د/ شامية غمري

السؤال الثالث والرابع

Solution of Electronic measurement and Tests (2)

Q_3 and Q_4

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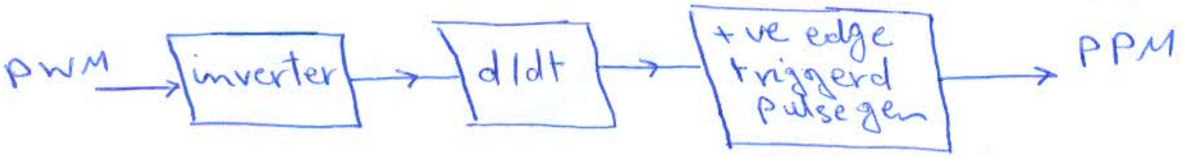
[3] Question ~~One~~ Three: (10 Mark) [*measures ILOs of a15, b15*, b16 and c.18]

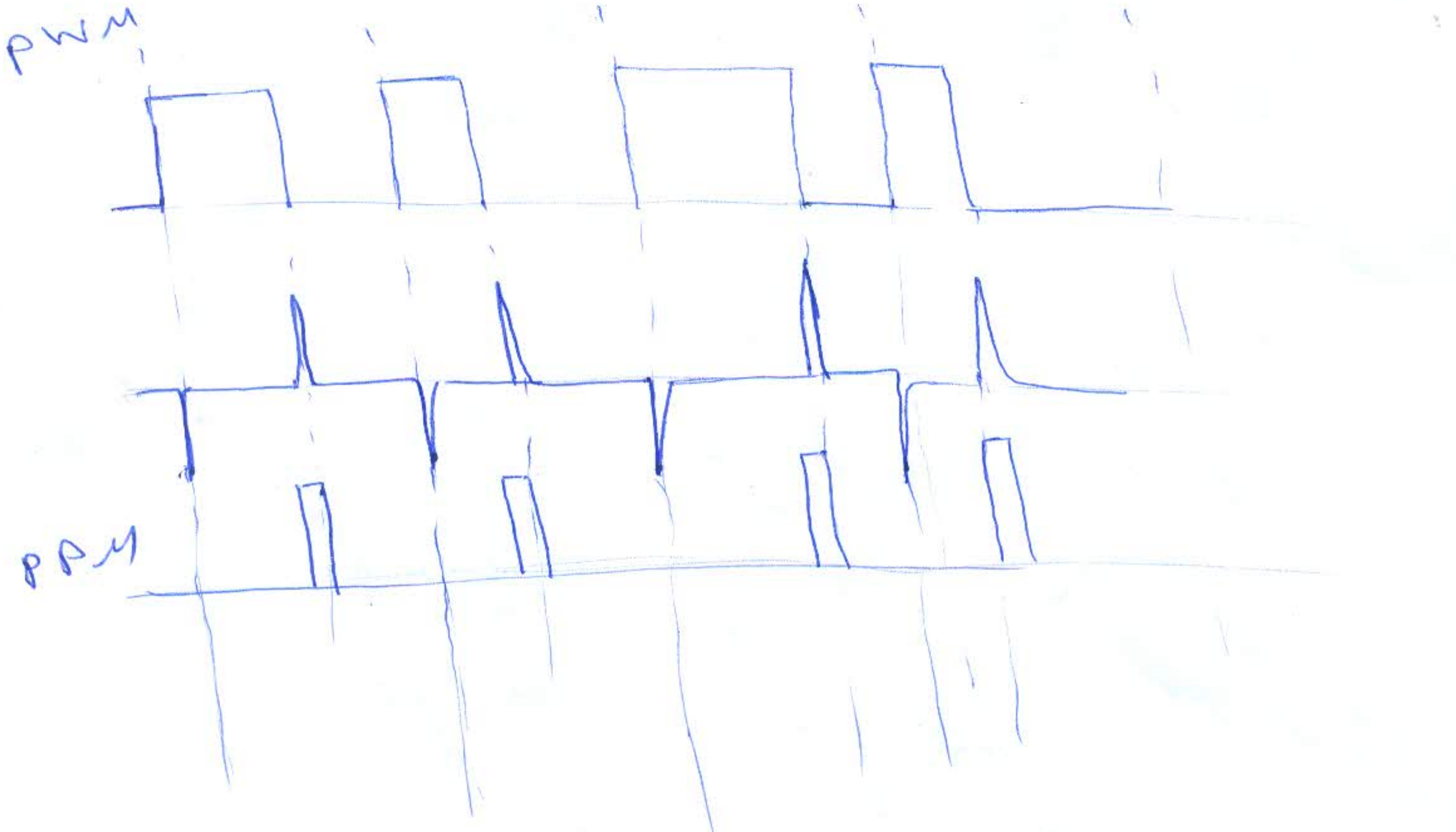
A- i- Explain, with the aid of sketches and diagrams the steps of pulse position modulation generation.



→ The PWM signal is sent to an inverter

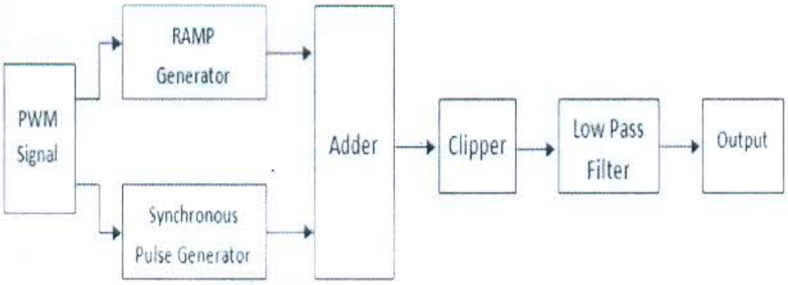
→ This is then followed by a differentiator which generates +ve spikes for PWM signals going from high to low and -ve spikes for Low to high.

→ These spikes are then fed to the +ve edge triggerd pulse generator which generates fixed width pulses.



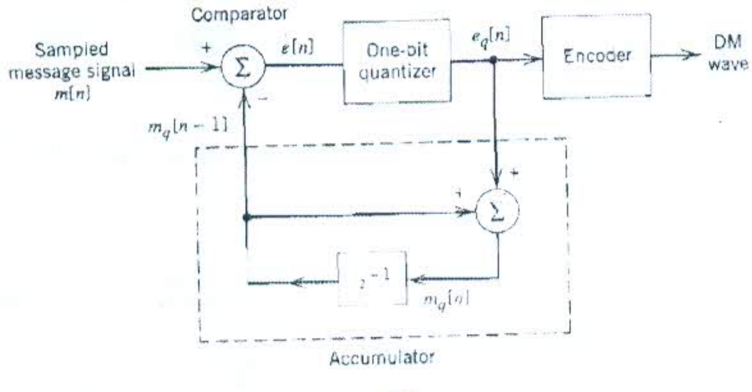
ii- Based on the analysis of part i, draw a block diagram of PP demodulation

Pulse width demodulation



B- With the aid of analysis and diagrams, find the advantages of sigma delta modulation over delta modulation. [b.16.1*(3 marks)*]

For Delta modulation



(a)

$$e[n] = m[n] - m_q[n-1]$$

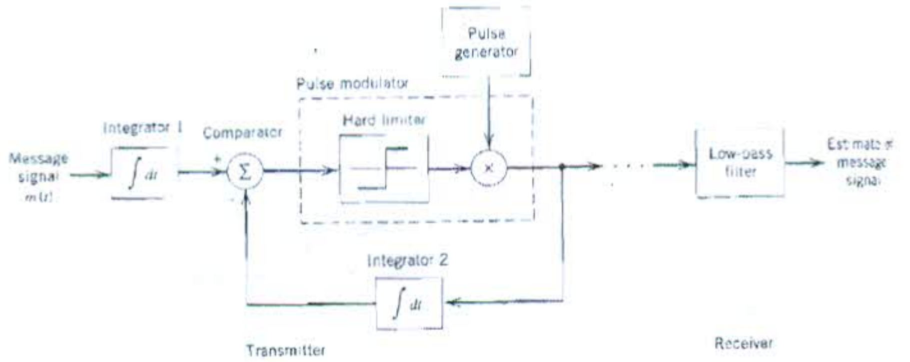
$$e_q = \Delta \, \text{sgn}(e[n])$$

$$m_q[n] = m_q[n-1] + e_q[n] \qquad m_q[n] = m[n] + q[n]$$

$$e[n] = m[n] - m[n-1] - q[n-1]$$

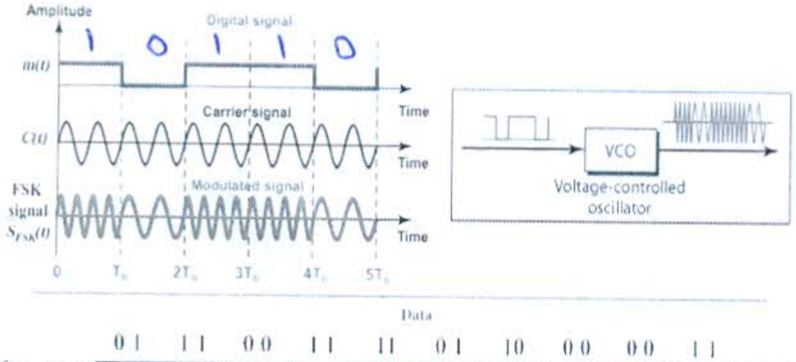
Thus except for the quantization error $q[n-1]$, the quantizer input is a *first backward difference* of the input signal, which may be viewed as a digital approximation to the derivative of the input signal or, equivalently, as the inverse of the digital integration the quantizer input in the conventional form of delta modulation may be viewed as an approximation to the *derivative* of the incoming message signal. This behavior leads to a drawback of delta modulation in that transmission disturbances such as noise result in an accumulative error in the demodulated signal. This drawback can be overcome by *integrating* the message signal prior to delta modulation. The use of integration in the manner described here has also the following beneficial effects:

- The low-frequency content of the input signal is pre-emphasized.
- Correlation between adjacent samples of the delta modulator input is increased, which tends to improve overall system performance by reducing the variance of the error signal at the quantizer input.
- Design of the receiver is simplified.

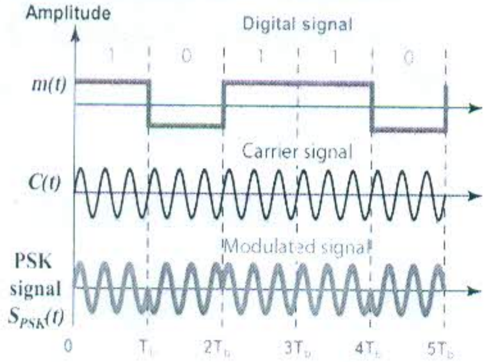


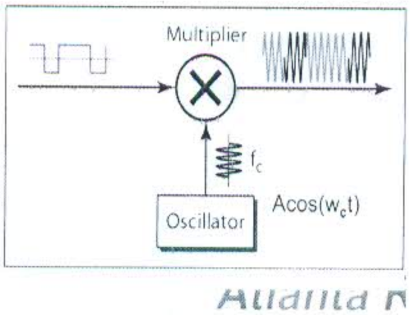
C- Draw the generator circuits for BFSK and BPSK and then compare between their outputs on the basis of signal in time domain, spectrum, band width [a.15.1, b.15.1, c.18.1 *(3 marks)*]

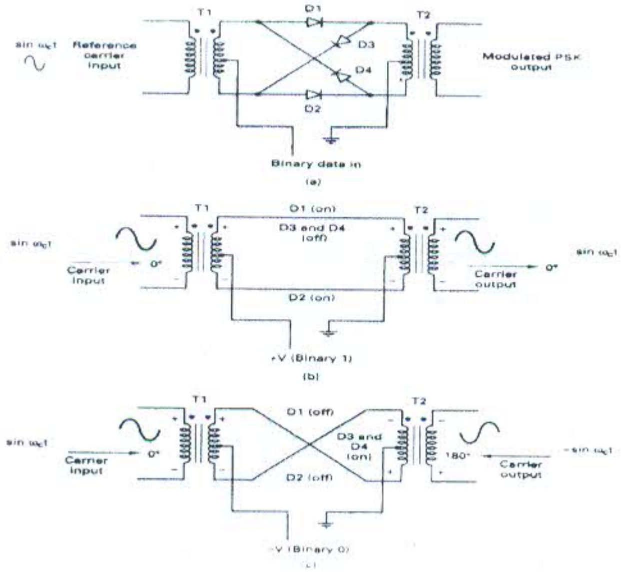
Implementation of Binary FSK



Implementation of BPSK:

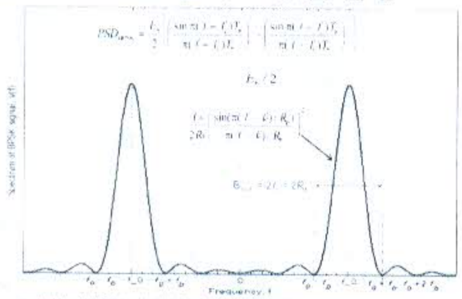






Bandpass Power Spectral Density of Binary PSK

Assumes baseband rectangular pulses:

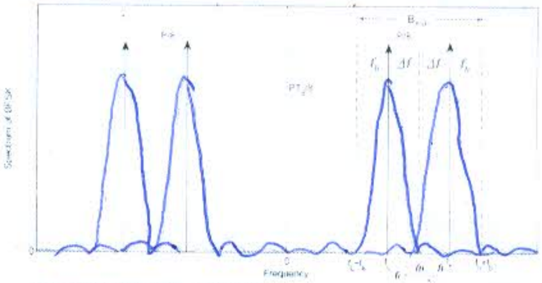


- Null-to-Null RF bandwidth: $B_{BPSK} = (f_c + f_b) - (f_c - f_b) = 2f_b = 2R_b = 2/T_b$
- 90% power RF bandwidth: $B_{90\%} = 1.6f_b = 1.6R_b$ for rectangular pulses.
- 99% power RF bandwidth: $B_{99\%} = 20f_b = 20R_b$

Atlanta RF

Bandpass Power Spectral Density of Binary FSK

Assumes baseband rectangular pulse stream:



- Energy per bit: $E_b = PT_b$, watt-second.
- The Null-to-Null RF transmission bandwidth for Binary FSK is:
    - $B_{null} = (f_2 + f_b) - (f_1 - f_b) = (f_2 - f_1) + 2f_b = 2\Delta f + 2f_b = 2(\Delta f + R_b)$ = *Carson's Rule.*

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[2] Question Two: (10 Mark) [*measures ILOs of a15 and b15*]

A- Compare between Line codes and Error Control codes and then explain the principles that decide the validity of a certain code for a specified communication link.

line codes	Error Control codes
- variation in the txed data stream by varying the representation of the symbol polarity and transiation timming	- variation in the txed data stream by adding extra bits in a specified mannar
- applied to acheive certain spectral requirements	- applied to improve the bit error rate
- EX: NRZ, RZ, AMI Manshester ---	- EX: parity check cyclic codes Hamming BCH and convolutional codes (Turbo--)

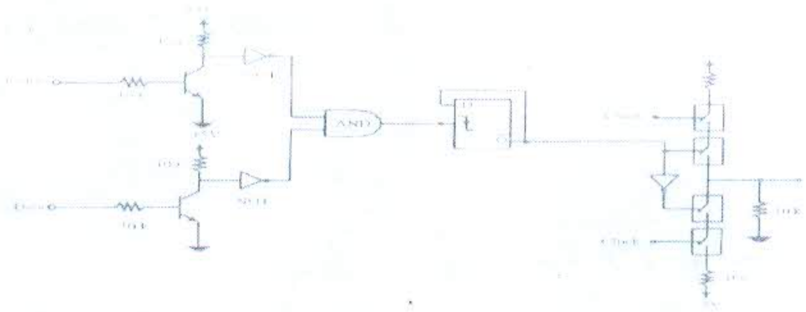
⇒ for a specified comm. link, the principles that decide the validity of a certain code are

- self synchronization
- spectral efficiency
- error detecting capability
- low probability of bit error
- low transmission speed
- Transparency.

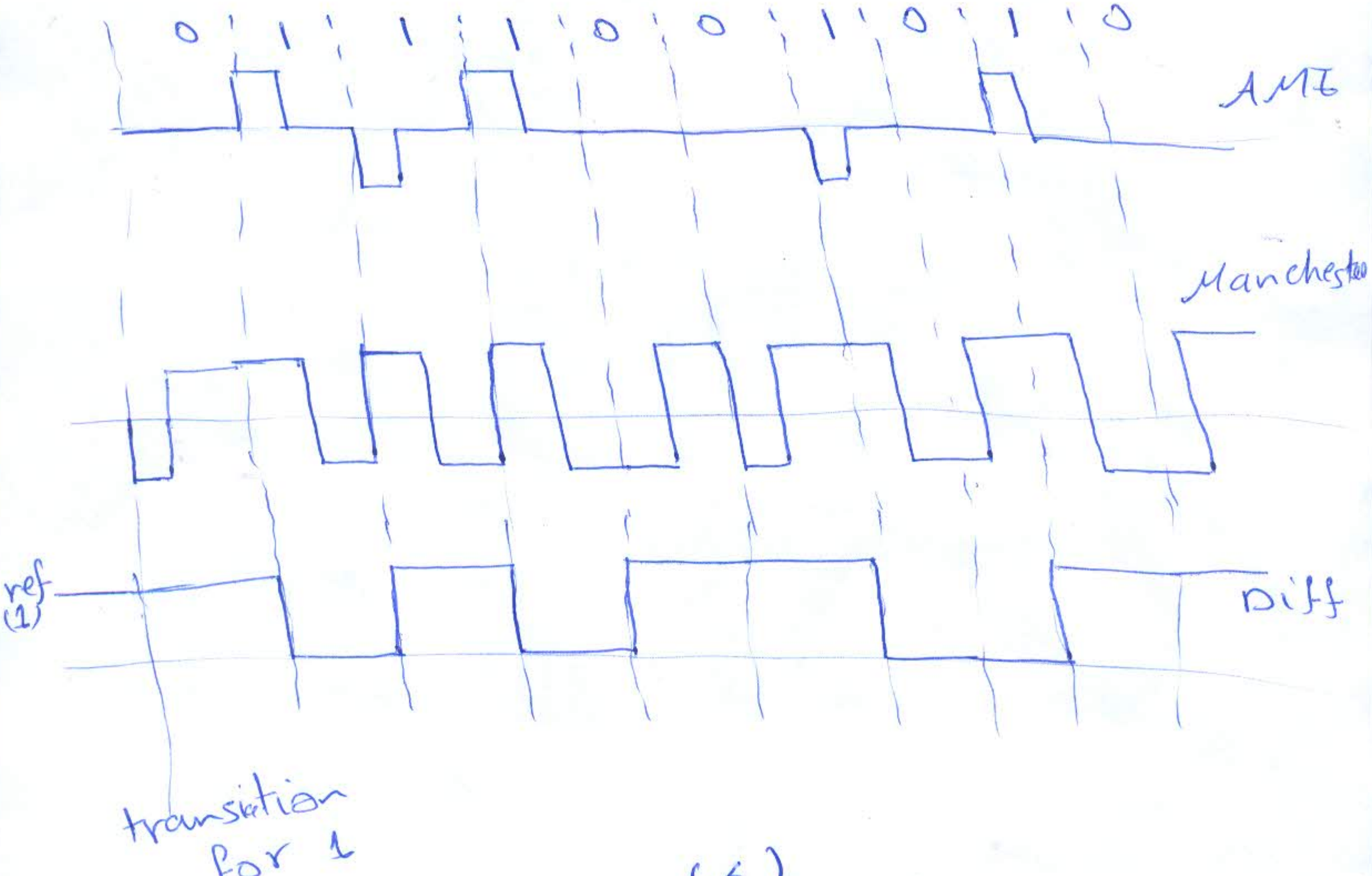
B- Draw the electronic circuits that generate the following line codes.

i- AMI ii- Manchester iii- Differential

and then **find** the out put of each of them, if the input data stream is "0111001010"



AMI



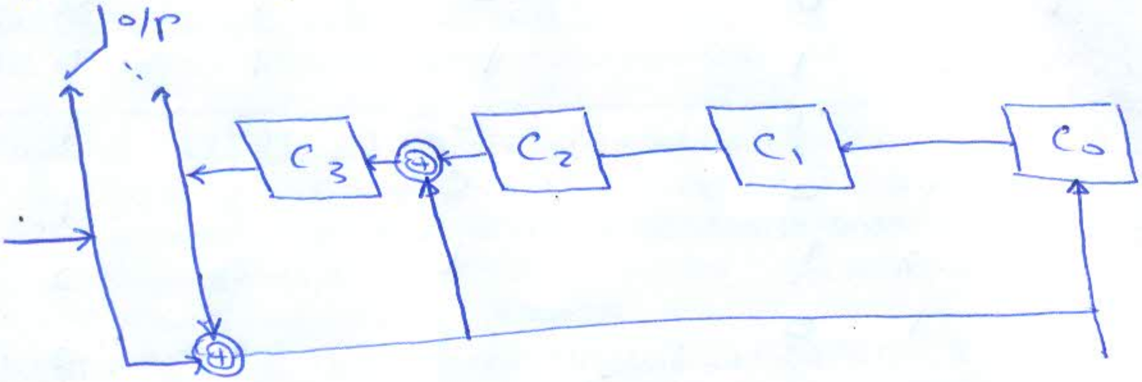
C- A CRC is constructed to generate a 4-bit FCS for an 11-bit message, the generator polynomial is $X^4 + X^3 + 1$ [b.15.2 *(4 marks)*]

i- Draw the circuit that would perform this task

ii- Encode the data bit sequence "10011011100", illustrating the operation of the generator through a truth table

iii- Explain the algorithm that is used to detect error

P = 11001



for FCS

```
          11100110101
        ________________
11001  | 100110111000000
         11001
         -----
         01010
          11001
          -----
          01011
          11001
          -----
           1110
             .
             .
             .
        ----------
           1101   FCS
```

Txed = 10011011100 1101

C_3	C_2	C_1	C_0	C_3: $I \oplus C_3 \oplus C_2$	C_0: $I + C_3$	I
0	0	0	0	1	1	1
1	0	0	1	1	1	0
1	0	1	1	1	1	0
1	1	1	1	1	0	1
1	1	1	0	1	0	1
0	1	0	0	0	1	0
0	0	0	1	1	1	1
1	0	1	1	0	0	1
0	1	1	0	0	1	1
0	1	0	1	1	0	0
1	0	1	0	1	1	0

| 1 1 1 0 1 |

$\Rightarrow$ for erro detection

since $Z = T + E$ (error)

received ↙ ↘ Txed

$\frac{Z}{P} = B + \frac{S}{P}$ → syndrom

$\therefore \frac{T+E}{P} = B + \frac{S}{P} \Rightarrow Q + \frac{E}{P} = B + \frac{S}{P}$

$\therefore \frac{E}{P} = (B + Q) + \frac{S}{P}$

we can construct a table for the probable errors and their corrisponding syndroms