



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 –FSK



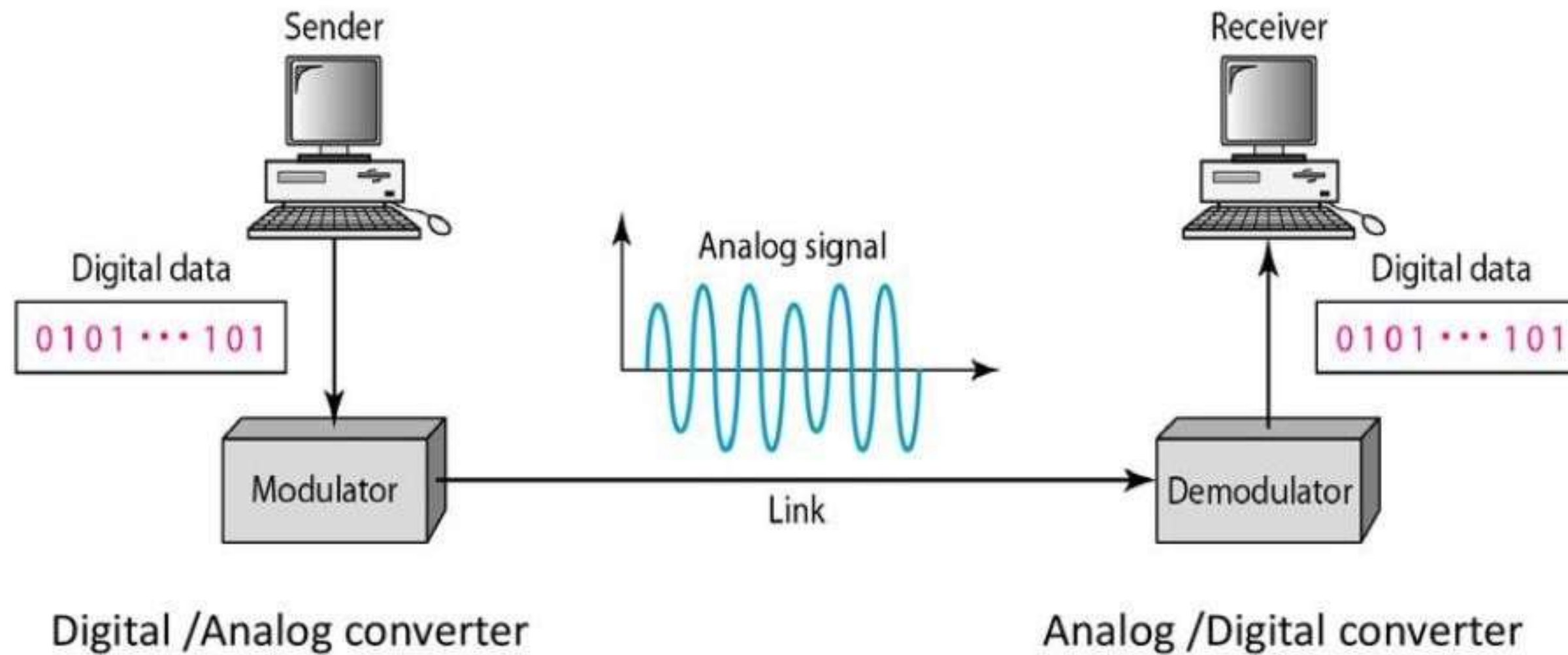
WHY WE NEED THE DIGITAL MODULATION?

- Digital modulation is required if digital data has to be transmitted over a medium that only allows analog transmission (modems in wired networks).
- Digital signals, i.e. 0/1, can be sent over wires using voltages.
- Wireless must use analogue sine waves.

- **This translation is performed by digital modulation:**
 - Digital data is translated into an analog signal (baseband).
 - Shift Keying is the translation process.
 - Amplitude, Freq., Phase Shift Keying (ASK/FSK/PSK).



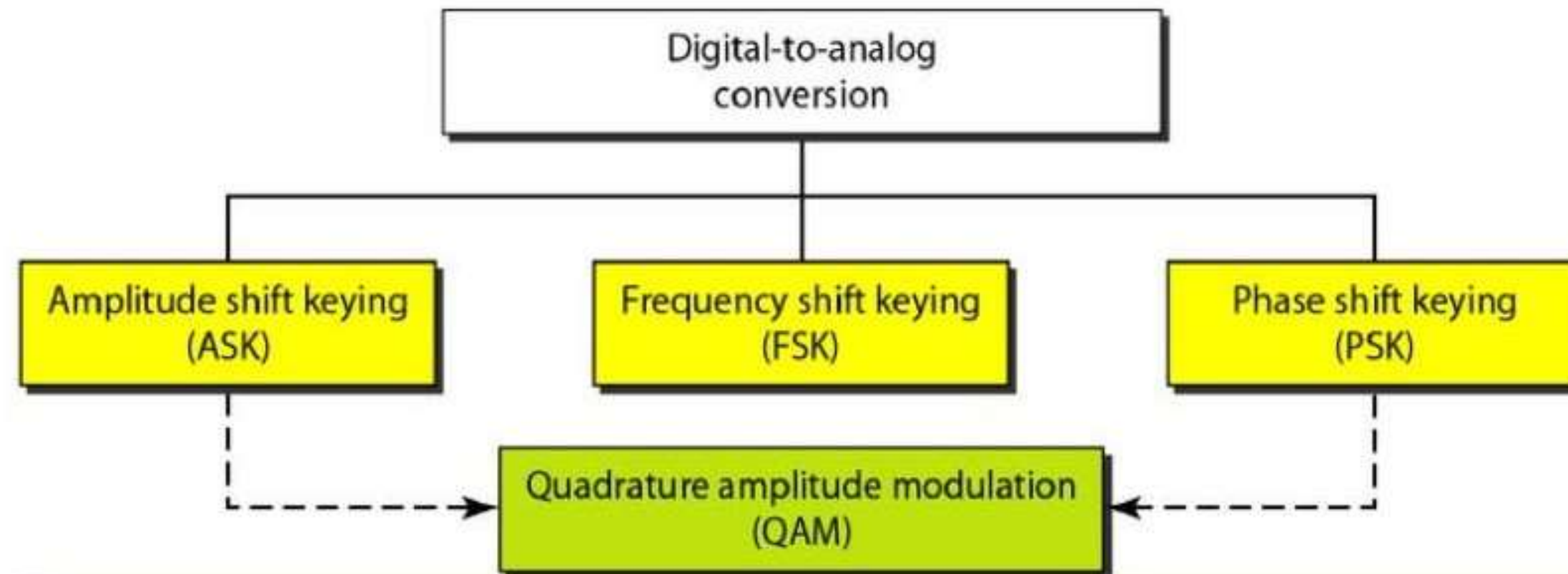
MODULATION OF DIGITAL DATA





TYPES OF DIGITAL TO ANALOG CONVERSION

- A sine wave is represented by three characteristics: Amplitude, Frequency and Phase.
- We can change one of these characteristics to represent digital data.





ASPECTS OF DIGITAL TO ANALOG CONVERSION



- **Carrier Signal or carrier frequency:**
 - A high frequency signal that acts as a basis for the information signal.
 - Digital information then modulates the carrier signal by modifying one or more of its characteristics (Amplitude, frequency or phase).
 - This kind of modification is called modulation or shift keying, and the information signal is called modulated signal.



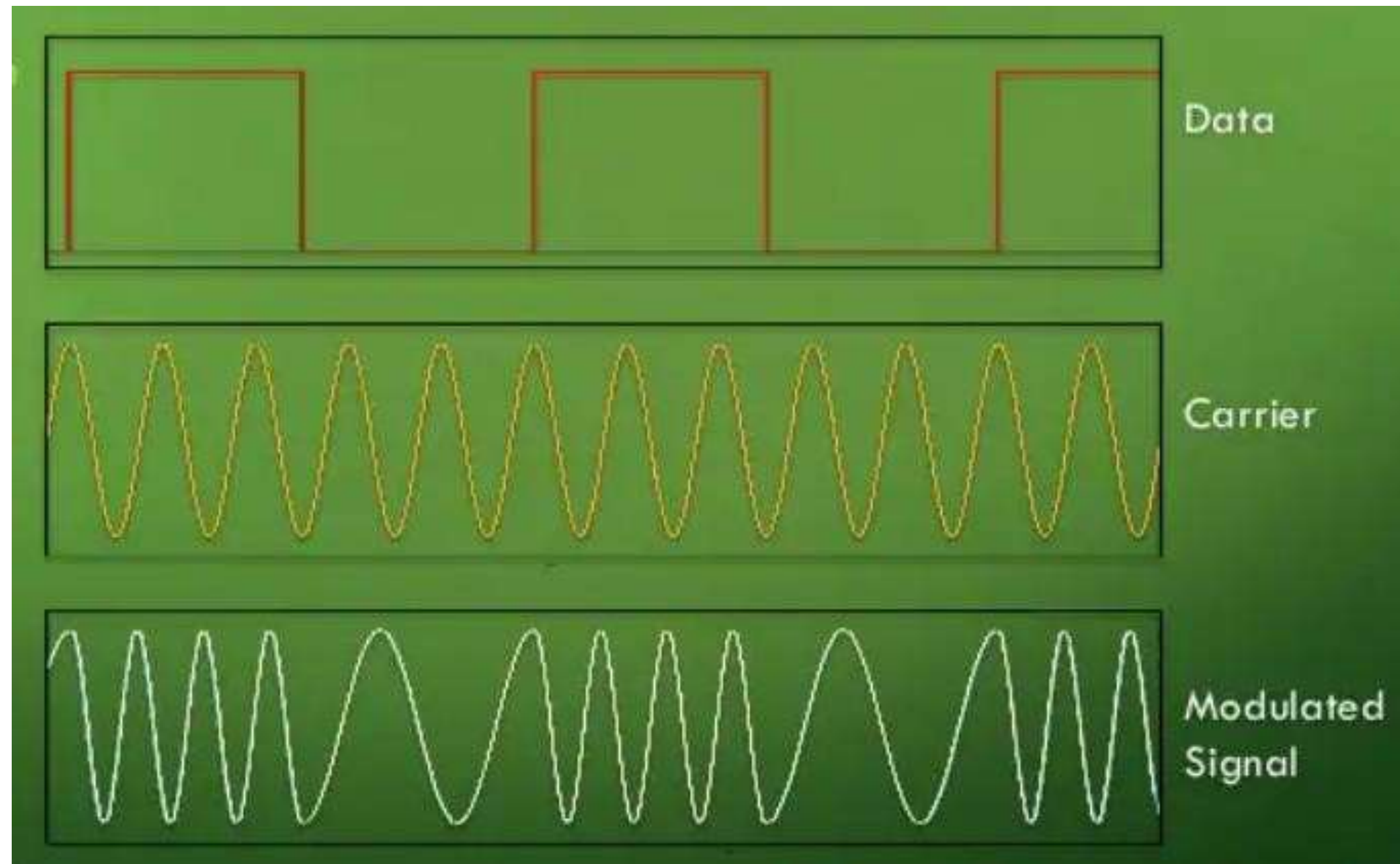
FREQUENCY SHIFT KEYING



- Similar to the analog FM, it is a constant-amplitude angle modulation
- The modulating signal (f_m) is binary.
- Often called binary frequency shift-keying (BFSK).



WAVEFORMS





GENERAL EXPRESSIONS



- General expression for FSK

$$V_{fsk}(t) = V_c \cos\{2\pi[f_c + v_m(t)f_d]t\}$$

Such that:

V_c = Carrier Voltage v_m = Modulating Voltage

f_c = Carrier Frequency f_d = Frequency Deviation



GENERAL EXPRESSIONS



- The modulating signal is a normalized binary waveform where:
- For logic 1, $v_m = +1V$

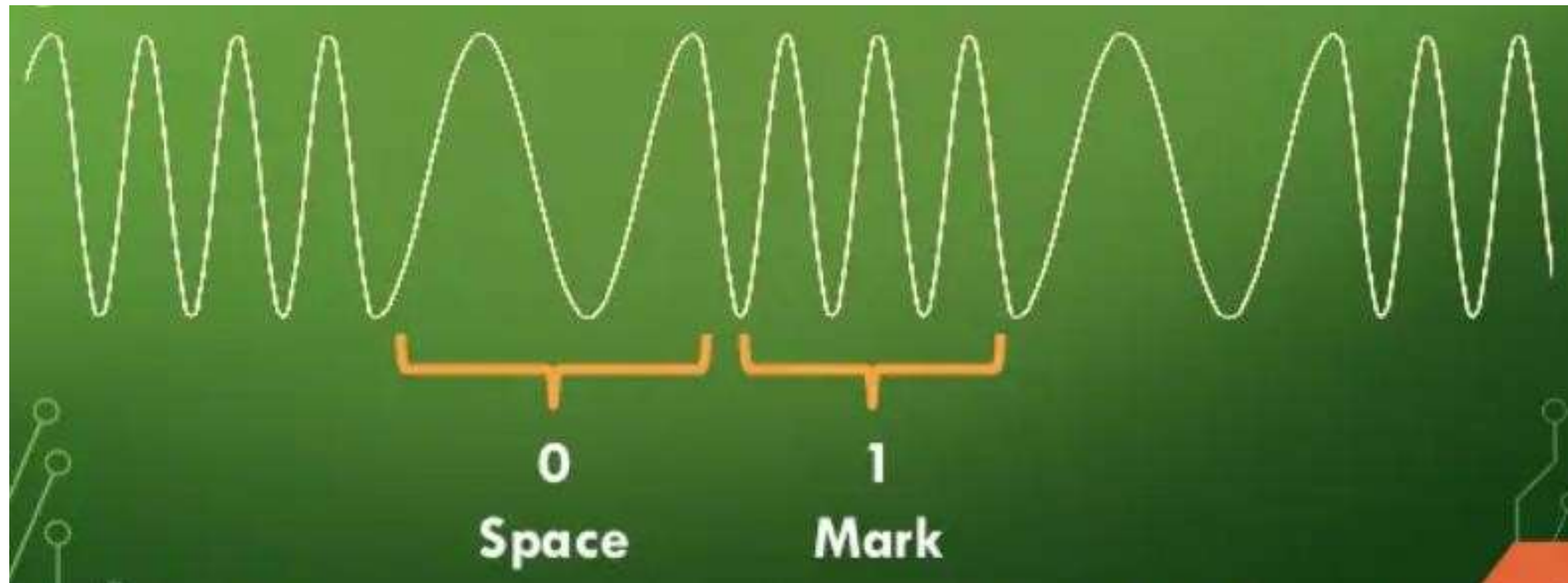
$$V_{fsk}(t) = V_c \cos\{2\pi[f_c + f_d]t\}$$

- For logic 0, $v_m = -1V$

$$V_{fsk}(t) = V_c \cos\{2\pi[f_c - f_d]t\}$$

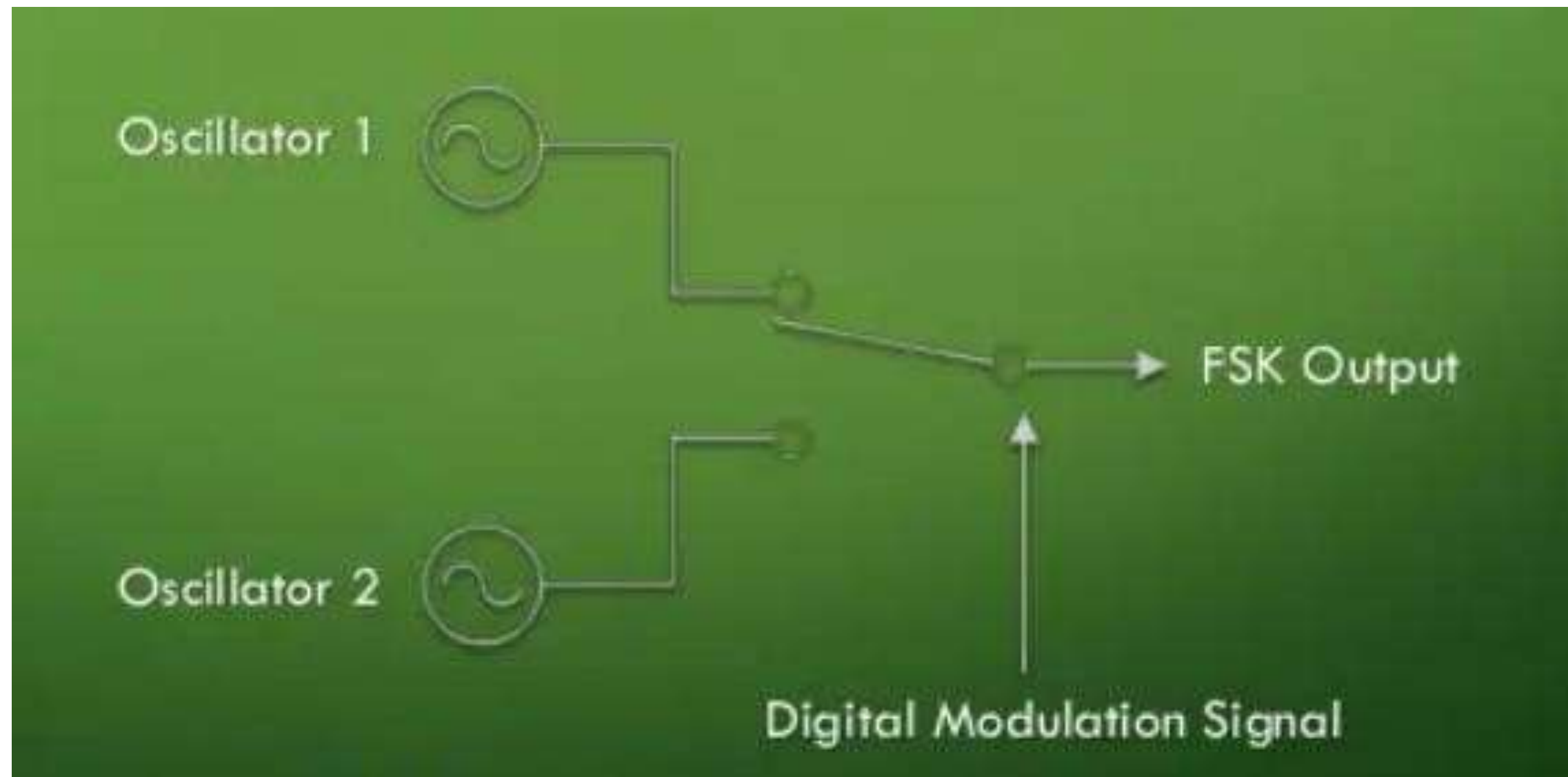


SPACE AND MARK FREQUENCIES



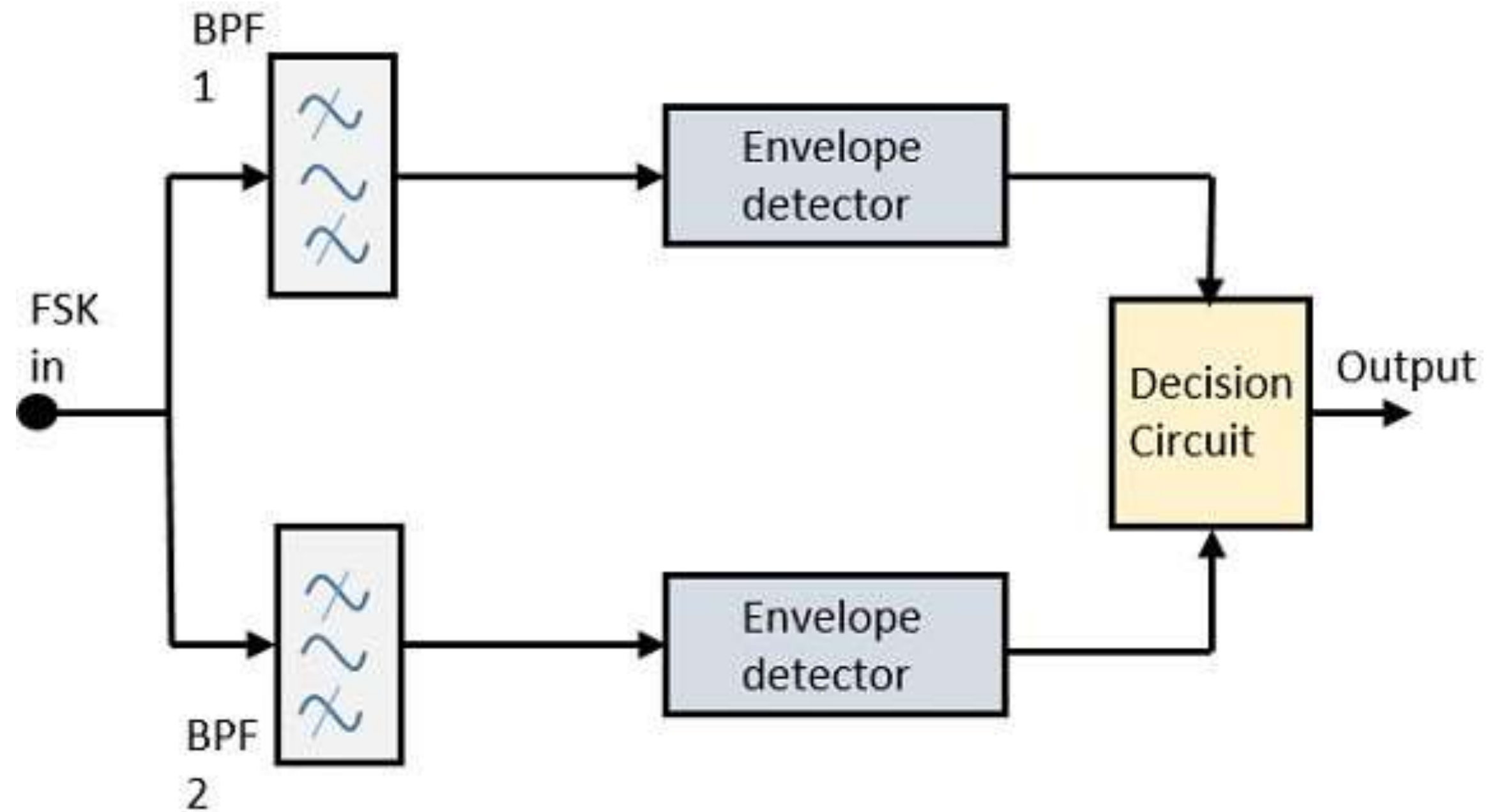


FSK GENERATION





FSK DETECTION





ADVANTAGES



Advantage

- It has lower probability of error (P_e).
- It provides high SNR (Signal to Noise Ratio).
- It has higher immunity to noise due to constant envelope. Hence it is robust against variation in attenuation through channel.
- FSK transmitter and FSK receiver implementations are simple for low data rate application.



DIS ADVANTAGES



Disadvantage

- It uses larger bandwidth compare to other modulation techniques such as ASK and PSK. Hence it is not bandwidth efficient.



APPLICATIONS



- Caller ID on Telephone Systems
- Amateur Radio
- Early Telephone-Line Modems.
- Emergency Broadcast Systems
- Modems



THANK YOU