



SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35



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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB301-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

UNIT 4 – DIGITAL MODULATION TECHNIQUES

TOPIC – PSK



PHASE SHIFT KEYING

Phase Shift Keying *PSK* is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications.

PSK is of two types, depending upon the phases the signal gets shifted. They are –

Binary Phase Shift Keying *BPSK*

This is 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 *DSBSC*

modulation scheme, for message being the digital information.



QUADRATURE PHASE SHIFT KEYING



Quadrature Phase Shift Keying *QPSK*

This is the phase shift keying technique, in which the sine wave carrier takes four phase reversals such as 0° , 90° , 180° , and 270° .

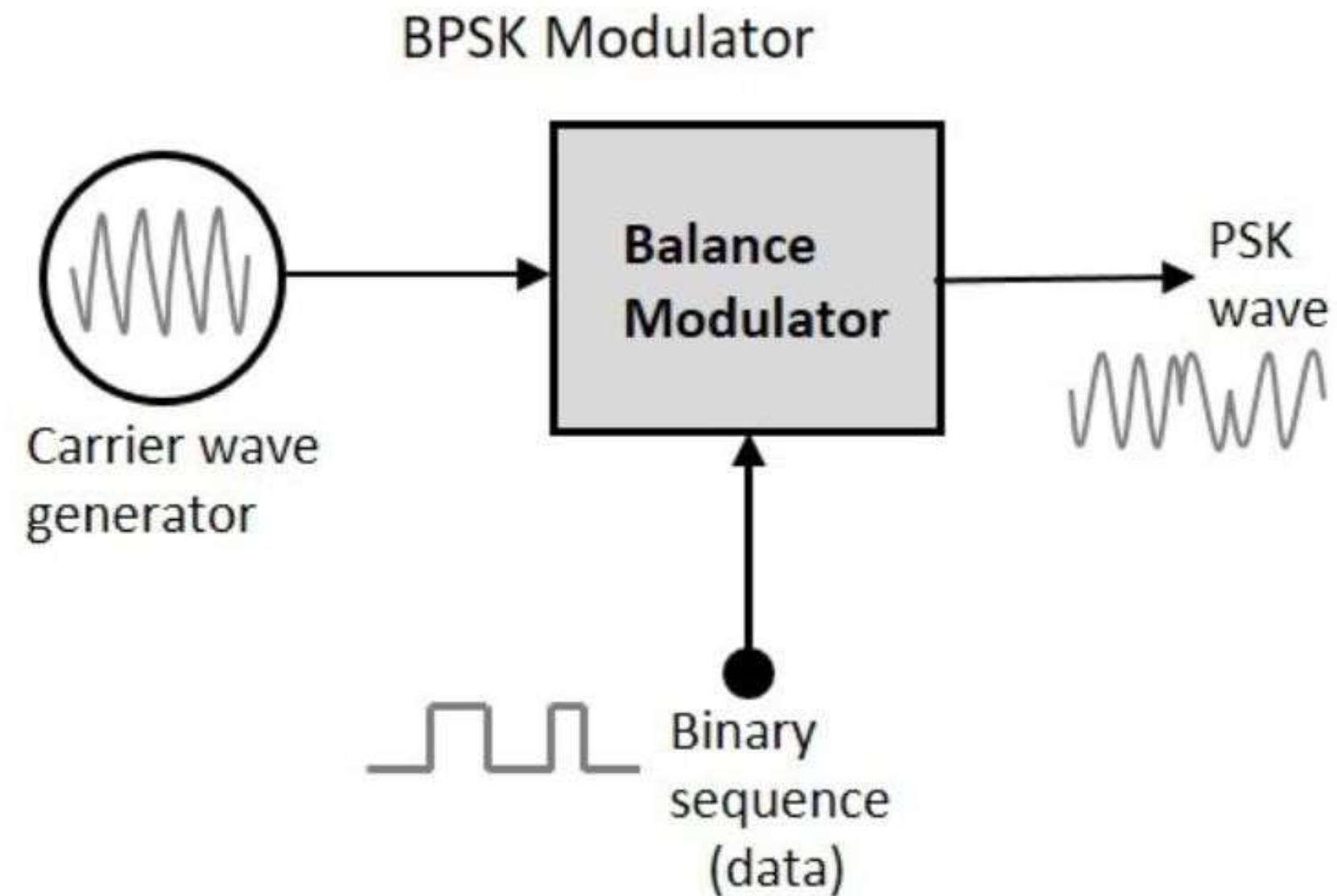
If this kind of techniques are further extended, PSK can be done by eight or sixteen values also, depending upon the requirement.



BPSK MODULATOR



The block diagram of Binary Phase Shift Keying consists of the balance modulator which has the carrier sine wave as one input and the binary sequence as the other input. Following is the diagrammatic representation.

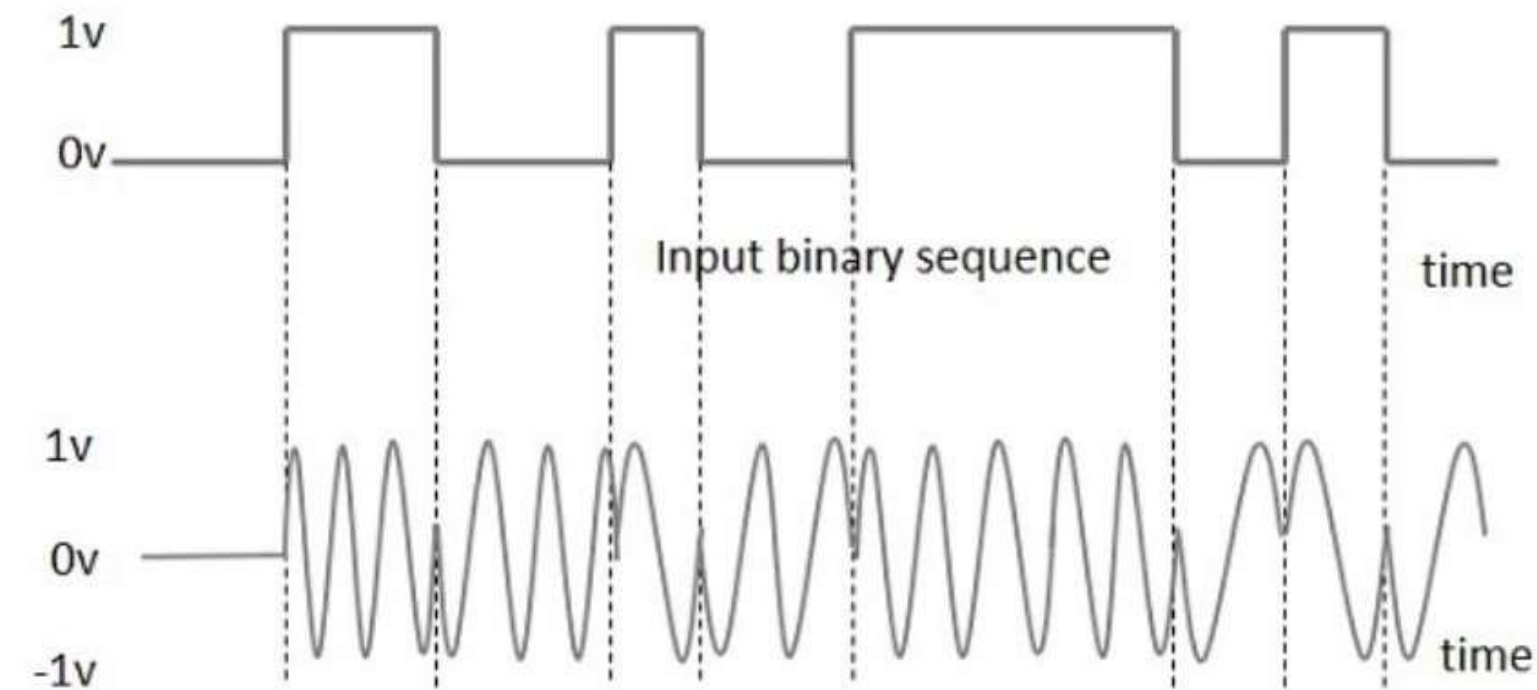




BINARY PHASE SHIFT KEYING WAVEFORM

The modulation of BPSK is done using a balance modulator, which multiplies the two signals applied at the input. For a zero binary input, the phase will be 0° and for a high input, the phase reversal is of 180° .

Following is the diagrammatic representation of BPSK Modulated output wave along with its given input.

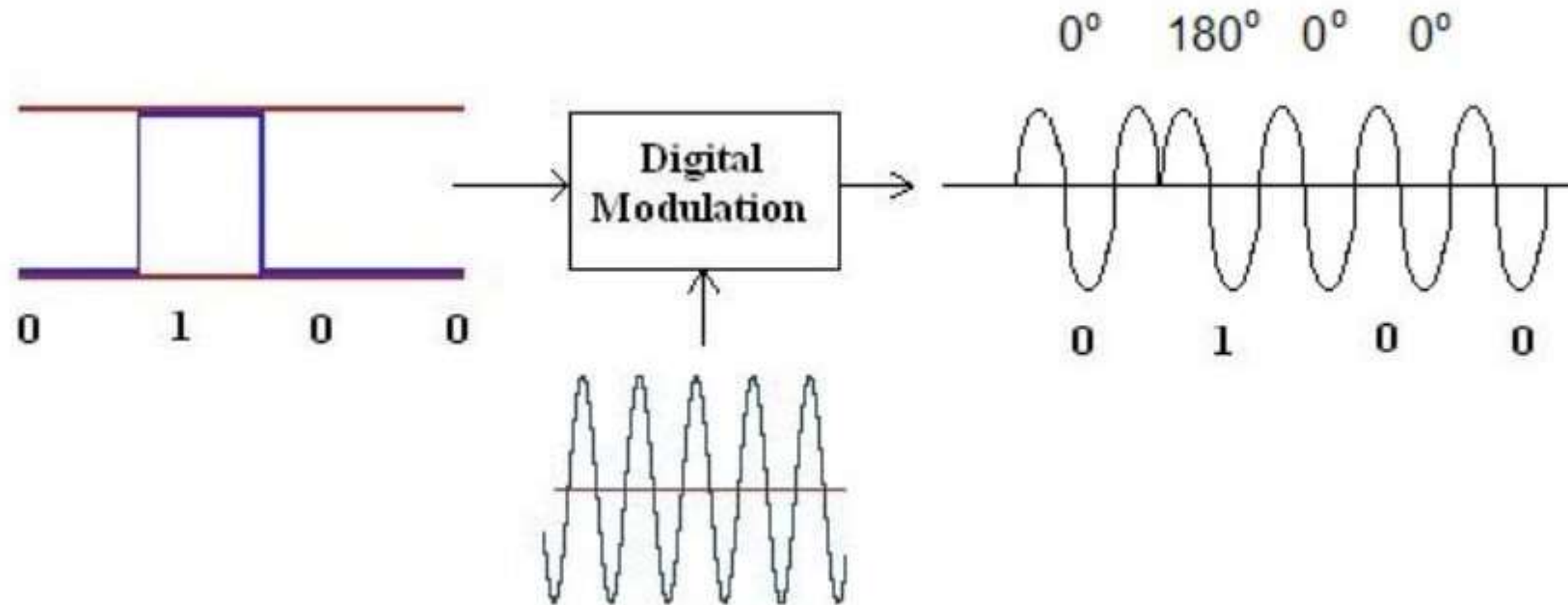


BPSK Modulated output wave

The output sine wave of the modulator will be the direct input carrier or the inverted 180° *phaseshifted* input carrier, which is a function of the data signal.



BINARY PHASE SHIFT KEYING WAVEFORM



Following are the equations used to represent BPSK.

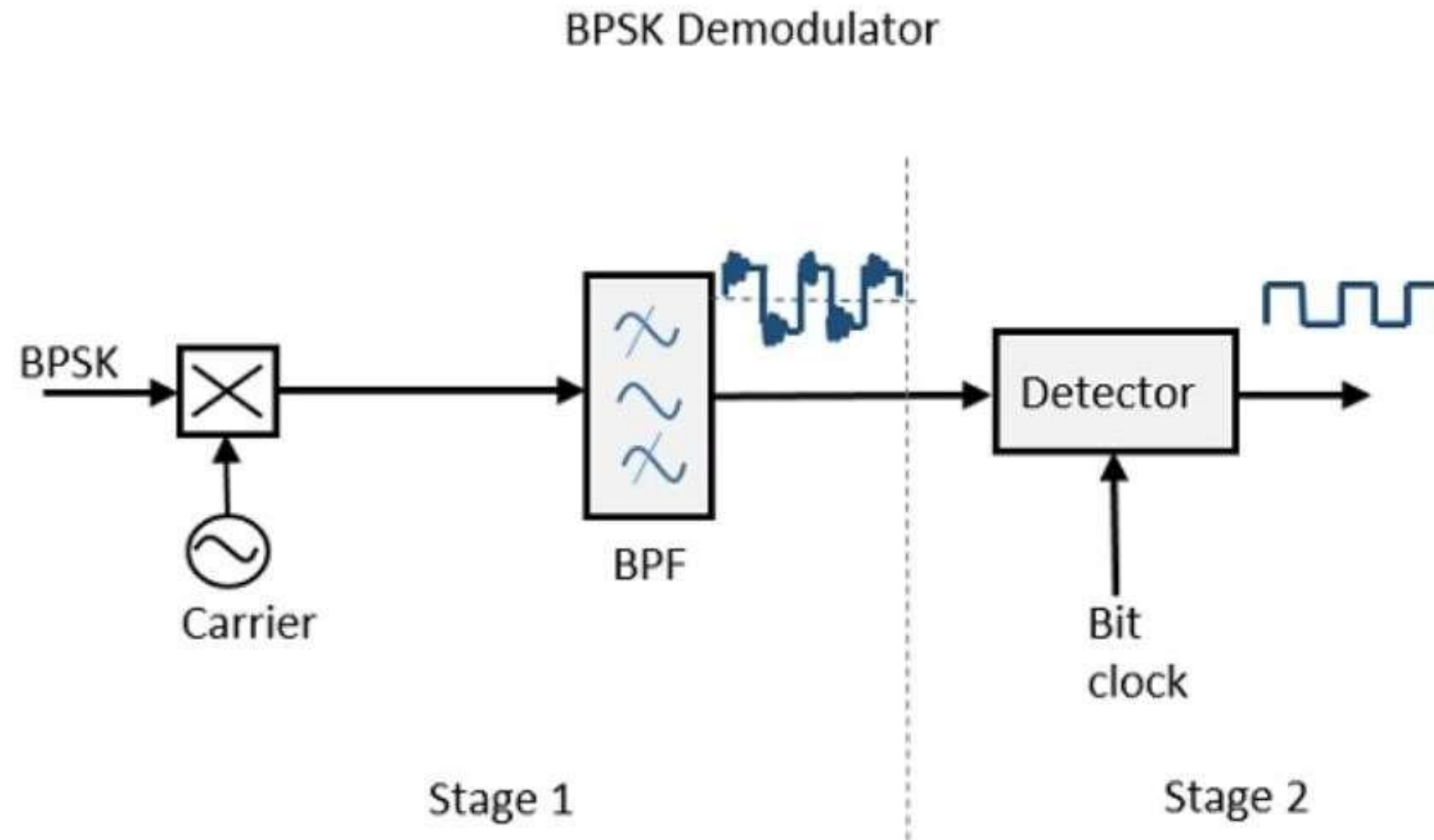
$$\Rightarrow s(t) = A \cdot \cos(2\pi f_c t) \text{ for Binary 1 than}$$

$$\Rightarrow s(t) = A \cdot \cos(2\pi f_c t + \pi) \text{ for Binary 0}$$



BPSK DEMODULATOR

The block diagram of BPSK demodulator consists of a mixer with local oscillator circuit, a bandpass filter, a two-input detector circuit. The diagram is as follows.





BPSK DEMODULATOR



By recovering the band-limited message signal, with the help of the mixer circuit and the band pass filter, the first stage of demodulation gets completed. The base band signal which is band limited is obtained and this signal is used to regenerate the binary message bit stream.

In the next stage of demodulation, the bit clock rate is needed at the detector circuit to produce the original binary message signal. If the bit rate is a sub-multiple of the carrier frequency, then the bit clock regeneration is simplified. To make the circuit easily understandable, a decision-making circuit may also be inserted at the 2nd stage of detection.



BPSK ADVANTAGES



Following are the benefits or **advantages of PSK**:

- It carries data over RF signal more efficiently compare to other modulation types. Hence it is more power efficient modulation technique compare to ASK and FSK.
- It is less susceptible to errors compare to ASK modulation and occupies same bandwidth as ASK.
- Higher data rate of transmission can be achieved using high level of PSK modulations such as QPSK (represents 2 bits per constellation), 16-QAM (represents 4 bits per constellation) etc.



BPSK DISADVANTAGES



Following are the **disadvantages of PSK**:

- It has lower bandwidth efficiency.
- The binary data is decoded by estimation of phase states of the signal. These detection and recovery algorithms are very complex.
- Multi-level PSK modulation schemes (QPSK, 16QAM etc.) are more sensitive to phase variations.
- It is also one form of FSK and hence it also offers lower bandwidth efficiency compare to ASK modulation type.



THANK YOU