clock recovery and level converter will produce perfect high and low voltage according to the received signal. Positive voltage represents a demodulated logic 1 and –ve voltage represents a logic 0

COMPARISON:-

ParameterRb	ASK	FSK	PSK
VARIABLE CHARACTERISTICS	AMPLITUDE	FREQUENCY	PHASE
NOISE IMMUNITY	LOW	HIGH	HIGH
COMPLEXITY	SIMPLE	MODERATE	VERY COMPLEX
ERROR PROBABILITY	HIGH	LOW	LOW
PERFORMANCE IN PRESENCE OF NOISE	POOR	BETTER THAN ASK	BETTER THAN FSK
BIT RATE	SUITABLE UP TO 100 BITS PER SEC	SUITABLE UP TO 1200 BITS PER SEC	SUITABLE FOR HIGHER BIT RATE
BAND WITH	2Rb	2Rb+(F2-F1)	2Rb
	Rb-bit rate	F2-higher frequency for bit 1in FSK	F1-lower frequency for bit 0 in FSK

DIFFERENTIAL PHASE SHIFT KEYING (DPSK)

In DPSK the phase of the modulated signal is shifted relative to the previous signal element. No reference signal is considered here. The signal phase follows the high or low state of the previous element. This DPSK technique doesn't need a reference oscillator.



if the data bit is LOW i.e., 0, then the phase of the signal is not reversed, but is continued as it was. If the data is HIGH i.e., 1, then the phase of the signal is reversed, invert on 1 In DPCM instead of one- bit, two or more bits are transmitted at a time. As a single signal is used for multiple bit transmission, the channel bandwidth is reduced.

Quaternary Phase Shift Keying (QPSK)

This modulation scheme is very important for developing concepts of two-dimensional I-Q modulations . In a sense, QPSK is an expanded version from binary PSK where in a symbol consists of two bits and two orthonormal basis functions are used. A group of two bits is often called a dibit‘. So, four dibits are possible. Each symbol carries same energy

Instead of the conversion of digital bits into a series of digital stream, it converts them in to bit-pairs. This decreases the data bit rate to half, which allows space for the other users ie, for a given binary data rate, the transmission bandwidth for QPSK is half of that needed by BPSK modulation scheme.